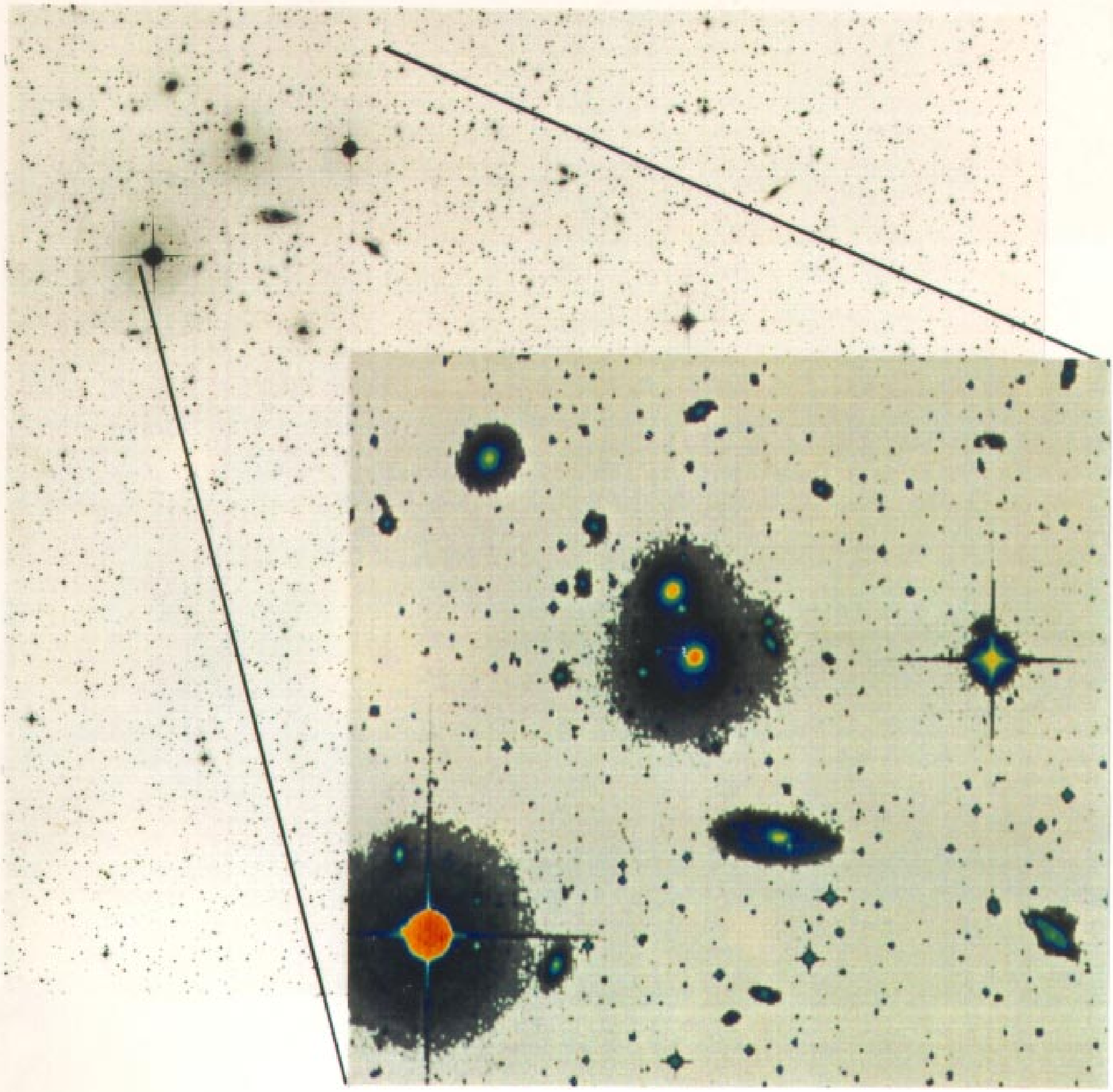
International Astronomical Union
Commission 9



Working group on "Wide-field imaging"

Newsletter 2

IAU WORKING GROUP
ON
WIDE-FIELD IMAGING

Newsletter No. 2

August 1992 Editor: H.T. MacGillivray

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Editor's Note

I am pleased to release this the 2nd Newsletter of the Working Group (WG) on Wide-Field Imaging (WFI). The first was issued in January of this year, and it is the intention of myself and the WG Chairman that we should see regular releases of the WFI Newsletter on a twice-yearly basis.

We have been very pleased with the response to both the WG and the Newsletter. Membership of the WG now comprises nearly 200 persons from all over the globe. The enthusiasm to contribute articles and send information to the editor has been excellent! Please continue to send contributions for publication. In the future, I intend to aim for more short and snappy presentations, with emphasis on very recent results and news.

The Organising Committee (OC) of the WG has been very active over the past 6 months. The Committee met during two days in Baltimore earlier this year, and a very constructive meeting was held. You may read the write-up of the meeting elsewhere in this Newsletter.

One of the more important decisions taken by the OC was to hold a full meeting of the WG in August 23 – 27th 1993 in Potsdam (Germany). The purpose of that meeting is to bring together all sides of WFI, from data acquisition, data handling and archiving, techniques for data processing etc., up to the broad range of science being produced in the field of WFI. You will see Richard West's detailed plan for the meeting also in this Newsletter.

Richard and I envisage a very active and fruitful year ahead. We are truly in the middle of a very exciting period in WFI, with the 2nd epoch photographic sky surveys on the major Schmidt Telescopes now well underway, the great promise shown by the new fine-grain emulsions, the proven capabilities of digitally stacking of photographic plate scans for going much deeper, and the advent soon of deep digital surveys of the sky.

Finally, it only remains for me to say that I look forward to seeing many of you at our meeting in Potsdam next year.

Harvey T. MacGillivray
Editor

The IAU Working Group on Wide-field Imaging

Whenever you open a semi-popular astronomical journal you will be reminded of the fact that Wide-Field Imaging has other uses than those which are strictly scientific. Few basic sciences are as 'visible' as is astronomy. Spectacular pictures of the sky convey to the public an image of our science as a fascinating and desirable human activity, hereby supporting the astronomical community all over the world in an indirect, but very efficient way.

Many of these images have been made by specialised wide-field telescopes, in particular by the large Schmidts. Others, and here I think in particular about the beautiful work by Dave Malin, come from the prime foci of 4-metre class telescopes. These telescopes, for instance at Kitt Peak, Mauna Kea, Siding Spring, Calar Alto, Roche de los Muchachos and La Silla are all equipped with complex optical systems, e.g. triplet correctors, which give well-corrected, flat fields of the order of 1 degree diameter.

However, at some of these telescopes, comparatively small CCDs have recently taken over and the photographic option is no longer offered to visiting astronomers. This may not constitute a disaster if it was only used for making pretty pictures, but this is not so. Lamentations are now heard in other quarters, above all among some astrometrists.

Until much more powerful meridian circles are built than those which are now in existence (and this may never happen), the only possible way *to measure the positions of very faint objects directly into the standard reference frames*, e.g. FK5, is to obtain deep, high-angular resolution, wide-field photographic exposures which show the faint objects and the sparse, brighter astrometric standards at the same time. The existing astrographs have too small apertures and do not go deep enough. Schmidt plates may reach all but the faintest magnitudes, but the relatively short focal lengths of the world's large Schmidt telescopes limit the precision which can be obtained. Let us hope, therefore, that at least some of these 4-m class telescopes will maintain the photographic option, in any case until the CCD mosaics have become large and stable enough to be used for such fundamental research programmes.

The question of photography versus digital detectors was one of the subjects discussed by the WG Organising Committee (OC) when it met last April in Baltimore. We were fortunate to be joined by Richard Kron (Chicago) who is actively engaged in the preparations for the use of large CCD mosaics for surveying. In the meantime, Richard has been co-opted as a member of the OC and there is no doubt that he will greatly strengthen our interaction with the digital detector specialists.

An important decision at the OC meeting was to hold a major meeting in 1993, with the title: *'Astronomy from Wide-Field Imaging'*. It will take place in Potsdam, Germany (near Berlin) from August 23 – 27, 1993. A detailed description of the plans for this meeting will be found in this issue. All WG members are cordially invited and so are all others with an interest in this type of research.

The large number of excellent articles in this issue of the Newsletter is a visible sign of the great interest in wide-field techniques and the science that results. (It also says something about the efficiency of the Editor — thanks, Harvey!) I am convinced that the meeting next year will confirm this trend and will be a great opportunity for researchers from all continents to get to know each other and to exchange ideas, technical as well as scientific. Do plan to come to Potsdam!

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Report of the 1st Meeting of the WFI WG Organising Committee

The first meeting of the Organising Committee for the Working Group on Wide Field Imaging was held at the Space Telescope Science Institute in Baltimore, USA, on 13–14 April 1992. Those present were:-

Full committee members:

J. Guibert	H.T. MacGillivray	(Secretary)
R. Humphreys	D. Malin	
K. Ishida	I.N. Reid	
B. Lasker	M. Tsvetkov	
H. Lorenz	R. West	(Chairperson)

Invited consultants:

G. Burdsall (representing KODAK)
J.-L. Heudier (as past Chairperson of the WG on 'Astronomical Photography')
R. Kron (to provide input on CCD sky surveys)

Burdsall and Kron were only present for the first day of the meeting. Heudier was able to be present throughout.

1. Welcome and Opening Discussions

Lasker welcomed everyone to the STScI. He pointed out the importance of WFI in present-day astronomy, how the situation in both ground-based and space-based astronomy owed much to the availability of wide-field data. He cited the Hubble Space Telescope as a specific example which depended heavily for its support on scans of the plate material from the Schmidt Telescopes. There were tremendous opportunities ahead, with the availability now of second epoch photographic sky surveys from the Palomar, UK and ESO Schmidt telescopes and with the advent soon of deep wide-angle surveys using CCDs.

West thanked Lasker for his welcoming remarks. He congratulated the committee members on the fact that everyone had been able to attend. He regretted the small, as yet, proportion of female members on the committee, but hoped this would be remedied in the course of time. West reiterated that this was a unique occasion, with a newly formed WG on a topic which encompassed all wide angle astronomy, and he looked forward to the successful workings of the OC and of the WG itself.

West then gave a general introduction to the WG on WFI, its background and its goals. The WG had been established at the 1991 General Assembly of the IAU in Buenos Aires under Commission 9. It had a mandate for the forthcoming 3 years, and hence had the opportunity to show its worth. West saw 4 main activities for the WG:-

1) integration (of techniques and science);
2) coordination (e.g. of the photography and CCD groups);
3) standardisation (procedures, formats, archival media, etc.);

and 4) dissemination and sharing of information to the larger community.

On the last point, West noted that a Newsletter of the WG had been started, and this would be the main forum for the dissemination of information. The Newsletter would be distributed twice yearly (the first issue having been released in January 1992). There was subsequent unanimity among the OC members that the Secretary should encourage contributions highlighting the science coming from WFI as well as the expected contributions on the technical side.

There followed some further discussion on the scope of the WG in 'Wide-Field Imaging'. There was general agreement that the WG should incorporate imaging in the (near) infra-red, since as pointed out by Kron the scientific goals and techniques are very similar. Spectroscopy is another area with overlap, and it was agreed that objective prism spectroscopy should fall within the remit of the WG. In essence, any activity that provided (2 or 3-D) imaging of more than a single source at a time could legitimately be regarded as a 'survey' type activity and could fall within the scope of the WG.

2. Sky Surveys and Patrols

2.1 Overview

West provided an overview of 'Sky surveys and patrols'. Basically, the distinction between a 'sky survey' and a 'sky patrol' is that a survey is multi-coloured, goes very deep, is done at high resolution and is only performed a small number of times (i.e. once or at most twice to provide second epoch information). In this way, the sky survey provides a stable record of the sky. A patrol on the other hand is only performed in one (or at most 2) colours, does not go so deep, is done at low resolution and is performed frequently so as to 'capture' rapid changes of the sky. The main sky surveys to-date are those produced by the Palomar, ESO and UK Schmidt Telescopes, while the main patrols to-date are those of Harvard and Sonneberg. Some 700,000 photographic plates are now available as a result of the latter patrols. The use of CCDs on small telescopes for future sky patrols now appeared practical. However, West emphasised that photography was not a thing of the past when it came to sky surveys, and we must ensure the continuation in the future of the major Schmidt telescopes and photographic sky surveys.

Concern was voiced as to the continuation of the photographic sky survey work on the major Schmidt telescopes. Reid pointed out that support for the Palomar Schmidt cannot be guaranteed after the POSS-II sky survey is completed. Malin pointed out that the scientifically useful life of the UKST was not infinite, that it was perceived as vulnerable in some quarters and that its funding may cease when the AAO agreement came up for review. There was a strong reaction from the WG members to work to support the continuation of the UKST.

Malin voiced a further two concerns, namely the move of 4m telescope facilities away from providing support for prime focus photography, and the fact that the new class of 8m telescopes currently under construction had no capability to undertake photography altogether. Malin regretted both of these moves. He also stated that there was a misperception amongst young up-coming astronomers that photography is 'old-fashioned' and obsolete. On the contrary, there were a number of very good reasons for the continuation of photography on large telescopes. Reid made the point (which received no objections) that the astrometric capabilities of the photographic plate were not matched yet by CCDs and would not be matched for a considerable time to come.

Burdsall warned the OC regarding the dangers of cutting the need for specialised, on-glass photographic materials. He indicated that KODAK were taking a close look at the needs for photographic material from 1995 onwards, and if there was a move to reduce the production of the materials, then it would be very difficult to reverse that decision at a future date. He urged the OC to use caution with regard to any decisions concerning the reduced usage of photographic materials.

2.2 CCD Surveys

Humphreys provided a review of the present state of CCD surveys. Their main advantages were in the linearity of the detector, the fact that they were easily and accurately calibrated and that they were fast and reached faint limiting magnitudes. Their main disadvantages were the (as yet) small area covered and the fact that to be efficient there was a need for rapid on-line reduction of the data. As yet they were no substitutes for the photographic plates, but would take on an increased rôle in the future.

Humphreys described the main surveys currently in operation or planned. In the US, there were currently 2 sky surveys underway: at the Steward Observatory and at the USNO (Flagstaff). These were on small dedicated telescopes. In the UK, the Cambridge group were proposing a survey of the NGP using an array of 6 2048 x 2048 CCDs on the INT, while the Hitchhiker Parallel CCD Camera (University of Wales) was already permanently installed on the WHT 4.2m telescope, but as yet only operating in serendipitous mode. In Japan, experiments were already being undertaken with an 8000 x 8000 CCD mosaic on the Kiso Schmidt telescope with plans to eventually have a similar system operational on the Japanese 7m telescope.

Two future projects in particular were highlighted:-

a) that of the NASA Spaceguard survey, a programme for the rapid detection of near-Earth objects;

and b) the Sloan Digital Sky Survey of the North Galactic Cap.

The latter, in particular, is an ambitious project aimed at imaging (in 4 colours) and spectroscopy (~ 1 million galaxies down to r ~ 18 mag) of ~ ¼ of the sky starting in 1995.

The presentation stimulated much discussion. It was seen that there was a lot of commonality between the requirements of the photographic plate digitisation community and of the CCD community. Indeed, Kron made the point that it was possible that the workings of this WG could assist the CCD community since algorithms of interest (e.g. star/galaxy separation) and data handling capabilities had already been developed specifically for the large databases derived from the photographic plates. Kron suggested that much of the code could perhaps be used very easily without modification.

In the course of the discussions, other areas of complementarity between photographic and the proposed CCD sky surveys became apparent. The main problem with the photographic sky surveys was that the colour information was not contemporaneous. This, therefore, caused a major problem when attempting to differentiate between objects of varying intensity and objects of genuine extreme colour. CCDs can get contemporaneous colours, but the problem is that since the CCD surveys are new, the history of any strange object is not known. The major photographic sky surveys can provide information on the history of each object, which is vital for variability and proper motion studies.

The main perceived problems in this type of work are common to groups working in both areas, viz. the archiving, processing and analysis of very large quantities of data. A future proposed workshop focusing on techniques would be beneficial, and help secure interaction and links between persons working in the two main types of sky surveys.

Kron was invited to become a full member of the OC in order to provide input on the CCD sky surveys.

2.3 Space Schmidt Project

Lorenz described the Astrophysical Schmidt Orbital Telescope (ASCHOT). This is a collaborative project between the Byurakan Astrophysical Observatory (Armenia) and the Central Institute of Astrophysics in Potsdam (Germany). The aim is to build a wide-angle UV Space Schmidt Telescope in order to undertake a full UV sky survey and to provide a comprehensive study of UV emission from extragalactic and galactic objects. The telescope would reach a limiting magnitude of 24 for stellar objects at a wavelength of 1500 Angstroms.

2.4 Re-establishment of Sky Patrols

West pressed for the re-establishment of sky patrols, which would be aimed at recording the sky at frequent intervals. He considered that it would be timely now to invest effort in investigating the parameters for a future dedicated patrol-type instrument. Reid was sceptical about the need for such an instrument. He felt there was no clear scientific case for such. He continued that the need for such an instrument should be driven by a clear scientific goal, and that the requirements of that science should dictate the design characteristics of the telescope. Kron added that the best way forward to make a scientific case would be to take the best examples of projects benefitting from high frequency observations and to use these to work out the design parameters that would be required to optimally achieve those projects. West was invited to provide a more detailed proposal for discussion at the next meeting.

3. Photographic Techniques

3.1 Overview

Malin gave a comprehensive overview (graphically illustrated with the use of slides) of the importance of photography in wide-field imaging. He pointed out the further gains to be made with the use of the new fine-grain films on both the UKST and the AAT and pressed for the further refinement of those films by KODAK. The potential inherent in photographic enhancement techniques and in new fine-grain film revealed very clearly that photography was definitely not a thing of the past. There were quite obvious advantages in the use of fine-grain film for future sky surveys.

Malin said that problems of loading film (as opposed to plates) in the UKST had now been solved, but that possible effects of distortion needed to be examined. Malin pressed for the WG to set up a Working Party to study the integrity of the films for astrometric purposes. He suggested that comparisons should be undertaken between scans on glass plates and films to quantify any effects of e.g. stretching of the films, stability, etc.

3.2 Interaction with Suppliers of Photographic Materials

Malin pointed out that there were 3 salient points regarding the characteristics of new photographic materials:-

1) speed, contrast and resolution;
2) spectral sensitivity;

and 3) choice of base material.

Regarding these points, there was thus a list of items he wished to be raised for discussion with KODAK:-

a) the possibility of an extreme high-contrast emulsion (with a gamma of 5) for the detection of very faint objects;
b) the provision of fine-grain emulsions that would conform to the more commonly used passbands (U, B, V and R);
c) the possibility of non-hardened 4415 emulsion on a glass backing.

After discussions, it was agreed that:-

1) Malin would be the point of contact between the astronomical community and KODAK.
2) KODAK agreed to investigate the possibility of supplying a blue-sensitive Tech Pan-type emulsion.
3) Malin would undertake tests on some existing emulsions that KODAK would place on glass.
4) The WG would arrange for 'dealerships' for the purchase of photographic materials from KODAK.

Finally, in summing up from the KODAK point of view, Burdsall said that he was happy from these discussions that the astronomical community was still interested in continued supply from KODAK, and that there was no large-scale migration away from the use of photographic material in the foreseeable future. He would report these conclusions to the most senior level at KODAK.

4. Digitisation

4.1 Overview

MacGillivray described the present situation regarding the digitisation of the sky survey material. There had been 2 recent meetings on the subject of 'Digitised Optical Sky Surveys', the first at Geneva in May 1989 and the second in Edinburgh in June 1991. The proceedings of the latter meeting had been published by Kluwer.

There were several groups around the world in the process, or in various stages, of completing scans of the major sky surveys:- APM, APS, Muenster, STScI, COSMOS and USNO. There was a certain degree of complementarity in these scanning activities, in that US groups were prevalent in the Northern sky while non-US groups were prevalent in the Southern sky, although there was also some overlap. Basically, the demands from science or needs of a major support programme were driving the scanning programmes. Plans to make the data available to the astronomical community were advanced: the STScI were making (lightly) compressed pixel data available on CD-ROM disk, while the catalogues of the POSS-I survey were accessible at the APM and APS groups. The COSMOS group was intending to distribute its catalogue from the UKST 1st epoch survey on CD-ROM.

There was some concern that the current machines are not extracting the full information content of the photographic plates (positional information present at ~0.3 micron scales, the machines accurate to only ~1 micron and a density range of 5 [100,000:1] available on plates, but machines only digitising a 0-3 [1000:1] density range). Also, concern had been raised at the Edinburgh DOSS meeting that sampling intervals needed to be about 10 microns or smaller, in particular for the scanning of fine-grain films. At the present time there had necessarily to be a trade-off between scanning speed, dynamic range and pixel size.

New initiatives had come from the availability of fine-grain films (which had shown several advantages over the IIIa emulsions) and from the results of digitally stacking several tens of plates of the same field. These had highlighted the potential for new science from usage of fine-grain film on the Schmidt telescopes.

A number of issues were raised:-

a) what plates should be digitised (all plates or only the survey plates? What about the objective prism plates?);
b) some machines may be optimised for specific projects/specific types of plates; should there thus be better coordination of who does what?
c) the groups will be distributing catalogues for user consumption: should we undertake a comparison of the machines to ascertain the integrity of the catalogues thus released?;
d) should there be standardisation, e.g. of distribution medium, parameters, formats, conventions (e.g. equinox 2000)?;

and e) what should be the rôle of the data centres in all of this: should the groups act as the providers and supporters of their own data, or should the data centres do this?

In the ensuing discussions, comparison of the machines for internal 'standards' was considered important. Accordingly, MacGillivray was assigned the task of obtaining suitable plate material and circulating it around the various participating groups. Reid volunteered to be the adjudicator if there was sufficient interest in carrying out such a comparison.

With regard to formats and conventions, etc. it was decided that the data was necessarily machine specific and it would not be sensible to impose constraints, especially if these might be impossible to meet. However, the groups were encouraged to adopt IAU conventions (e.g. nomenclature, equinox, etc.) wherever appropriate.

4.2 Overlays for Sky Surveys

Lasker raised the issue of film overlays for the sky surveys. There had certainly been great enthusiasm for the overlays in the past, but there were now no funds to support their production. West was of the opinion that the way ahead should be the computer way, and that it would be necessary to provide digital overlays with the scanned sky survey material. Lasker was urged to investigate whether overlays could be provided with e.g. the STScI CD-ROM distribution of their PDS scans.

5. Archival and Retrieval of Wide-Field Data

5.1 Overview

Lasker initiated the discussions on archival and retrieval of wide-field data. His main themes were:-

1) the purposes of archiving;
2) the materials to be archived;
3) what requires IAU-level cooperation;

and 4) how can the community access the archived material.

On the reasons for archiving, Lasker pointed out that there was an overriding need to preserve the information from the photographs, which was now more important because of the deterioration in some of the existing photographic plates (e.g. due to gold spot disease). There was also a requirement to allow the community access to quantitative data from the plate archive for the furtherment of science.

Regarding the materials to be archived, Lasker listed 4 categories:-

a) the plates themselves (obviously required for posterity);
b) the raw pixel scans from the machines;
c) the object catalogues produced from the scans;

and d) the deep data produced from digital stacking and CCD mosaics.

On the archive medium, Lasker pointed out that magnetic tape was now not an option due to much higher density and more compact alternative media. At present there was a strong reliance on exabyte and other forms of helical media, although optical disk and optical film media were now evolving rapidly. Lasker considered that the way ahead for long-term archival recording was with the optical disk technology. He suggested that at the next conference, we had presentations from experts on both the tape and disk devices.

Concerning what needs IAU cooperation, Lasker pointed out that IAU conventions were generally accepted but not always used. Instead, the need to stay close to the data rather than the sky dictated the use of site specific ad hoc conventions. Lasker thought that the issue here was not desperately important, but nonetheless merited some consideration.

On the user access to the archived material, Lasker thought that there could be a universally available facility for catalogue searches, and suggested that there should be further community discussion on the best way forward. At present, users had access to scan materials at the scan centres. This was often the best approach, but was relatively costly. Scanned data was being exported by various groups and this is a successful activity at the present time. Perhaps the logical way forward for very large data sets was by means of network access to the scanning centres, and Lasker suggested that the DOSS/WFI community might be able to drive the global growth of broad-band, full service network connectivity.

West pointed out that the IAU (Commission 6) had discussed how information could be more easily transferred between astronomers. It was quite obviously an aim of the IAU that all astronomers have access to networks. Networking is, however, a major problem in parts of Eastern Europe. Nonetheless, it was seen to be very important to improve scientific activities by means of satellite links, and West thought that money would become available to help out. West said that if this WG felt there was a need to transfer catalogues by means of network links, then this would provide further support to Commission 6. Very soon all countries should have reasonably good connections and hence the WFI data could be more easily transferred.

5.2 Wide-Field Plate Archive Data Base

Tsvetkov outlined the history behind the Wide-Field Plate Archive database. It had been initiated at the 21st General Assembly as resolutions A8 and C11-14. There had been previous work carried out to survey the Wide-Field Astronomy instruments and plate archives. Tsvetkov's aims were now to undertake a comprehensive survey of such instruments and plate archives and to put the information into computer readable form. Tsvetkov had arranged a list of 143 Wide-Field telescopes which were used for professional work, and for these information had been obtained on:-

a) the size of clear aperture,;
b) the aperture of the mirror;
c) focal length;
d) telescope type;
e) field of view;
f) year of start of operations;
and g) elevation of site above sea level.

On the list of existing plate archives, Tsvetkov had distributed a 1st circular letter to over 200 observatories and institutes in September of 1991. He had received 63 replies, and from that he had drawn up a list of the existing plate archives. The information he had obtained regarded the type of material (plates, glass copies, films) and the number of plates (direct and objective prism). Also noted were whether the catalogue information was in computer readable form. His results indicated that there were in existence over 1.3 million wide-field plates.

Tsvetkov outlined his plans for organising this information. He intended to have completed his survey by 1992/93. From this he would create a computerised database sometime between 1993 and 1996. The database would have a range of information on the plates:-

1) observatory and telescope used;
2) plate or film;
3) sky coordinates of field centre;
4) size of plate or angular extent on sky;
5) time of exposure;
6) a list of plate-specific details (e.g. length of exposure, direct or objective prism, multiple or single exposure, hypersensitisation, type of emulsion and filter used, etc.).

There would also be information on availability of the material, whether it had been digitised, whether copies of the data existed, etc.

Finally, Tsvetkov described an ambitious aim to have the entire WFI plate collection digitised. He envisaged that such a project should take from 2.5 – 5 years to complete on a low-precision digitiser, and that there would result some 1000 terabytes of information. This would be the ultimate in preserving the information content of the photographic plates.

While there was clear support amongst the OC members for Tsvetkov to produce a database of the plate archive material and to make that list of plates available, it was not generally accepted that there was a need to digitise the entire plate collection, unless there was a strong case, such as for example deterioration of a set which might lead to a complete loss of a valuable record.

Malin made the further point that although institutions had lists of plates, this did not necessarily mean that the plates were available. Experience had shown that some scientists had not returned plates after borrowing and that the plates were lost to the community. Malin urged the OC to make a strong statement that astronomers should return the plates to the originating institute after use.

The discussions thus stimulated a number of resolutions:-

a) Tsvetkov was asked to identify platers which were stored in a bad way, and hence at risk;
b) The WG should assist institutes that do not have databases of their plate material and advise them on how to create the databases;
c) The OC should make every effort to see to it that plates were returned. It was suggested that this could be brought to attention through the Newsletter.
d) We should start the same enquiry with groups acquiring large-scale CCD frames with a view to organising a similar database based on digital material.

6. Organisational Matters

6.1 Definition of 'Wide-field'

There was considerable debate as to what constituted a 'wide' field and what did not. Should there be an angular size cutoff? If so what should that cutoff be? Small-sized CCDs (e.g. 512 x 512) might not constitute wide fields, but then perhaps the larger CCDs (8096 x 8096) would? Objective prism surveys should be included but what about multi-slit observations? Due to the difficulty in reaching a decision on the matter, the Secretary was commissioned to 'word' a suitable definition. [*Note added:- the Secretary has suggested that any observation involving simultaneous observation (direct or spectroscopic) of more than a single object in the optical or infra-red can be legitimately regarded as 'Wide-Field Imaging'*].

6.2 Relations to the CCD World

Throughout the 2-day meeting it had been accepted that the OC was 'weak' on the CCD side. This had been rectified by inviting Kron to join the OC to represent the CCD community.

6.3 Communications

6.3.1 WG Newsletter

Comments were invited from the OC members as to the form of the Newsletter. These were fully positive. Further suggestions as to what might go into the Newsletter in the future were made. There was quite general support for more shorter contributions. The editor should seek articles from various groups which would describe what they are currently doing in the area of WF astronomy. Small items of news and information would be valuable. Lists of references to articles being produced would also be helpful, as would lists of the most recent major publications from the different sites. Generally, the idea of the Newsletter as a rapid means of information dissemination was formulated.

6.3.2 Electronic Newsboard

The idea of creating an electronic newsboard as a means of disseminating information had been proposed. It was not clear to the OC members that at this stage this would serve a useful function. There were difficulties of it being managed properly. Also, it was generally felt that the Newsletter served this function better and provided more of a 'personal touch'.

6.4 WG Membership

The WG currently had some 170 members. This was considered perhaps large in WG terms. The Secretary affirmed his intention to keep the list of members 'active', and this would be distributed fairly regularly.

6.5 WG Structure

On the whole, the WG structure was satisfactory. However, we should seek to establish better representation from the CCD community. The areas of expertise in data handling, archival etc. were also seen as lacking, and steps should be taken to build up the membership from persons having such knowledge.

6.6 Action Plan and Priorities 1992-94

The most immediate item was to arrange for a meeting of the WG as early as possible. It was accepted that this could not be done before 1993. The OC should also, however, prepare for a session at the 1994 IAU General Assembly being held in Amsterdam. Details were left to the next OC meeting, which would be organised to coincide with the WG meeting in 1993.

7. 1993 Conference

Ishida conveyed to the OC members the formal invitation from B. Hidayat to combine a 1993 WFI meeting with the proposed meeting on Schmidt Telescopes in Indonesia, also to be held in 1993. This was welcomed by the OC. However, it was felt that a meeting in Indonesia would prohibit many WG members from attending due to the expense and time taken to travel. The OC decided to decline Hidayat's invitation at the present time, but requested West to write to Hidayat to thank him for the invitation and to indicate the possibility of a meeting in that area at a future date.

Both Minnesota and Potsdam had been suggested by OC members as possible venues for the 1993 WFI meeting. Expressions of interest were thus invited from representatives of the possible host institutes. Humphreys favoured a smaller meeting which would involve both the photographic and CCD communities but which would focus more closely on techniques for data processing, analysis etc. It was the opinion of the majority of OC members, however, that they would like the 1993 meeting to be much broader in scope and allow presentations on both techniques and the science. The conference centre in Potsdam was capable of housing a large gathering. Accordingly, it was decided that the 1993 meeting be held in Potsdam. A further meeting on more specialised topics could subsequently be arranged for circa 1994-95 in Minnesota.

The programme for the 1993 was worked on at length. It would be a 4.5 day meeting with the following structure:-

Day 1: sky surveys and patrols;
Day 2: data archival and processing;
Day 3: Solar system studies [*Note: ½ day*];
Day 4: Galactic studies;
Day 5: Extragalactic studies.

Areas of responsibility among OC members were assigned as follows:-

Day 1: West, Malin, MacGillivray and Kron;
Day 2: Lasker (+ 1 expert on data processing) and Tsvetkov;
Day 3: Guibert and Heudier;
Day 4: Reid, Ishida and Humphreys;
Day 5: MacGillivray and Lorenz.

There was general support for the move to have the emphasis on review presentations, although contributed papers were also welcomed. There would be the capability for demonstrations. The OC would be the SOC for the meeting; Lorenz would arrange the LOC. The proceedings would be published by a commercial publisher (probably Kluwer) and in a format similar to the 1991 Edinburgh DOSS meeting proceedings. The editors would be the representatives of the 4 WG subgroups, viz. MacGillivray, Lasker, Malin and West.

8. Summary of Decisions and Resulting Action Items

West summarised the main decisions that had been reached during the meeting and the action items which had resulted:-

8.1 WGWFI Goal

The WG should seek to integrate both the techniques side of WF astronomy and the science that gets done. WFI should encompass both the optical and infra-red region of the spectrum due to the similarity of the techniques used.

8.2 Continued Support for the Large Schmidts

There is concern to ensure the continuation of the Large Schmidt telescopes and the valuable survey work they are undertaking.

8.3 Prime Focus Photography

Photographic possibilities have been reduced on many 3 – 4m class prime focus facilities. We must ensure that the capability is kept in place, at least on some facilities. The problem with astrometry using CCDs must ensure the continuation of photographic sky surveys, at least for the time being.

8.4 Interaction with 'Wide-Field' CCD Work

Kron to become a member of the OC (and of WG). He will ensure liaison between the WG and the CCD-mosaic community.

8.5 KODAK Products

a) Malin to become WG spokesman and sole tester of new products.
b) Malin and KODAK to prepare well-founded, detailed proposal for institute 'dealership' in order to facilitate distribution of KODAK products.
c) Burdsall to investigate whether U+B+V type 4415 emulsions can become available.
d) Burdsall to get KODAK to remove hardener from glass-based 4415 emulsion in order to allow better sensitisation.
e) Burdsall to investigate whether extremely high contrast fine-grain emulsion can be made available for deepest possible photography.

8.6 Digitisation

a) WG to investigate optimal pixel size for digitisation:- 5 – 10 microns?
b) WG to elaborate detailed test scheme to help digitisers recognise strengths and weaknesses of their machines + software; astronomically-oriented tests to be preferred (i.e. alpha, delta, magnitudes of objects), stability, etc. MacGillivray to obtain and distribute plate material, Reid to specify details of test and undertake the evaluation, assuming community interest in such an activity.

8.7 Value of Photography

The WG reconfirms great value of photography in astronomy for at least another decade. However, there is a desire for new and better emulsions. CCD and photography are complementary. WG to inform astronomical community about the strengths of photography and its superiority in certain areas.

8.8 Overlays

Lasker to investigate possibility of computer-based overlays, i.e. as well as the CD-ROM digitised images there would be identifications for objects in the field. He will discuss with J. Mead.

8.9 Presentations on Tape and Optical Disk Technology

WG to arrange for talks on tape and optical disk technology for the 1993 meeting; also how to keep digital archives and most suitable archival medium. This is an evolving technology.

8.10 CCD Archive

WF to impress upon the CCD community that they must archive their data.

8.11 Recovery of Plates

WF to press for recovery of plates on loan to astronomers. WG to suggest ways of persuading them to give the plates back to the archive.

8.12 Archives at Risk

Tsvetkov to draw up a list of observatories/institutes at which plate archives appear to be in danger of being irrevocably lost. WG to find ways to salvage such plate archives.

8.13 Nomenclature

WG recommends the use of IAU conventions where possible, while recognising the need for machine-specific designations in preliminary catalogues.

8.14 Data Centres

Persons from NSSDC, Strasbourg, etc. to be invited to 1993 WG meeting.

8.15 Objective Prism Plates

Prism plates lie within the jurisdiction of the WFI WG. West will inform E. Griffin of this decision.

8.16 Definition of Wide-Field

Observations which use multi-plexing capability.

8.17 Newsletter

MacGillivray continues as editor for next 2 years. Situation to be reviewed then. Articles to be short. Encourage progress reports and 'newsy' items.

8.18 Newsboard

Not needed (yet).

8.19 Future Meetings/Conferences

1993 meeting to be held in Potsdam with dates 23 – 27 August. A smaller meeting to be arranged in Minnesota (for 1995?).

8.20 Schmidt Telescope Meeting

West to write to B. Hidayat to thank him for the invitation.

9. Closing Remarks

The business of the meeting having been concluded, West thanked Lasker and the STScI for their hospitality over the previous 2 days. The meeting had been highly successful and West pointed out there was much to be done in the future. He looked forward in particular to the Potsdam conference which would be a marvellous opportunity to bring the entire WG together.

H.T. MacGillivray
Secretary to the OC

News and Views

1. Sky Overlay Maps

The Atlas of Sky Overlay Maps for the Palomar Sky Survey (Dixon, Gearhart, and Schmidtke, the Ohio State Radio Observatory, 1981), has proven to be an extremely valuable tool. Each transparent overlay is customized to an individual survey field and identifies all entries in the Master List of Nonstellar Astronomical Objects (Dixon and Sonneborn, 1980) as well as all SAO stars. Unfortunately, a similar set of overlays has never been produced for the ESO/SRC Sky Survey — primarily because important lists of southern galaxies were not published until later in the 1980s. I intend to initiate a program to create a set of transparencies for the ESO/SRC Atlas, but I first seek input from the astronomical community in the following areas:

1) I would like to determine the need or interest for a set of southern overlays. Are transparencies still a viable medium? Or, should they be totally scrapped in favour of real-time software displays?

2) I would like to identify individuals or institutions that may have plans to undertake a similar project. Perhaps a collaborative effort could be organized.

Please send comments or suggestions to the address below. Thank you.

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2. Eliminating Satellite Trails from Photographic Exposures

An astronomer in New South Wales, Australia, has just finished planning a night's photography with the United Kingdom Schmidt Telescope. He once worried about how many satellite trails would clutter the plates each night, but no longer. Picking up the telephone, he FAXes field coordinates and possible times for four plates to the non-profit Center for Analysis of Satellite Interference with Astronomy (CASIA) in the United States.

At CASIA (pronounced like the first three syllables of Cassiopeia), an analyst receives the message. He enters observatory, plate centers, and times of interest into a dedicated computer. Accessing a data base of orbital elements on over 7000 artificial Earth satellites updated three times a week, in three hours the computer generates a list of culprit satellites predicted to cross the four plate fields. Several satellites are expected to be so faint and moving so fast that they will not even register. One plate scheduled near local midnight will avoid all streaks without further intervention. Two others would show a few trails each, but the times of these satellite passes are noted in order to interrupt the exposures. The fourth region will have to be rescheduled because a high satellite lingers in the field throughout the planned interval.

Since darkness is still many hours away, these findings are EMAILed back to Australia. Included are suggested times when slow-moving satellites are absent from the region in need of rescheduling. Although it means more work for him, the observer does not mind having to close the dark slide for a minute or two every half hour or so. Only once in a great while does an unpredicted satellite still sneak through. The total plate exposure time remains the same, but now almost every plate is truly 'A'-grade!

This scenario is not some wide-field astronomer's fantasy, but possible now with modern computers and communications. CASIA is completing a proposal to the IAU for beginning operation this fall. If your organization could benefit from such a service, kindly address a letter indicating your interest in CASIA to Dr. Jacqueline Bergeron, IAU-UAI Secretariat, 98 bis Boulevard Arago, F-75014 Paris. A copy to the author would be appreciated.

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3. Morphology of Complexes in the LMC

We have started a project of wide-field imaging in order to study the morphology of complexes and supercomplexes in the LMC, via star-counts and spectral classification, from plates taken with the U.K. Schmidt Telescope. Iso-density contour diagrams, as well as histograms of the distribution of spectral types of their stellar population are in progress. The regions under study are centered at Shapley 'constellations' I, IV, IX and X. Our results will be published shortly.

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Sky Surveys and Patrols

Several major photographic sky surveys are currently in progress in both hemispheres.

In the North, the Oschin 48-inch Schmidt at Palomar is busy taking plates for the 3-colour POSS-II, which covers the entire northern sky (+90° – +0°) on 3 x 894 = 2682 plates. The original plates are reproduced at the ESO photographic laboratory in Garching for the corresponding Atlas; after some problems at Kodak with the manufacture of the copy plates, the production has now entered into a more steady phase. A digitized version of the POSS-II will be produced at the Space Telescope Science Institute in Baltimore.

Following the SERC-J survey of the sky south of -20° (the blue part of the 2 x 606 = 1212 plate 'ESO/SERC Survey of the Southern Sky'), as well as a 163 plate IR survey of the southern Milky Way and the Magellanic Clouds, the 48-inch UK Schmidt at Siding Spring has now embarked upon the AAO-R survey (second epoch red survey with 606 plates), and a 731 plate IR survey of the remaining part of the southern sky. Moreover, the 2 x 288 = 576 plate SERC-EJ/ER survey of the -15° – -0° zone is well underway and is being reproduced at the photographic laboratories at the Royal Observatory in Edinburgh. At La Silla, and following the ESO(R) (606 plates) half of the ESO/SERC Survey, the ESO 1-metre Schmidt continues with the 288 plate extension of the Quick Blue Survey (QBS) to the equator and plans are now being made to begin the second epoch QBS south of declination -20° (606 plates). Both the UK and the ESO Schmidts have long-term objective prism surveys in the south.

These and earlier optical sky surveys have come into extensive use by astronomers engaged in the identification of the many thousands of X-ray sources, recently detected during the ROSAT survey of the entire sky. Many positive identifications have already been made and optical studies of a broad selection of these objects have begun with large telescopes.

Wide-field telescopes have also been intensively involved in the follow-up of transient high-energy sources, detected with the WATCH instrument on the GRANAT satellite. A rapid series of several such events in the second half of July called for good logistics to ensure the close collaboration between the X-ray astronomers and those at the large Schmidts. The launch of another WATCH instrument on the free-flying European Retrievable Carrier (EURECA) with the Space Shuttle Atlantis, on July 31, 1992, will undoubtedly lead to many more detections in the period until its planned retrieval next year.

Some (relatively) good news: it now appears that the photographic Sky Patrol at Sonneberg, Germany, will be allowed to continue for at least another couple of years, before the support from the funding authorities is likely to be cut off. The unique work at Sonneberg has been described in recent articles in the German language journal 'Die Sterne' and also in the June 1992 issue of the ESO Messenger. On every clear night since the mid-1950s, and as far as the weather permitted, the entire visible part of the sky has been recorded with 14 patrol cameras, each covering a field of 26° x 26° on 13 x 13 plates in blue and red, down to 14.5 (pg) and 13.5 (pv), respectively. More than 140,000 patrol plates are now in the Sonneberg archive, together with another 100,000, mostly from selected field programmes.

Together with their colleagues in Tautenburg and Jena, the Sonneberg astronomers have now begun a project aimed at transferring their great experience in patrol work into the future. In a first study, optical calculations are being made for a new type of wide-field, very fast, medium-sized patrol telescope, optimized for CCD work.

At the end, a sad note: the ASHOT project, described in the last issue of this Newsletter, has run into severe problems, caused by the present change of political structures in Europe. Let us hope that this set-back will be temporary only, and will be overcome when new agreements for the bi- and multi-lateral scientific cooperation between the involved countries come into place.

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Comet Halley Wide Field CCD Camera

Thanks to the generous support by the former director general of ESO, Prof. L. Woltjer, it was possible in late 1985 to erect a wide-field camera at La Silla, with the intent of imaging Comet Halley. The camera used an RCA 640 by 1024 pixel CCD chip, the largest one available at that time. The imaging was done using short focal length lenses, mostly of 100 mm, corresponding to a pixel size of 31 arcseconds and a field of about 5.5 by 9 degrees. In front of the lens was an optical filter, which selected the photometric band-pass. About 2000 images were obtained, many through narrow-band filters. A large sub-set has been composed into a video-film which shows the dramatic development of the Comet's ion-tail during the weeks following perihelion passage.

During periods when the Comet was not observable, the system was used for experimental imaging of other objects, e.g. the LMC and the Coma Cluster. In the latter field, we noted the big diameters of elliptical galaxies, about twice as large as they can be measured on photographic Schmidt exposures. Other extended, low surface-brightness objects were detected in Hydrogen alpha.

The last set of images was taken during the period of the η Aquarid meteor shower (which incidentally is associated with Comet Halley). The pictures show many streaks from meteors associated with that shower. Also this application of a wide-field CCD camera was novel. the operation of the camera ended in May 1986, when demand rose for the detector's installation at the (much) larger telescope, for which it had originally been acquired.

The operation of the Comet Halley camera gave a foretaste of what can be achieved with a permanent set-up. The high sensitivity and immediate computability of the images are perhaps the most striking advantages, but also the constancy of performance is very important. With the CCD, and contrary to the photographic process, there is no problem of uniformity of response, from exposure to exposure. Also, some of the distinction between Sky Surveys and Sky Patrols will disappear, since any exposure can be added to previous ones of the same field. Hence, what starts as a Sky Patrol of rather poor detection limit, may end as a very deep Sky Survey. In the process, anything which varies in magnitude, or moves, will be detected; numerous discoveries are certain to be made.

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UK Schmidt Telescope (UKST) News from ROE

1. Return of UKST plates to ROE

The Plate Library of the Royal Observatory Edinburgh operates as both permanent archive and lending library for all plates taken with the UKST. Over 15,000 plates have been taken since the telescope came into operation in 1973. Many plates have been sent 'on loan' to astronomers all over the world on the understanding that they would be returned to Edinburgh once the project was complete. It is regrettable that too many of the Library's stock have been 'on loan' for surprisingly long periods of time. We ask everyone who has UKST plates (including glass and film copies) which are no longer required to return them to ROE as soon as possible. It is to everyone's advantage for plates to be absent from Edinburgh for the shortest realistic time, for the following reasons:

1) About half the recent requests received for UKST material can be satisfied by the loan of existing plate material. This results in a considerable saving in telescope time and means that more projects can be satisfied if new originals do not have to be taken. Long delays often occur when plates are not to hand in the Library.
2) Plates are best stored under conditions such as those at Edinburgh. Some plates are suffering from microspots; these can be treated and selenium toned once they are returned to Edinburgh. This process prevents the spread of these flaws.
3) Many of the plates will become more valuable with time as they will form 'first epoch' plates for many future studies. It is also impossible to predict when any one plate may become exceptionally useful due to the exposure having been made at a particular time or in a particular waveband.
4) On several occasions ROE has received a request to borrow an existing plate and has then been unable to trace either the plate or the borrower, usually due to the borrower moving to another institute.

Hence, we ask everyone who has UKST plates (including glass and film copies) to return them to ROE as soon as they have completed their project. If necessary, we can supply suitable boxes for the safe shipment of the plates and can send these boxes to any address on request. We also ask users who change address and wish to take their plates with them to inform us in order to prevent plates getting lost. If anyone finds UKST plates which have no obvious owner, please contact us and arrange shipment to Edinburgh. Users in Australia may, of course, return their plates to Coonabarabran rather than to Edinburgh.

2. Equatorial (EJ and ER) Surveys and Atlases

As at 15th June 1992 282 fields have an A-grade accepted for the EJ survey and 211 fields have an ER A-grade. The total number of fields in the survey is 288.

The first issue (50 fields) of the EJ Atlas on film has been sent to over 50 customers and the second instalment (also of 50 fields) will soon be ready for despatch. The anticipated completion date is 1994. We remind readers that this film Atlas can still be ordered from UKSTU, ROE at a cost of £4,000 with payment to be made by instalments. Please contact us for a copy of our special order form.

We will shortly begin the copying of the ER Atlas onto glass. Once production has begun it becomes increasingly difficult to accept further orders. Any potential customer who would like this atlas should contact UKSTU, ROE as soon as possible.

3. Magellanic Cloud Mini-Survey

The UKST is taking plates in various colours on 12 fields covering the SMC (fields 28-9, 50-1) and LMC (fields 32-3, 55-7, 84-6). It is planned to photograph all fields in the following wavebands: U, B_J, V, OR, (Short)R, I and with the prism. Each set will be copied onto film and the sets of 12 can be purchased individually at a cost of £250 per set. Orders can now be placed for three of the sets; OR, SR and I. The OR consists of sky-limited IIIa-F exposures taken with an OG590 filter. The I and SR sets are made using the same originals as the SERC I/SR Atlas of the Milky Way and Magellanic Clouds (90 minute IV-N + RG715, 15 minute IIIa-F + RG630).

The B_J set will be made from new originals exposed in dry nitrogen and will therefore be more uniform than the films included in the ESO/SERC Southern Sky Atlas. It is hoped that this set will be available by 1994. We would be particularly interested in hearing from anyone interested in the U and V sets as this would help in scheduling the telescope to obtain the original plates.

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Gold Spot on Photographic Plates

Since the alarming discovery of 'gold spot' degradation of plates in the late 1970s, the spectre of the world's plate archives slowly self-destructing has haunted astronomers and archivists alike. Although the effect was soon dubbed 'gold spot disease' it was in no way infectious and it was soon realised that it was only seen on the fine-grain (mostly IIIa- type) emulsions, and once infected, the initial 'rash' was slow to spread to the rest of the plate. These IIIa emulsions are unusual in being pure silver bromide; most normal negative materials contain some silver iodide.

Curiously, the plates of some institutions hardly suffered at all from gold spot, among them substantial collections at ESO and the AAT, though many plates from the UK Schmidt were affected. Even when new processing recommendations from Eastman Kodak were followed some UKST plates still deteriorated, though post-processing toning of the plates with selenium toner largely (though not completely) prevented further degradation.

The new, anti-gold spot recommendations from Kodak included a change from normal to rapid fixer and the elimination of Hypo-Clear from the processing cycle. Curiously, the use of iodide as a preventative was not reported as useful in the series of publications from Kodak where the gold spot problem was addressed, despite the fact that the addition of iodide ion to the fixer was found to be an excellent preventative when gold spot was found on (bromide emulsion) microfilms in the 1960s.

It now seems that those observatories that fix iodide-containing plates such as IIa or 098-04 in the same fixer as the IIIa types are those where gold spot is relatively rare and conversely, where fresh fixer is used, or cross-contamination is deliberately avoided, gold spot thrives. A test of this is now being conducted at the UK Schmidt, where two fixer lines are being used in parallel, one with and one without the addition of 2 grams per litre of potassium iodide. The long induction period of gold spot prevents instant appraisal of the results (but see next news note) but we will keep Working Group members informed of developments, or (we hope) the lack of them.

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Rapid Test to Evaluate Resistance to Gold Spot

In *J. Imaging Tech.*, **17**, 91 (1991), Adelstein et al. describe a method of testing the resistance of processed photographic emulsions to gold spot, (or redox blemishes as they are perhaps more usefully known). In essence, they have improved on earlier methods of exposing processed materials to hydrogen peroxide vapour. Most laboratories concerned with archival permanence of photographic materials use some variant of this test but the results are not reproducible.

The paper discusses the reasons for this and goes on to describe a simple piece of apparatus that seems to eliminate some of the variables that result in erratic test results. In essence this consists of a desiccator fitted with a fan that is used in the early part of the test to ensure good circulation of the vapour, careful specimen placement in the test vessel and tight specification of peroxide application and humidity control. Samples can be reliably evaluated in a test cycle that runs for 18 hours, using equipment and conditions that most astronomical institutions should be able to duplicate fairly well.

A more recent issue of *J. Imaging Tech.* **36**, No. 1, is an issue featuring the conservation of images. Papers include work on the degradation of polyester magnetic (video-tape) materials as well as the more conventional photographic products and laser discs.

Reported by D. Malin

Recent UKST Experience with Kodak Tech Pan Film

1. Introduction

Kodak Technical Pan emulsion has been available since the early 1980s on a variety of substrates and formats from 35mm to large sheets, known variously as Types 2415 or 4415 depending on the thickness of the film base. Experimental coatings have also been supplied on glass as special product 153–01. In all cases the emulsion is believed to be essentially the same, though coating weights and overcoats may vary.

The sensitive material is an extremely fine grained, high resolution, panchromatic negative film with an extended red sensitivity which peaks at around 650nm, betraying its origins as a solar flare patrol film. This material has been widely used in the amateur astronomy community but has largely been ignored by the users of large Schmidt telescopes. In the main this was because samples of the on-glass material did not respond to normal reduction hypersensitization techniques and film-based products could not be readily accommodated in their large, curved focal planes. In addition, films of a size suitable for use in the UKST have only recently become available.

In this note we briefly review the important properties of this emulsion that make it so useful with small focal ratio telescopes and describe some recent results obtained with the UK Schmidt.

2. Properties

Tech Pan is a substantial improvement over the broadly equivalent, red-sensitive, IIIa-F emulsion on glass in almost all respects. The only situation where this is not true seems to be when the emulsion is coated on glass, where it responds very poorly to hypersensitization (hypering). This report therefore refers only to Tech Pan coated on 178μm thick polyester (Estar) base (i.e. Type 4415), which does hyper well.

The enhanced imaging properties of the film are the consequence of its extremely fine grain and its remarkably low granularity. Both properties are a factor of two improvement on the fine grain IIIa which were considered excellent in this regard. Tech Pan maintains contrast characteristics which are similar to the IIIa types. These essential factors combine to give a very high resolving power, ~320 lines/mm compared with ~200 for IIIa emulsions. The spectral sensitivity is also reasonably flat through the visible region, though it does not extend quite as far into the red as IIIa-F.

Unfortunately, these data (Kodak 1982, 1987) are not strictly comparable since they refer to different processing conditions, but are sufficiently convincing to explain the improved performance which is found in practice. Most surprisingly, these considerable advantages, which translate directly into significant scientific gains, are obtained with little or no increase in exposure time since the reciprocity failure of the optimally hypered emulsion is extremely low. Indeed, so promising is this material that a decade ago Heudier (1981) suggested that the DQE of this emulsion could reach 4–5%, which is a very high figure for a photographic detector.

Another major advantage of film is cost, which is about a tenth that of glass–based products, so there are substantial savings to be made from its wider use as well as the obvious transportation, storage and handling advantages of a film based material. We have also found that the hypering regime uses much less nitrogen than IIIa materials, again with useful cost savings. A further advantage is the large batch production mode of film coating, so we expect much smaller batch-to-batch variations than we find with Kodak spectroscopic emulsions on glass. All these properties have encouraged us to explore ways of using Tech Pan in astronomy.

3. The Use of Film in the UK Schmidt

The focal plane of the UKST corresponds to the surface of a sphere of 3.05m radius, so the film must be deformed by radial stretching to ensure good overall focus. The UKST plate holders are intended for glass plates, so a new holder had to be designed and constructed to accept film. This is now in regular use and exposures on Type 4415, 178μm thick Estar base Tech Pan film are now routinely obtained with excellent edge-to-edge focus. The polyester base itself is extremely stable, having excellent strength, toughness and flexibility properties (Kodak 1970).

Problems were encountered initially with hypersensitization since film based Tech Pan seemed to require much longer hydrogen soak than IIIa types and we were unable to hyper Tech Pan on glass at all. We now find that the long nitrogen pre-soak normally used for IIIa emulsions is not necessary, but that the material requires a much longer (or higher temperature) soak in hydrogen than is usual to reach an acceptably fast speed. Once optimised, however, exposure times are found to be

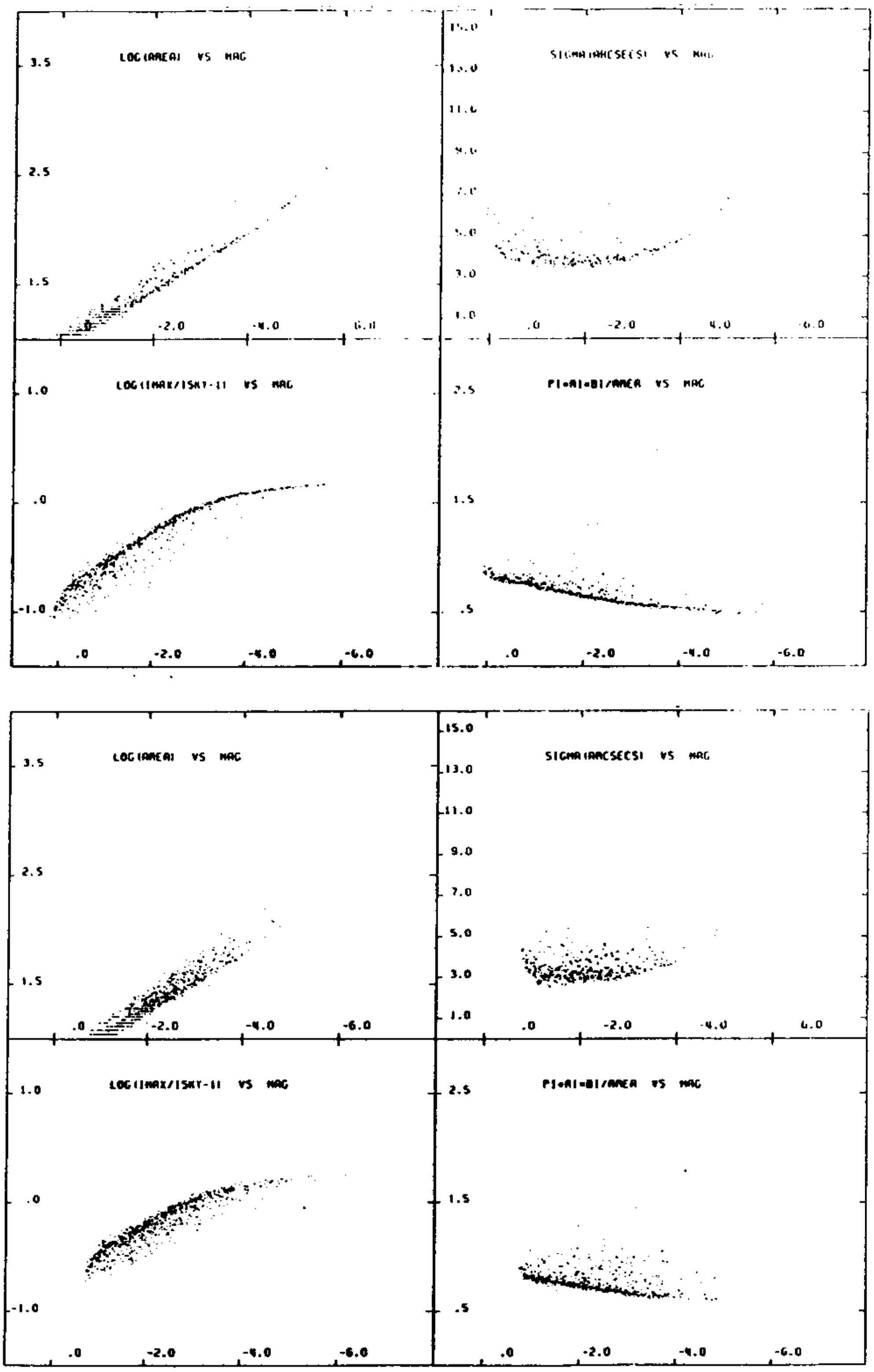

Figure 1.

comparable to the earlier generation of emulsions. Experience at UKST also indicates that hypered Tech Pan keeps for several months when stored at low temperature in nitrogen before any serious degradation in speed or fog-level occurs.

4. Recent Astronomical Results and Performance

To extract quantitative data from Tech Pan exposures they must be scanned with a measuring machine such as COSMOS, but qualitative tests also show that they respond well to photographic image enhancement techniques, as demonstrated by Russell et al. (1992). COSMOS data from recent scans of films indicate substantial information gains over IIIa-F. Examination of COSMOS quality control plots reveal no non-uniformities that can be attributed to the emulsion. COSMOS star/galaxy separation plots for Tech Pan data and an equivalent grade IIIa-F plate are given in Fig. 1. The difference is striking, with the stellar locus being extremely well defined and extending to fainter magnitudes than the IIIa-F. The enhanced star/galaxy discrimination should lead to much improved deep galaxy catalogues.

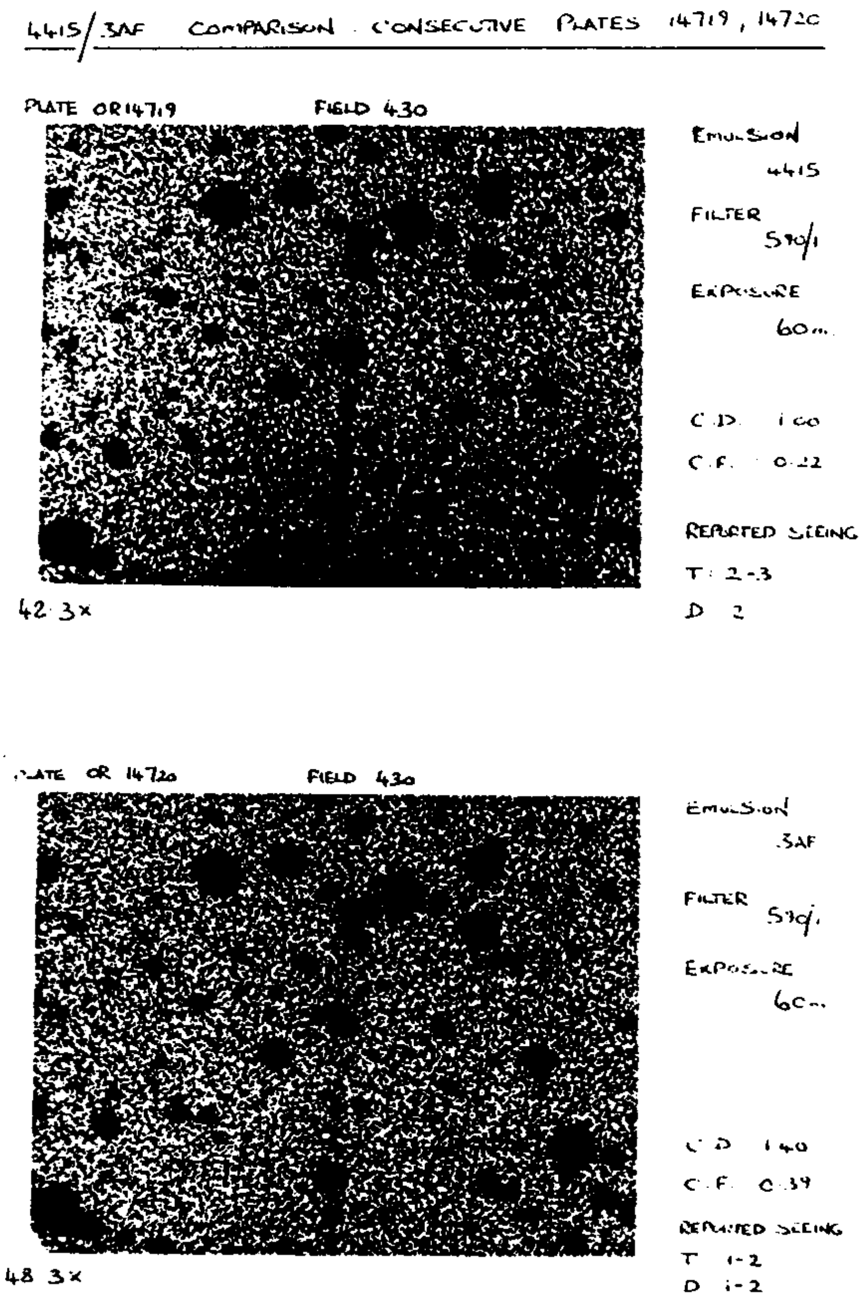

Figure 2.

Phillips and Parker (1992) have shown that low surface brightness galaxy intensity profiles obtained from COSMOS 8μm pixel mapping mode scans of Tech Pan film can reach 26.5–27 R magnitudes per square arcsec, corresponding to less than 0.4% of the sky background, and at least 1 magnitude better than IIIa-F. The sky noise per pixel was also ~0.8% so the observations are at least equivalent in depth to 5–10 minute CCD observations with the AAT but with the advantage of a wide-field and without any processing of the raw data.

The repeatability between COSMOS scans of two test films of the Virgo cluster was excellent, with galaxy profiles faithfully reproducing published profiles but extending to considerably fainter isophotes. These results indicate that Tech Pan exposures are likely to be excellent for faint galaxy photometry, and are able to detect fainter objects than on normal, survey-quality UKST plates. Finally, Fig. 2 provides a direct comparison between images of the same area of sky recorded with consecutive exposures on Tech Pan and IIIa-F. The sharp, faint images are seen against a very low noise background and amply confirm the promise of Tech Pan.

5. Conclusions and Recommendations

Provided a few simple procedures are adhered to there is every reason to expect that deep, low-noise, high-resolution astronomical photographs can be consistently obtained with Schmidt telescopes using Tech Pan emulsion coated on thick Estar base. Speeds comparable to optimally hypered IIIa-F are achieved if the hydrogen hypering is optimised and if the films are developed in D 19 for 8–10 minutes.

Because of its improved resolution, high contrast and fine grain the film clearly provides better image quality. This is evident in fainter isophotal limits, better contrast retention, higher photometric accuracy, increased signal to noise and fainter overall magnitude limits. These factors, together with the substantial cost savings and other substantial storage, handling and transportation advantages offer important new opportunities for small focal ratio, wide field optical telescopes.

An expanded version of this report will be published elsewhere.

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Scanning Activities at the STScI

One of the two STScI PDS microdensitometers is now dedicated to second-generation plate scanning. Descriptions of the collaboration between Caltech and the STScI to digitize and distribute the POSS-II survey appear elsewhere in this newsletter as well as in abstracts by Djorgovski et al. and by Lasker et al. The program additionally includes the digitization of all plates in the AAO-R Survey (Morgan et al., 1992).

The second generation scans use 15μm pixels and a 23040^2 raster (occupying 1.2 Gbytes uncompressed). The initial scanning efforts are proceeding slowly (3 plates per week), pending the completion of the upgrades described below and in the previous Newsletter.

During this phase, considerable attention has been directed to quality control of the production scanning process. Apart from the usual considerations of bit and pixel statistics, procedures for the impersonal control of the two major PDS scanning defects, shearing and chopping, have been developed. Shearing, which occurs when right- and left-going scan lines are incorrectly aligned, is detected (typically to a precision of 0.03 pixels) with an interline correlation function. Chopping, which occurs when the servo response is inadequate to keep the Y-position (axis orthogonal to the fast scan motion) at the value defined by the metrology system, is detected with a relatively simple operation involving the interline correlation function. This procedure was developed in collaboration with Nick Weir (Caltech), and is currently being calibrated; the sensitivity is believed to be better than 0.05 pixels.

In addition to these tests, based on scans of astronomical data, two new sets of test plates have been acquired. One is a Ronchi ruling oriented at 30° to the scan axis, such that scans at zero Y-increment are very sensitive to chopping. The other is a 140 x 140 line grid on a 14-inch plate, to be used for long term metrology control. Discussion regarding the measurement of the second grid at other institutions would be welcomed.

The compression of the GSC-I scans (≈ 10x, using the algorithm described by White et al. [1992]) is now in progress, and community distribution of these on CD ROMs will begin in about one year. Some compression experiments have also been done on the POSS-II scans. It appears that compressions of 20 – 30 may be feasible for community distribution for the POSS-II.

The second PDS has been removed from service to support the installation of an upgraded control system. This modification is based primarily on a Hewlett Packard (HP) 5527A control system for the metrology laser. This unit includes a servo controller which takes its feedback information directly from the metrology laser, a new 'divide-by-N' unit custom built by HP and integrated with the servo controller, and a programmable DVM for overall system monitoring. At the same time, all functions of the original Perkin-Elmer microprocessor are being replaced by a VAXstation 4000, interfaced by IEEE and by CAMAC. Full details of this project will be published after the integration is completed.

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Digitisation of the Second Palomar Sky Survey: Program Definition and Status

1. The Second Palomar Sky Survey

The second Palomar sky survey (POSS-II) is still under way using the 48-inch Oschin Schmidt telescope at Palomar Observatory. For a brief description, see Reid et al. (1991). When completed, the photographic survey will consist of some 900 fields spaced at 5° intervals, covering the entire northern sky in three bands: blue-green (IIIa-J emul. + GG395 filt.), λ_{eff} ~ 480 nm; red (IIIa-F emulsion + RG610 filter), λ_{eff} ~ 650 nm; and near-IR (IV-N emulsion + RG9 filter), λ_{eff} ~ 850 nm. At the moment, approximately 50% of the J plates, 60% of the F plates, and 15% of the N plates of adequate quality are in hand. The survey should be 90 – 95% complete by early 1996.

The new survey reaches ~ 1^m – 1.5^m deeper than the old POSS-I, mainly due to the new fine-grain emulsions and the improved telescope optics; the gain would have been larger, but the Palomar sky is now much brighter than in the 1950s. The typical limiting magnitudes are:

$$B_J \sim 22.5,\ R_F \sim 20.8,\ \text{and}\ I_N \sim 19.5$$

The fine grain emulsions and the better image quality make the classification of faint objects (stars versus galaxies) possible to a magnitude level at least 1^m – 2^m deeper than in the old survey. Photographic copies of the survey (glass and film) are being produced at the ESO photolabs in Garching and will be distributed to subscribers at cost.

2. The Digitization of POSS-II at STScI

There are presently *two* digitization efforts of POSS-II under way:

1. Digitisation of both the old POSS-I and the new POSS-II plates at the USNOFS by D. Monet et al. The main purpose of this project is to obtain proper motions for a large number of stars.
2. Digitization of POSS-II at STScI. (Glass copies of the POSS-I plates have been digitized by several groups, including STScI, RGO and U. of Minnesota.)

As reported in the previous newsletter, it is planned that the entire POSS-II will be digitized using the modified PDS plate scanners at STScI. A memorandum of understanding has been signed by STScI and Caltech to this effect, and the digitization of plates is now in progress. It is anticipated that the completion of the photographic survey and its digitization should roughly coincide (approximately 1995 – 1997 timeframe).

A description of the STScI POSS-II scanning parameters and quality control tests appears in an article by Lasker in this newsletter. Astrometric plate solutions will be provided for all fields by STScI. Photometric CCD calibration efforts are now under way at both STScI and Palomar. The scans, in a compressed form, will be distributed to the community, probably in CD-ROM format. The compression algorithm will result in no perceptible loss of photometric or astrometric accuracy.

3. Cataloging Efforts at Caltech

Caltech Astronomy and the Jet Propulsion Laboratory Artificial Intelligence Group are collaborating in the development of a system for constructing calibrated, object-classified catalogs from the digitized POSS-II (and also POSS-I, etc.). We employ a combination of existing packages (FOCAS and the SAS data analysis program library) and special-purpose machine learning and analysis software. The present system is capable of processing individual plates, while we continue to extend the system to be able to process and integrate multiple plate scans and CCD calibration data in an objective, uniform and (semi-)automatic fashion. The system will allow for continuous upgrading and re-calibration of the resulting Palomar Northern Sky Catalog as more CCD and plate data are added in.

In the end, we expect to have a catalog of all objects (in at least two, but often three, bands) down to the POSS-II limit ($B_J \sim 22$ mag), with approximately 90% accurate star/galaxy classifications down to $B_J \sim 20.5 - 21$ mag. A description and preliminary results of the classification method we employ appear in the proceedings of the Digitised Optical Sky Surveys Workshop, 1991. We anticipate that this Palomar Northern Sky Catalog will contain up to 20 million galaxies, and over 100 million stars, including over 100 thousand quasars. A fragmentary release of the Catalog may begin within 2 years or so, with a nearly complete release within about 5 years from now. The Catalog will exist as a continuously upgraded data base, which may be accessed via computer network links.

In addition to the 'obvious' projects (homogeneous optical identifications for radio, IRAS, X-ray, etc., catalogs, studies of large-scale structure, including clustering of galaxies, clusters, active nuclei, generation of objective cluster catalogs, studies of Galactic structure using star counts, multicolor searches for high-z quasars, etc.), numerous new investigations should become possible with such a data base.

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The APM Northern Sky Catalogue

Over the last few years we have been using the APM facility to measure the first epoch Palomar O and E sky survey plates, with the eventual aim of constructing a readily accessible Northern sky optical catalogue. The first phase of this project, concentrating solely on high galactic latitude fields (those with galactic latitudes 30 degrees or more away from the plane) has now been successfully completed. Consequently, we now have available a catalogue covering half the Northern sky, including the zero declination strip, and covering some 10,000 square degrees of sky. The catalogue contains well over 100 million objects down to limits of 22nd magnitude in O and 20th magnitude in E. The sky coverage of the catalogue is shown in the accompanying diagram, using the original token Palomar field centres for convenience.

The purpose of this article is to announce the availability of this catalogue for general astronomical use and to briefly describe how it was set up and what it contains.

1. Some Details of the Measuring

An area of 6.2 x 6.2 degrees for each of some 600 glass copy survey plates was scanned on the APM at a sampling interval of ½ arcsec. Detected images were parameterised in the usual way such as to preserve coordinate, intensity and general shape information (second moments, peak intensity, areal profile at eight logarithmically-spaced levels). By only saving these image parameter lists plus a coarse ½ mm resolution pixel map of the plate background, considerable data compression results, with the 4 Gbyte of data per plate being compressed by a factor of 200 to around 20 Mbytes (or around 12 Gbytes for the complete raw Phase I catalogue).

1.1 Astrometry

All plates were initially aligned with respect to PPM astrometric standards before scanning, using the standard APM real-time lining up procedure which invokes a six plate constant linear model plus standard Schmidt radial distortion. An area of a few mm around each target is scanned and a Gaussian fit to 1D marginal sums of the intensity distribution suffices to define the x-y table coordinates of the star. Generally only the brightest 15 standards per field are used at this point. The effect of this is to essentially align the plate with respect to the diffraction spikes of the standard stars. However, since the astrometry for the general purpose image detection used in scanning a plate is based on image moments (i.e. centre of gravity) a second astrometric alignment is automatically made using all the PPM stars on the plate. On average there are well over 200 PPM stars per field and we find a typical rms error for our simple linear plate model of around 0.5 arcsec. The rms error of the PPM stars is approximately 0.25 arcsec and the rms error in measuring the centre of gravity of a heavily saturated bright star is at least that. Diffraction spikes give much smaller rms errors but are systematically biased with respect to the star centre of gravity as a function of position of the star on the plate.

1.2 Photometry

The O passband is approximately equivalent to U + B (3200 – 4800 A) whilst the E passband corresponds to a narrow R (6300 – 6900 A). To a very good approximation, the colour O - E = 2(B - V) over a large range of colours, $0 < B - V < 1.5$, making the colour information available for the Northern sky extremely valuable and at the present time, unique in all-sky surveys.

The analysis threshold for both O and E plates was essentially defined by the average plate sky noise. This meant that we generally ended up setting a detection threshold of around 24 mag/sq arcsec for the O plates and around 23 mag/sq arcsec for the E plates. The dynamic range of the survey glass copies is very low since these plates were deliberately contrast enhanced for ease of eyeball inspection (sky is set at around 0.5 D, the plates saturate before 2 D, whilst the sky noise — mainly due to the large grain size of the originals — is around 0.1 D/sq arcsec). As a result of this the plate emulsion response is highly non-linear and of course for these plates there are no calibration wedges — which at least in one sense simplifies matters greatly.

Internally consistent magnitudes were derived using the scheme described by Bunclark and Irwin (1983). This produces a sensible linear magnitude system for stellar images by making use of the fact that the stellar profile should be consistent with a single point spread function irrespective of object magnitude, or indeed position on plate. The position of the blue edge of the stellar locus in an E, O – E colour-magnitude-diagram provides a simple method of calibrating the O-E colour, accurate to about 0.1 magnitudes, whilst simply assuming a constant depth for the survey plates gives an approximate zero-point for the magnitude system. (When sufficient Northern sky calibration becomes available we will of course fold this into the catalogue.) For galaxies the semi-major axis diameter provides an alternative measure of luminosity.

1.3 Image Classification

Images were morphologically typed as either stellar, non-stellar, blended or noise, using all the image parameter shape information. The classifier utilises 'fuzzy' decision making logic to place an object in a given category and quantifies how stellar-like each image is in terms of an N(0,1) stellar distribution as a function of magnitude.

The large grain size on the original plate material coupled with the low signal-to-noise near the plate limit renders the image classification 'objectively unreliable' at around a magnitude above the plate limit. However, brighter than this the added bonus of both the colour information and two independent estimates of the image classification make up for the relatively coarse grain size compared to modern emulsions. Specifying the 'accuracy' or 'completeness' of the image classification is singularly misleading but for those with a penchant for numerology a figure of 90% is representative.

2. Some Details of the Catalogue

In producing the final version of this Phase I catalogue we were driven by the requirement of ease of use for assorted astronomical projects and by a not incompatible desire to further compress the size of it. Consequently the final catalogue has undergone the following steps: firstly both plates for a field were matched up in order to produce a list of paired up images — the only requirement for an image match being positional coincidence to within 2 arcsec; secondly all non-matching images for both O and E plates were retained — for obvious reasons; finally after much astronomical soul-searching we retained only the following parameters for all O and E images: image classification category and stellarness index, x and y plate coordinates, magnitude, semi-major axis radius at detection isophote, ellipticity, and ellipse position angle. Each uniquely detected image has this information packed into 24 bytes with no loss of critical accuracy. (Clearly some images have both O and E data, some E only and some O only). Typically 100,000 images match up on both O and E plates and roughly the same number again do not match up for various reasons. This version of the catalogue occupies approximately 3 Gbytes — a further factor of 4 compression giving a total reduction in storage of nearly a factor of 1000 from the original plate material.

The catalogue is arranged on a field by field basis, with one file per field, and is archived in declination strips. Each file contains a file header block which provides the necessary information to convert to celestial coordinates — currently B1950 — but if demand warrants it we can readily produce a J2000 version.

Needless to say, both the original raw data tapes and various intermediate versions of the catalogue have been retained to cover the few pathological projects impossible with the fully compressed catalogue.

3. Some Details of Use and Availability

The main driving force behind this undertaking was not community altruism, but the need to urgently produce in a reasonably short timescale an optical database that could be used for various optical identifications projects in the Northern sky. It has already been extensively used for various ROSAT X-ray identification projects, IRAS infra-red surveys and an ever growing number of Radio based identification programs. This of course is only the tip of the astronomical iceberg and the potential uses of a database such as this are essentially unlimited: ranging from the trivial — producing thousands of finding charts for large area survey work or coordinates for multifibre spectrographs — to the more bellicose such as modelling the stellar population of our Galaxy or analysing the large scale distribution of galaxies/clusters.

3.1 Installation

Currently the catalogue is 'installed' on a microVax 4000 VLC system, with two dedicated 1 Gbyte data disks and an exabyte tape drive. The archive/storage medium is via multiple VMS backup savesets (one saveset per declination strip) such that no more than 1 Gbyte is archived per exabyte tape — simplifying data archive and retrieval operations. Assorted analysis software and DCL command procedures enable essentially automatic interrogation of the entire catalogue or parts thereof and indeed the slowest part of the operation is generally printing/plotting the results.

3.2 Availability

At the present time we are not distributing copies of the entire catalogue. However, potential users will be given access to smaller subsets for their own use. We will either provide users with a copy of the relevant subset plus software, so that they may undertake their own processing, or within reasonable limits we can carry out the processing in Cambridge and relay the results. Users who have projects requiring access to a significant fraction of the entire database are encouraged to contact one of the persons named below to discuss the possibility of a collaborative venture.

3.3 Future plans

We are currently fine tuning the 'user' interface to the VMS system and would also like to gauge demand for a UNIX-based version of the catalogue plus interrogation software and command procedures. At the present time the low cost and widespread availability of exabyte tape systems make this our preferred distribution medium. However, we would also be interested in comments on alternative media, such as CD roms.

Scanning of lower galactic latitude fields down to within 20 degrees of the plane is well underway and will soon be incorporated within the catalogue. Finally as indicated earlier, future versions of the catalogue will hopefully be based on real photometry, although to be honest, the internal calibration is good enough for most purposes.

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The Digitisation Programme at Edinburgh

The COSMOS machine at the Royal Observatory Edinburgh is a UK National Facility, and as such is available to the entire UK community, and to the Australian community through the Anglo-Australian Observatory agreement. The digitisation programme on COSMOS is driven by user demand. In this way, the optical identification programmes of (initially) the ROSAT project and subsequently the IRAS project, drove the requirement for scanning of the entire Southern sky 1st epoch UKST survey. It has subsequently been found that many other projects on COSMOS can be satisfied from the resulting processed survey data, and indeed we are now regularly servicing a much larger number of projects from the Southern sky 'Object Catalogue'.

The creation of the COSMOS/UKST Southern sky object catalogue is a collaboration between the ROE and the NRL (Naval Research Laboratory) in Washington D.C. A description of the catalogue is given in the paper by Yentis et al. (proceedings of the conference on 'Digitised Optical Sky Surveys', 1992). The catalogue was a project to process the COSMOS scans of the Southern sky IIIa-J survey (South of +2.5 degrees, $|b| > 10$ degrees) and the Short Red survey (South of +2.5 degrees, $|b| < 10$ degrees) into a database of the entire Southern sky and to install the database at the MPE in Garching for ROSAT optical identifications. Although the catalogue was completed in 1991, as a result of minor improvements which were incorporated to the processing software, the entire catalogue was reprocessed from scratch. This reprocessing has recently been completed, and as a result of community interest it has been decided to compress the catalogue (from 45 Gbytes down to approximately 5) for subsequent release on CD-ROM. Release on CD-ROM is aimed for the end of 1992/beginning of 1993.

As well as the southern sky object catalogue, the ROE/NRL collaboration has also involved the development of a comprehensive suite of algorithms for the detection of clusters of galaxies present on the photographic plate material. The procedures have been described in the same paper in the Edinburgh conference proceedings. As a result of improvements made to the Object Catalogue plus improvements to the cluster detection software, the new improved object catalogue is also currently being reprocessed to produce a new high-quality cluster catalogue from the data. The investigation of large-scale structure in the Universe from the distribution of galaxies and clusters is one of the principal scientific goals of the ROE/NRL collaboration. Cooperation with the MPE on the ROSAT data is aimed at providing a catalogue of true clusters free from biases which are usually present in other optical catalogues. The ROE/NRL cluster catalogue will become available for general use as appropriate.

COSMOS is now a fairly old machine, and the technology used in its construction has been superseded. We anticipate that the successor to COSMOS, SuperCOSMOS, will be in operation by June 1993. The design of SuperCOSMOS is based on state-of-the-art technology: granite air-bearing xy table, linear 2048 CCD array, transputers and sparcstations for data processing. Initially, we will use on SuperCOSMOS the same algorithms as on COSMOS. However, we plan ultimately to incorporate profile-fitting techniques for object parameterisation. SuperCOSMOS will have a 10 micron pixel size, a better than 0.5 micron accuracy and will operate initially at a data rate of 600 Kbytes/sec, the limiting factor on the data rate being the A/D conversion. We anticipate a plate scan time of approximately 1.5 hours, although our planning assumes a plate turnaround time of 2 hours when overheads (e.g. plate setting-up, temperature stabilising, focus map, etc.) are taken into account. Initially, we envisage an operation involving the scanning of 6 survey plates each day on the machine. The spare capacity will be used for non-survey and/or non-astronomical work.

Part of the planned digitisation programme on SuperCOSMOS has been described in the article by Hawkins in the proceedings of the Edinburgh conference. We certainly aim to produce high-accuracy, high-resolution scans of both the 1st (UKSTU-J, ESO-B and ESO-R) and 2nd (AAO-R) epoch surveys of the southern sky. In addition, we will incorporate the data from U and I surveys to produce a comprehensive database on the objects with as much colour and proper motion information as possible. The raw pixel data will initially be archived on exabyte tape, although we do not regard this as the long-term storage medium and the data will be transferred onto a more robust medium when cost permits. The raw pixel data will be available for access, and plans are well in hand for the distribution of a highly compressed version of the pixel data for the southern sky J survey on a single CD-ROM disk.

Our plans for the Northern sky do include the digitisation of the entire POSS-II (J, R and I) material. Here, however, we will be driven by the desire for the scientific exploitation of the new higher quality sky survey in the North. In particular, we envisage developing catalogues of galaxies and clusters which will complement our large-scale structure work in the South. The Northern sky database, however, will be made similarly generally available.

Looking beyond the initial phases of our planned digitisation programme on SuperCOSMOS, i.e. that of digitising the existing sky survey material with high accuracy and high-resolution, the possibility of new deep sky surveys in the southern sky on the UKST from the use of Tech Pan 4415 film is attractive, and we will ensure that SuperCOSMOS has the capability to extract the information from film. Furthermore, recent work at Edinburgh on the co-addition of digital data has revealed the enormous potential for sets of very deep wide-angle digital frames based on plate-stacking. These two new areas combined (i.e. digital stacking of large numbers of fine-grain film exposures of the same field) will allow a rich reservoir of high-quality deep data to be tapped well into the future.

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The Second HST Guide Star Photometric Catalog

We present an update on the status of the Second Guide Star Photometric Catalog (GSPC-II). A description of this survey is presented by Postman et al. in *Digitised Optical Sky Surveys* 1992, pp. 61-63. One important motivation for the GSPC-II survey is to expand the spectral range and limiting magnitude for the photometric calibrations of plates used to support HST observation planning and target acquisitions. GSPC-II survey was undertaken, however, with full awareness of the scientific benefits that result from well-calibrated digitized all-sky surveys. Stars and galaxies to limiting magnitude of V=19 are visible on the StScI-Palomar quick V plates (and to V=21 on the POSS E and SRC J plates). Many of the most interesting scientific programs require faint photometry, either to support qualitative decisions, or in the case of statistical studies, to minimize systematic errors. To satisfy both the functional and scientific needs, the GSPC-II will, initially, have 5% photometry in the Kron-Cousins V and R passbands to a limiting magnitude of V=18 (ultimately to V=21).

The survey is being conducted using CCD direct imaging cameras at observatories in both the northern and southern hemispheres (Wise Observatory, ESO, CTIO, KPNO, Megantic Observatory, Lowell Observatory, McDonald Observatory, and San Diego State University). The northern hemisphere program consists of 655 target fields, each one centered on the faintest star in the original GSPC survey (Lasker, Sturch, et al. 1988, *Ap. J. Suppl.*). The southern survey consists of 822 fields centered on the SRC J survey plate centers. Figure 1 shows the location of the 1477 fields on the sky.

For each field, two (V and R) short and two long exposures are being acquired. The short exposures (2 minutes) will get us to V=18 mag. The long exposures (20 minutes) will get us to V=21 mag. Figure 2 shows the 742 fields for which good short exposure data have either been acquired or for which unreduced data exists and is believed to be of the required photometric accuracy (5% to V=18). As the map demonstrates, the short exposure survey is nearly complete for $\delta \geq 0^\circ$. The long exposure survey is about 40% complete in the north and just getting underway in the south.

The northern short survey will be made publicly available when all fields with $\delta \geq 0^\circ$ are reduced and the appropriate catalog QA has been completed. This should occur sometime in mid to

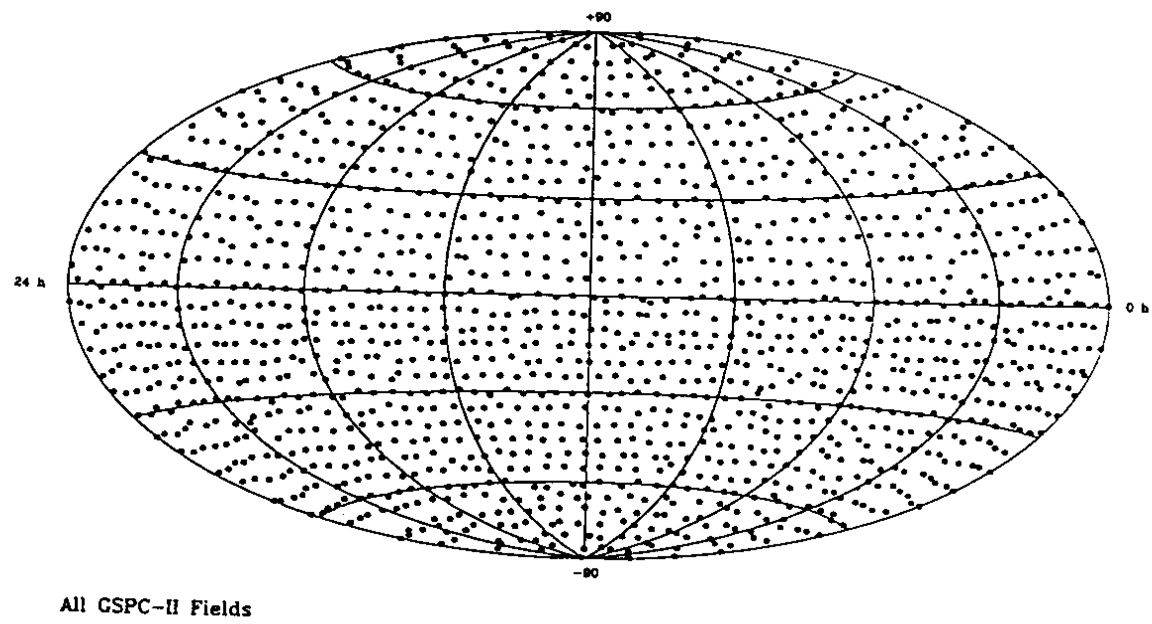

Figure 1. Aitoff equal area projection of the 1477 GSPC-II survey fields.

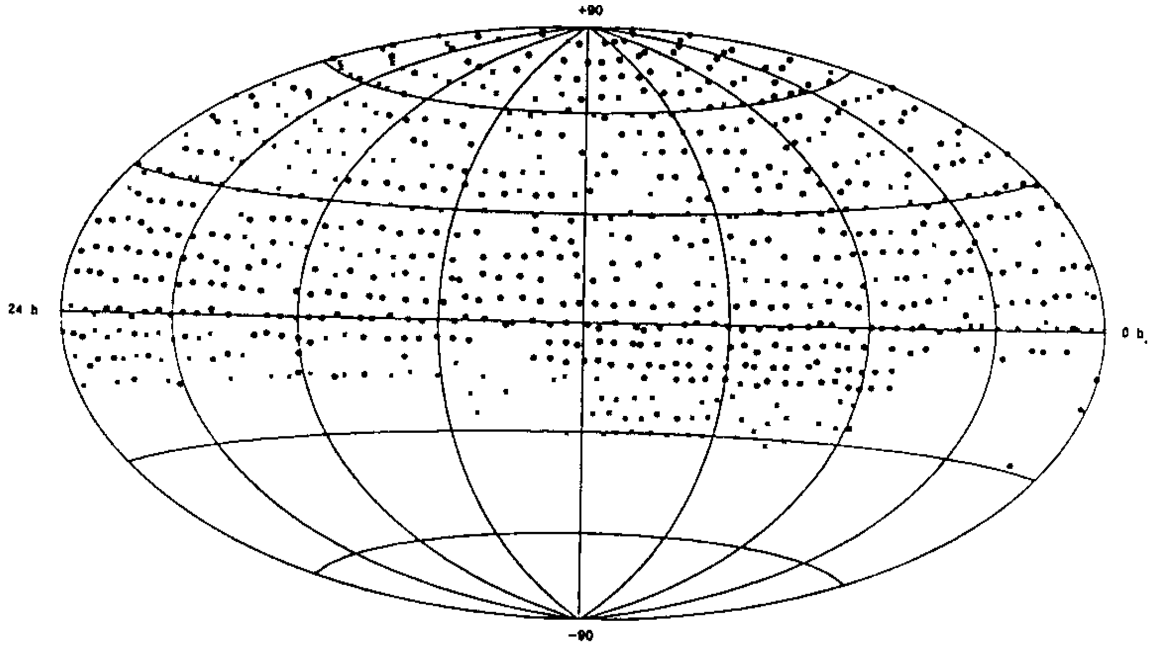

Figure 2. Similar projection for the 742 fields with good or unreduced data (believed to be good) as of June 1992.

late 1993. The catalog will contain two color photometry and positions for over 50,000 stars. It will most likely be distributed via ftp. An all-sky version will be released when the southern short survey is completed (circa 1995).

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Recent Results from the AGK3U

Having completed the AGK3U catalog (Bucciarelli, et al., 1992) based on the new Schmidt plate reduction techniques demonstrated in Taff, Lattanzi, and Bucciarelli (1990; see also Taff 1989 and Lattanzi and Bucciarelli 1991), we have begun to investigate the catalog from the point of view of Galactic structure and kinematics.

The first problem we have tackled is that of finding common proper motion pairs (see for instance Halbwachs 1986). Once we went to the trouble of designing our code, we also executed it on the *Positions and Proper Motions* (PPM) catalog of Roeser and Bastian (1989), the *Astrographic Catalog Reference Star* (ACRS) project of Corbin and Urban (1990; Part 1 and northern hemisphere only), and the AGK3 (Heckmann et al. 1975). The results are in Daou et al. (1992). Figure 1 contains a quick summary of the overall results; there is an exponential decrease in the number of found common proper motion pairs with mean catalog proper motion error. Extrapolating to zero error, for a 5 degree search circle, yields only a couple of common proper motion pairs in the *AGK* star list. We conclude from this that these types of catalogs can not be profitably searched to find physically associated stars (because they do not contain any?).

Next we went on to perform a standard, two dimensional, galactic kinematics analysis using the AGK3U proper motions. The development of the computer code to analyze the systematic trends in the proper motions of the AGK3U stars, and our familiarity with other catalogs, naturally suggests that we execute it on the same triplet too. We first used the AGK3 as a test case for the software and reproduced the results already obtained by Asteriadis (1977). In particular, as viewed for instance through the Oort parameters of galactic rotation, where Asteriadis obtained $A = 26.5 \pm 6.6$ *km/sec/kpc*

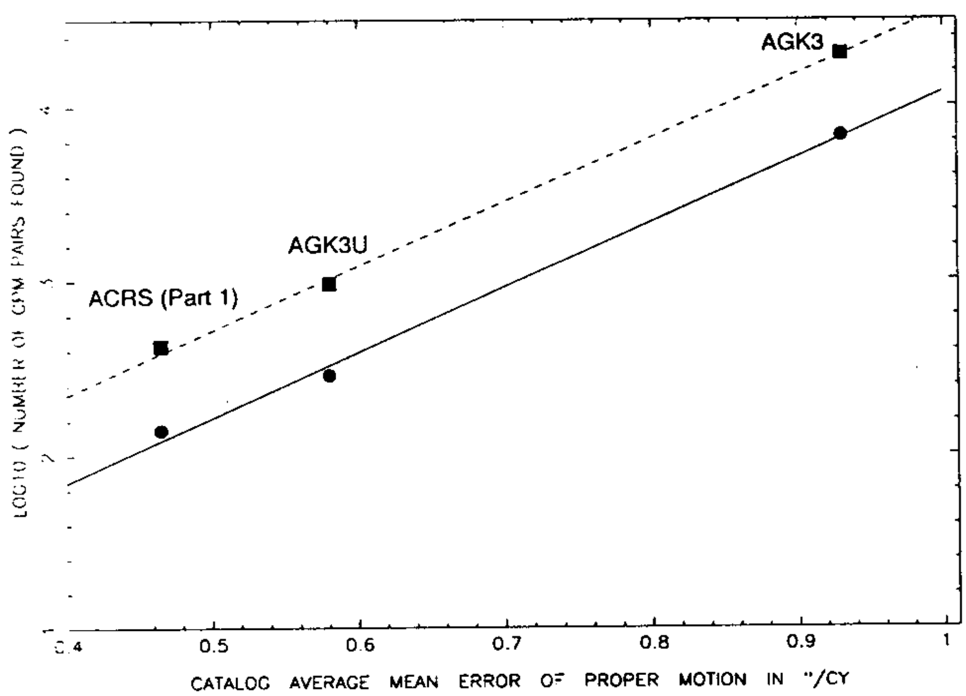

Figure 1. Results of common proper motion pair searches through three catalogs using 10 deg (squares) and 5 deg (circles) search radii. The least squares best fitting straight lines are shown. Note that they are parallel.

Table 1. Oort Constant Results

Spectral Type	Magnitude Range	Proper Motion Range ("/cy)	AGK3U Results			ACRS Results		
			Number of stars	A	B	Number of stars	A	B
				(km/sec/kpc)			(km/sec/kpc)	
O -B2	MAG≥8	MU<6	595	16.3	-29.3	381	77.6	-90.8
			598	21.3	-34.0	383	81.2	-98.4
	9.9≥MAG≥8	MU<6	502	19.2	-31.8	337	84.6	-102.6
			505	24.9	-37.2	339	88.0	-110.7
	MAG≥10	MU<6	93	4.0	-12.3	44	2.7	37.2
			93	4.0	-12.3	44	2.7	37.2
B3 - B9	MAG≥8	MU<6	4556	8.1	-6.1	2930	33.4	-20.8
			4568	7.7	-7.6	2955	29.6	-27.5
	9.9≥MAG≥8	MU<6	3997	7.5	-6.7	2704	19.0	-6.3
			4006	5.9	-8.4	2723	13.5	-15.8
	MAG≥10	MU<6	559	10.2	0.5	224	5.2	-12.3
			562	18.5	-0.5	230	22.3	-21.7
O - B	MAG≥8	MU<6	5151	9.7	-7.9	3316	35.9	-24.6
			5166	9.5	-9.7	3343	32.2	-31.2
	9.9≥MAG≥8	MU<6	4499	9.3	-8.6	3045	21.8	-12.6
			4511	8.1	-10.6	3066	16.4	-21.6
	MAG≥10	MU<6	652	9.9	-1.3	269	9.7	-14.3
			655	17.5	-2.1	275	26.0	-23.3
O - A	MAG≥8	MU<6	31445	14.0	-5.3	20404	17.2	3.6
			31663	13.9	-7.1	20610	13.1	5.3
	9.9≥MAG≥8	MU<6	25256	13.9	-5.9	17996	17.8	4.6
			25430	14.0	-7.4	18166	12.9	7.2
	MAG≥10	MU<6	6189	13.6	-2.5	2389	19.4	4.8
			6233	13.3	-5.5	2425	19.0	3.1
A5 - K	MAG≥8	MU<6	111774	10.1	-0.8	71074	1.7	5.7
			129320	13.3	-6.5	83956	8.2	2.3
	9.9≥MAG≥8	MU<6	50569	8.3	1.4	41763	4.0	0.7
			61430	10.4	-7.9	51034	7.6	-27.2
	MAG≥10	MU<6	61205	11.5	-3.7	29216	5.2	4.6
			67890	13.5	-8.3	32815	17.3	10.1

Spectral Type	Magnitude Range	Proper Motion Range ("/CY)	AGK3U Results			ACRS Results		
			Number of stars	A	B	Number of stars	A	B
				(km/sec/kpc)			(km/sec/kpc)	
ALL-(O-B2)	MAG≥8	MU<6	144394	10.1	-2.7	91808	6.3	2.2
			162402	12.9	-10.7	105004	11.3	-4.0
	9.9≥MAG≥8	MU<6	73062	9.1	-2.1	58049	10.9	-4.1
			84118	11.3	-14.3	67503	13.4	-29.6
	MAG≥10	MU<6	71332	11.4	-4.4	33645	6.7	4.2
			78284	13.1	-9.5	37374	15.2	8.1
ALL STARS			170464	13.4	-10.8	112542	9.2	-5.7

and B = -37.0 ± 6.2 *km/sec/kpc* using 599 O, B0, B1, and B2 spectral type stars we find A = 26.1 ± 6.3 *km/sec/kpc* and B = -44.3 ± 6.5 *km/sec/kpc* using 621 O-B2 stars. The closeness of these two sets of results, in view of the fact that we used a slightly different version of the AGK3 than he did, is gratifying. Note that this is true for the error estimates of A and B too.

Next we turned to the ACRS (Part 1) which, according to both its creators and the aforementioned common proper motion analysis, does, in general, really have good proper motions. Table 1 presents the values for the Oort A and B parameters, as obtained from the same computer code, for both the ACRS and the AGK3U. The spectral type, apparent magnitude, and total proper motion intervals are indicated on the left-hand side of the table. In general the AGK3U results do not show an unusual (or unexpected) systematic variation with spectral type. This was to be expected because we could not find an appreciable apparent magnitude nor color index effect in our double-checking (see Figs. 5 and 6 of Bucciarelli, et al. 1992). On the other hand, there is a very strong systematic trend in the ACRS columns, especially for the earliest spectral type stars. We have repeated these computations using the identical stellar subsets from both the AGK3U and the ACRS — while their overlap in the northern hemisphere is high it is not 100% — and the phenomenon remains. We are forced to come to the conclusion that the ACRS proper motions are contaminated by a systematic color index term, especially for the bluest stars. As these only represent a few hundred of the hundreds of thousands of stars in the ACRS, this effect is washed away in any but a spectral type or color index partitioning. (The original ACRS does not, in fact, have spectral types; we matched ACRS stars to the *AGK* list by DM number and then used the spectral types in the AGK3).

In summary, these scientific uses of the AGK3U proper motions clearly demonstrate that one can mix astrometrically reduced wide field-of-view Schmidt plates with astrographic material and materially improve the positions and proper motions. Moreover, it appears that no sensible magnitude nor color index dependent systematics are introduced.

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A Proper Motion Survey of the Hyades

The Hyades cluster has long served as one of the more important steps in defining the distance scale. It is also the nearest open cluster and, as such, can be used to probe both the dynamical evolution and the initial conditions during the formation of these systems. However, with the Hyades covering more than 100 square degrees of the sky, proper motions and good photometry are essential prerequisites to segregate the candidate Hyads from numerous background (and foreground) stars in the field — particularly at faint magnitudes. While there have been many previous surveys of the cluster — notably by van Altena (1969), Hanson (1975) and Luyten et al. (1981) — only the last covers the full area of the cluster, and none provide photometry of even moderate accuracy fainter than B ~ 15. We have just completed a proper motion survey covering ~ 115 square degrees and extending to $V \sim 19.5$, allowing us both to determine the luminosity function to $M_v \sim +16$ and the extent of mass segregation within the cluster.

Our survey is based on COSMOS scans of POSS I O/E plate pairs matched against UKST B and V plates (2 in each passband) in four fields ($\alpha = 4^h\ 5^m, 4^h\ 30^m$, $\delta = +12^\circ, +18^\circ$). Our photometry is calibrated using CCD data obtained with a TI CCD on the Palomar 60-inch telescope, and is good to ~ ±0.1 mag. for $V < 17.5$, with the uncertainties rising to ~ ±0.2 magnitudes at V = 19.5. The plate material give baselines of 33 – 35 years, and proper motions have been computed following the same methods outlined in the NGP study described in Reid (1990). Again, we have tied the system to an absolute frame using our measurements of galaxies (identified using standard star/galaxy separation techniques). As to the accuracy of our data, both internal (i.e. V vs. E against B vs. O pairs) and external (vs. Hanson, Luyten et al.) comparisons indicate accuracies of better than 7 $mas yr^{-1}$ to V = 17, rising to ~ 15$mas yr^{-1}$ for the fainter stars.

Figure 1 shows the proper motion diagram we derived for stars in the magnitude range $13 < V < 17$ (i.e. $8.5 < M_v < 12.5$), where we have both transformed to a co-ordinate system aligned with

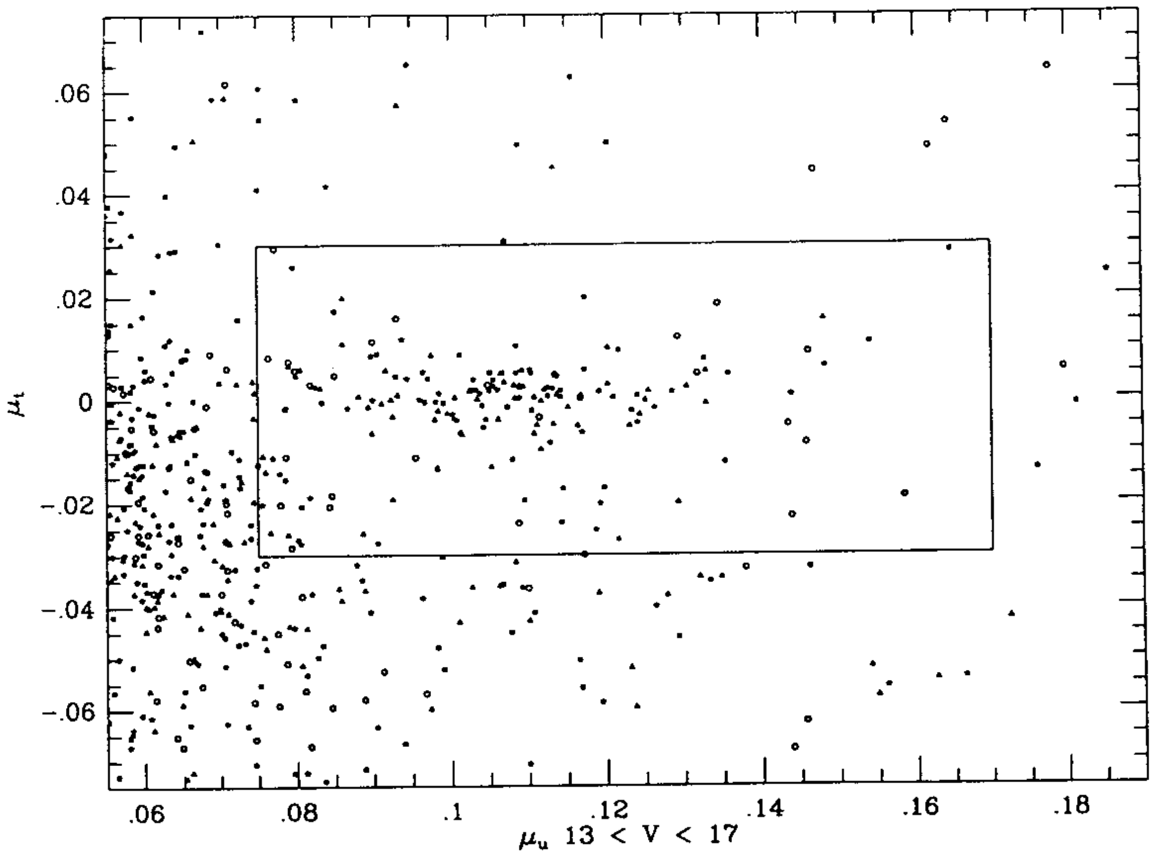

Figure 1.

the direction toward the convergent point and corrected the motions to the cluster centre. (The four symbols refer to the four fields surveyed.) The Hyades cluster stars form an obvious sequence in this diagram. (Note that the reflex solar motion vector intersects the bottom left section of this diagram., and this is reflected in the increased number of stars in this area.) Since we know the radial velocity at the cluster centre, and the recent studies by Gunn et al. (1987 — GGGZ) and Schwan (1991) provide an accurate estimate of the position of the convergent point, we can use the relation

$$r=\frac{V_s \sin\lambda_c}{k\mu_x^c} \tag{1}$$

where V_s is the space motion, λ_c the distance from the convergent point and μ^c_x the mean motion, to derive an estimate of the distance. Our mean motion of 0".111 ± 0".005yr^{-1} leads to a distance of 48.5 ± 0.4 parsecs (we quote the formal uncertainty in the mean). This is in excellent agreement with the recent estimate of 47.9 ± 0.8 parsecs derived by Schwan from the FK5 proper motion measurements of the brightest Hyades stars. This agreement implies that our absolute proper motions are at least in good agreement with the FK5 system.

As to the cluster luminosity function, Fig. 2 shows our results based on two criteria — first, including all stars within the box outlined in Fig. 1 (the upper histogram in Fig. 2); and second, a 'pruned' sample, limited to

$$0''.075 \leq \mu_x \leq 0''.17$$

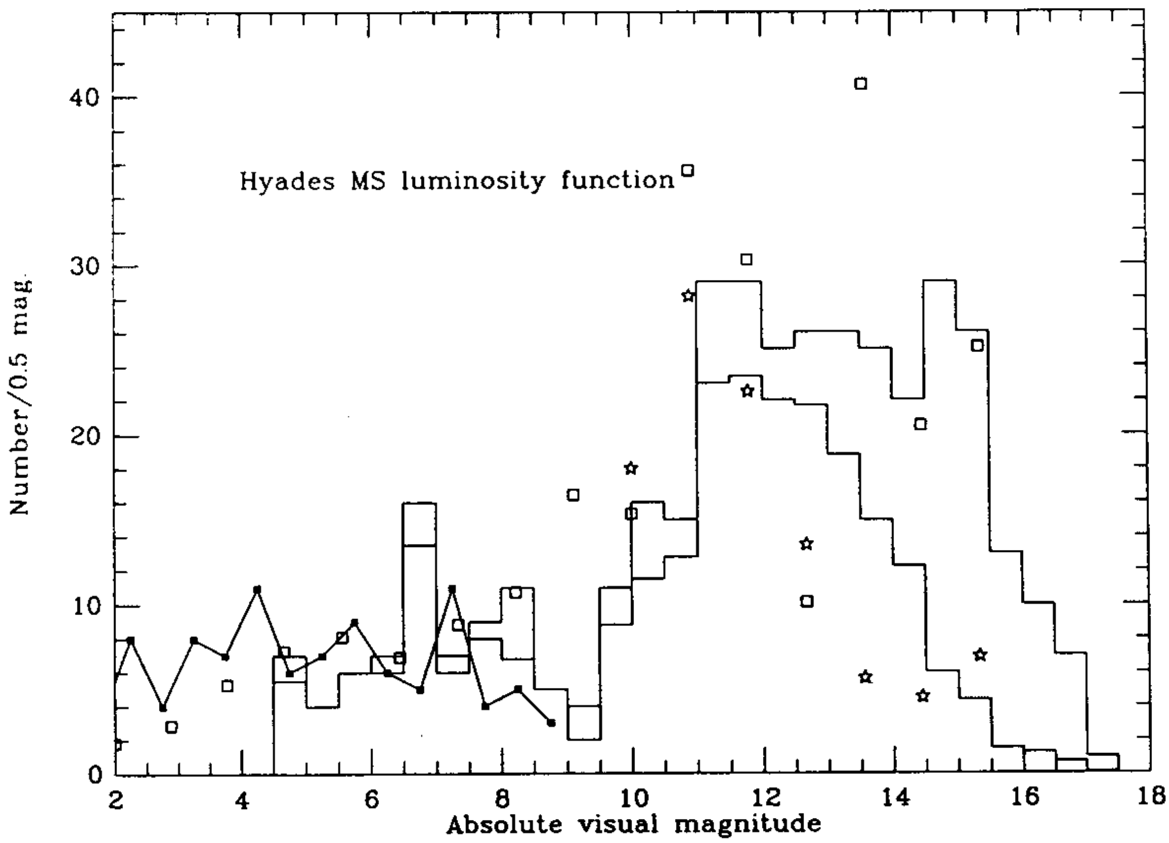

Figure 2.

and

$$|\mu_t| \leq 0''020, \ V < 11.5$$
$$|\mu_t| \leq 0''015, \ 11.5 \leq V < 15$$
$$|\mu_t| \leq 0''020, \ 15 \leq V < 18$$
$$|\mu_t| \leq 0''025, \ 18 \leq V$$

Moreover, we have applied weights of

50% for $0''.075 \leq \mu_u < 0''.080$, $V < 18$
90% for $0''.080 \leq \mu_u < 0''.085$, $V < 18$
25% for all stars $18 < V < 19$
and 10% for all stars $19 < V$.

The results are plotted as the lower histogram in Fig. 2.

All other stars in the sample have unit weight. The lower weights at lower μ_u take into account the increased inclusion of nearby disk stars (distributed along the reflex solar motion vector), while at fainter magnitudes there are numerous stars at all (μ_u, μ_t). We (Reid and Mateo [OCIW]) are currently obtaining VRI CCD photometry of all stars with $V > 14$ in the pruned sample, and our preliminary results (for 95 of 221 stars) tend to confirm the low probabilities associated with the fainter stars. Hence our results suggest that the Hyades have a luminosity function broadly consistent with that of the field (the stars plotted in Fig. 2), peaking at $M_v \sim +12$ and with few low luminosity stars. Leggett and Hawkins (1988) derived similar results from their RIJHK photometry of Luyten proper motion stars in a single Schmidt field.

Clearly Hyades members are spread over a substantial range of μ_u in Fig. 1 and, since the velocity dispersion is only 0.25 kms^{-1}, equation (1) shows that a considerable spread in distance is the only factor that can produce this result. Indeed, there are stars known to be Hyads at distances of

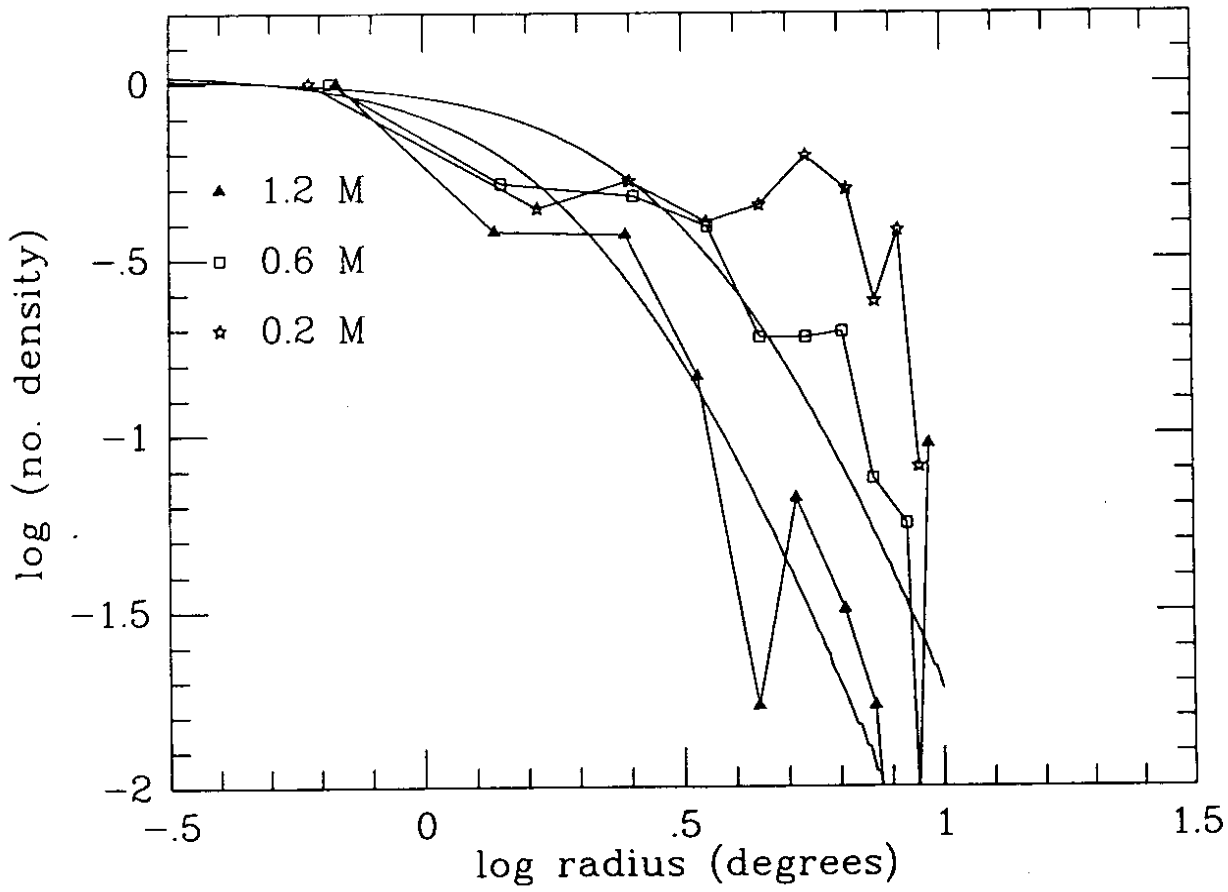

Figure 3.

from 33 to 65 parsecs — as compared with a binding radius of ~10.5 parsecs for a mass of ~450$M_\odot$. Moreover, our results show strong evidence for mass segregation — in contrast to the findings of GGGZ. Figure 3 plots the radial distributions for three mass intervals. Clearly the lower mass stars have a significantly more extended distribution than the brightest stars, and while this may reflect field star contamination for the 0.2$M_\odot$ grouping, it emphatically does not for the intermediate-mass range. Following GGGZ, we have plotted the best-fit Plummer laws

$$\Sigma(r)=N\times(1+\frac{r^2}{A^2})^{-2}$$

where A, the core-radius, is 3°.98 (from GGGZ) for the intermediate-mass stars, but 2°.5 for the 1.2$M_\odot$ group — that is, the more massive stars have a more compact distribution, as one expects from mass segregation. Clearly this has a bearing on whether more distant clusters — which are often only surveyed in the immediate vicinity of the brightest members — really have a deficit of low-mass stars.

Apart from obtaining VRI photometry — both of this sample and of fainter Luyten stars in the same fields — we (Reid, Mateo and Hawley [Lawrence Livermore]) are currently using the 200-inch Hale telescope to study the range in chromospheric activity amongst the lower luminosity Hyads. We are also working on a similar analysis of the more distant Pleiades cluster using POSS I and POSS II plates.

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Recent Activities on Wide-Field Imaging in Japan

1. Introduction

Researches based on wide-field imaging started in Japan in 1974, when a 105/150/330 cm Schmidt telescope was constructed at Kiso Observatory [1]. Kiso Observatory used to be a branch observatory of Tokyo Astronomical Observatory (TAO), University of Tokyo (UT) until TAO was removed from UT on July 1, 1988 to be reorganised as a new institute, the National Astronomical Observatory of Japan. Kiso Observatory is now a part of the Institute of Astronomy, Faculty of Science, University of Tokyo, which is also a new institute formed on July 1, 1988. The report of Kiso Observatory until 1988 was published in 15 issues of the *Kiso Information Bulletin* (KIB). KIB was succeeded at the time of the reform by a new series of the *Annual Report of the Kiso Observatory.*

The following is a brief summary of the recent activities related to wide-field imaging which are mostly based on observations with the Kiso Schmidt telescope.

2. Surveys

A survey for ultraviolet-excess galaxies has been continuing. Those galaxies that were detected on multi-colour plates were called Kiso Ultraviolet-excess Galaxies (KUGs), and 15 KUG catalogues have been published so far [2]. Total sky coverage is about 4500 square degrees and the average number density is 1.8 KUGs per square degree. The limiting magnitude of the survey differs from plate to plate ranging from 16 – 18.5 mag (17 mag on the average). A survey for ultraviolet-excess stellar objects (KUVs) has also been continuing using the same method as the KUG survey [3].

Several other surveys are under way. They include those for carbon stars [4], emission-line stars in the Orion region [5], Herbig-Haro objects [6], and galaxies behind the Milky Way [7].

3. Star Count and Galaxy Model

A total of 16 Kiso plates covering 21 square degrees toward the North Galactic Pole were scanned with COSMOS and produced UBV magnitudes of 18,000 stars down to V = 19 mag [8]. The data were used to construct a Galaxy model [9]. An improved model was presented which was based on a systematic analysis of wide-area star counts including new data on SA 54 obtained from 10 Kiso plates [10]. A study is in progress on the structure of the Galaxy using asymptotic giant branch stars with circumstellar dust shell, which were extracted from the IRAS point source catalogue [11].

4. Galaxies and Clusters of Galaxies

A two-dimensional luminosity distribution of 791 galaxies, which comprise about 90% of RSA galaxies accessible from Kiso Observatory, was obtained in the photographic V band with the Kiso Schmidt telescope. This is the largest homogeneous database of detailed surface photometry of galaxies which was compiled using the same telescope and a single data reduction system. The printed version of the database was published as the *Photometric Atlas of Northern Bright Galaxies* (PANBG) [12]. PANBG was used to map the peculiar velocity field in the Local Supercluster [13] and to investigate the spatial distribution of spin vectors of galaxies [14]. Other studies based on PANBG are in progress.

A project is under way to map the Hubble 'constant' in various directions and at various depths using the Tully-Fisher relation as a distance tool. The initial studies were carried out for the Coma cluster [15] and Pisces-Perseus region [16]. Surface photometry data have been obtained for the Hydra I cluster [17], Pisces-Perseus region, and the CfA strip. Universality of the Tully-Fisher relation has been investigated using new surface photometry data for a sample of Virgo spirals complete down to B = 18 mag [18].

5. Solar System Objects

Comet Austin was intensively observed. Near-nucleus phenomena were investigated using CCD data [19], and disturbances of the plasma tail were analysed mainly using photographic plates [20]. Astrometry of the peculiar minor planet Hidalgo was carried out to detect a possible non-gravitational effect [21].

6. Software Development and Instrumentation

SPIRAL (Surface Photometry Interactive Reduction and Analysis Library) [22] was developed at Kiso Observatory and has been efficiently used for surface photometry of galaxies, HII regions, comets, etc. Efforts have been made to port SPIRAL to the IRAF environment [23]. A preliminary version was distributed to domestic users for testing. The official version of SPIRAL/IRAF will be released in summer 1992.

Efforts have also been made to develop software for an automated analysis of digitised Schmidt plates [10][24]. The one called AIMS (Automated Image Measuring System) has been enhanced to analyse wide-field CCD data as well as photographic data and ported to a UNIX workstation [24].

A common user CCD camera for the Kiso Schmidt telescope was commissioned in April 1992. A single 1000 x 1018 CCD chip, TC215 made by TI Japan, covers a FOV of 12′ x 12′ with a resolution of 0.75 arcsec per pixel.

Development of a mosaic CCD camera is under way using the same TC215 chips. An experimental model was constructed in October 1991, which was equipped for 16 TC215 chips. This mosaic CCD camera has been used for wide-field CCD imaging of clusters of galaxies and surveys for distant supernovas and quasars [25].

A test was carried out on near infrared imaging with the Kiso Schmidt Telescope. A camera equipped with a PtSi 512 x 512 array was attached to the prime focus and *J, H,* and *K* images of several galaxies were successfully obtained. The detector will be replaced soon with a PtSi 1000 x 1000 array, and a new camera with a mosaic of the 1000 x 1000 arrays will eventually be built. Near infrared observation will be made at bright night.

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Report on FOCA, a Balloon-Borne Ultraviolet Imaging Telescope

1. Introduction

About 70 square degrees, essentially at high galactic latitude, down to the UV magnitude 18 have been observed at 2000 Å with a balloon-borne, 40-cm aperture imaging telescope called FOCA (a brief description is given in Milliard et al., 1991). The field of view is 2.3 or 1.5 deg depending on the telescope focal length version; the corresponding angular resolution is 20 or 12 arcsec respectively. About two thirds of the nominal quality observations have now been processed resulting in a catalog which contains about ten thousand UV detections. At such an angular resolution the vast majority of detected objects look like point sources though they cover the variety of objects found at faint magnitudes (subluminous stars, galaxies and QSOs), whose B magnitudes can be fainter than 21 in the visible for the deepest images.

The next flight of the telescope is now scheduled for the spring of 1993, with a photon counting device as detector instead of today's intensifier plus film. Flights on a yearly basis are expected until 1996. A brief description of the results and the list of observations at nominal quality are given below.

2. A Brief Description of the First Results

Several areas so far have been investigated. Determination of the UV luminosity function of galaxy clusters (Donas et al., 1991) or field galaxy counts (Millliard et al., 1992); analysis of star formation in clusters of galaxies (Donas et al., 1990); hot evolved stars in globular clusters (Laget et al., 1992). All studies are based on the derived UV magnitudes supplemented by specialized catalogs in the visible to provide either a color index or additional information such as morphology, variability, redshift etc. which are of primary interest for interpreting the data. Cross-identifications with the GSC of the Hubble telescope, or other specific catalogs are performed by automatic position coincidences. We deal with a typical error box of a 2–4 arcsec which, at the observed density at high latitude ($B \leq 21$), is used to select the candidates. If in addition a color information is available, then the procedure becomes very reliable.

The list of the nominal quality observations at high galactic latitude is given below (FOCA ref. number, 1950 equatorial coordinates of the guide star near the field center, name).

3. On-going Development

An exciting and more pioneering aspect of the search and survey analysis is the identification of the numerous faint UV sources. They can presumably be stars, galaxies or QSOs whose B magnitudes can be fainter than 21 on the deepest images, and thus have no counterparts on the POSS-O prints. Understanding the nature of the faint UV detections would benefit most from cross-identifications in a catalog with a visible color, covering the field of view, and complete down to 21-22 B-magnitude for stellar and extended objects*. In a first approach, we plan to use the APS database from the digitized POSS-I (Pennington et al., 1991). POSS-II, when available, will presumably help at the faint end.

At the present stage, we take the opportunity of this newsletter to kindly ask the community for any deep-sky document like catalogs in numerical form, finding charts, working documents or prints of plates relevant to the listed fields.

*Fully in the scope of dedicated 2 m. telescopes equipped with mosaics of large CCDs, as suggested by R.W. West in Newsletter No. 1, p.7.

FOCA No	Alpha 50	Delta 50	Object
090	13 39 52.9	+28 37 38	M3
091	15 16 01.9	+02 15 51	M5
036	16 39 16.7	+36 17 46	M13
039	17 15 35.0	+43 11 21	M92
018	08 51 57.6	+78 20 18	NGC2715
033	11 59 04.1	+65 13 04	NGC4125
081	12 19 29.2	+47 27 34	NGC4258
071	12 18 16.7	+15 49 06	NGC4321
012	00 34 43.9	+40 03 27	M31
002	01 30 48.1	+30 08 00	M33
097	13 29 50.2	+47 29 28	M51
082	09 58 57.0	+69 01 41	M81-82
029	14 01 04.2	+54 54 21	M101
010	08 17 26.1	+20 54 26	Cancer clust.
067	11 42 45.5	+20 10 03	Abell 1367
034	12 26 02.3	+12 23 39	Virgo clust.
028	12 57 08.0	+28 20 06	Coma clust.
089	15 36 52.8	+34 50 13	Abell 2111
052	08 37 34.2	+46 00 39	S.A. 28
051	08 48 36.0	+43 54 51	S.A. 28
030	13 03 47.1	+29 17 48	S.A. 57
031	13 09 32.4	+28 07 52	S.A. 57

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SPAN/DECNET 17579:: milliard or laget or donas

1. Introduction

The Working Group on Wide-Field Imaging (WGWFI) of the IAU Commission 9 'Instruments and Techniques' was established in July 1991 at the 21st IAU General Assembly in Buenos Aires. It was unanimously agreed that one of the most important tasks of the new WG would be the creation of a computer-readable Data Base with the existing wide-field plate archives and all astro-photoplates obtained from the end of last century until now (West, 1991, 1992; Tsvetkov, 1992).

The basis for starting this large project is the considerable progress in the use of digitizing techniques and powerful computers that has taken place during the most recent years. The size and duration of the project was expected to be very considerable, and it was therefore very comforting that the response to the first circular letter which was mailed at the end of September 1991 in every respect surpassed our expectations.

At the 21st General Assembly, resolutions A-8 and C-11/14 (IAU — Information Bulletin, No. 67, 1992) were adopted in support of the WGWFI work and especially about the importance of the astronomical archives. Following this, and at the initiative of the Commission 29 'Stellar Spectra', a parallel project on 'Archiving and Distribution of Spectroscopic Data', which includes wide-field objective prism photographs, was started last December.

Here it is necessary to mention that the beginning of the work on the creation of a global astronomical plate archive was begun already in 1980 on the initiative of B. Hauck (1982, 1982a) and resulted in a first list of existing astronomical plate archives. In this list, there are 42 institutes/observatories, and 36 of these announced that they possessed astronomical plate archives, but without distinguishing between the wide-field direct plates and the spectroscopic ones.

The main difficulty of the work of a plate archive creation for inclusion in the CDS/SIMBAD or other astronomical data centres was that only 6 of these plate archives were in suitable form for the computer processing in 1982.

In 1986 C. Jaschek started a general programme in the 'Centre de Données Stellaires', Strasbourg, connected with the collected information about the archives of astronomical observations in different branches of activity. From 141 answers of Jaschek's questionnaire (Jaschek 1988, 1989) all over the world 68 institutes (about 50%) declared they possess photographic plate archives. Among the declared archives only 20 were in the complete or not fully complete computer readable form. There are no differences between the wide-field direct plates and the simple 'narrow-field' ones listed in the questionnaires. As a summary Jaschek (1989a) evaluated that the majority of the archives are still not computer readable and much remains to be done. He concluded regrettably that the archiving is not regarded in the astronomical circles as important.

However, thanks to Hauck's and Jaschek's important works, there has been a considerable success of the present, renewed effort to document the existing photographic plate archives. Today there are some new positive moments in comparison with the archive work from 10 years ago:

- the wider use in the astronomical photographic observations of computer processing techniques, and
- greatly improved possibilities for the digitisation and retrieval of the photographic material and the creation of the Data Base for this purpose.

The existence of some well-known centres, e.g. Baltimore (STScI), Minnesota, Edinburgh, ESO, Muenster, Paris, Tokyo, etc., for the digitisation of the mentioned plate archives is here of special interest and it is quite likely that a future, joint project may lead to the large-scale digitisation of many of the plates in the archives, thereby justifying and further validating the Data Base project now begun, cf. e.g. Lasker et al., 1990; Jenker et al., 1990; MacGillivray and Beard, 1989; Cannon, 1989; Crane, 1984; Horstman et al., 1989; Humphreys and Penington, 1989; Guibert and Moreau, 1991; Ishida, 1987.

2. A List of Existing Wide-Field Instruments

The existence and use of wide-field plates have always been closely connected with the activity of the various wide-field telescopes — Schmidt, Astrographs, 'fast' Cameras, Ritchey-Chrétien type, etc. and has been vital for the progress in photography as a method to record the astronomical observations since the end of last century.

The search for astronomical archives forced us first to make a list of wide-field instruments used for obtaining the plates in these archives at the different observatories. During the data collection, papers by Bahner (1965), West (1974), Wolf (1981), Ponomariov (1987), Bräuer and Fuhrmann (1992), Hazen (1992), were used, as well as the information obtained from various astronomers (their names are given in Table 1) who answered the first circular letter. The data received for individual archives shows that there have been results from astronomical observations carried out with at least 174 wide-field instruments since 1889. We can add to this number the data for 51 instruments at 34 observatories which have not yet declared the availability of their astronomical archives. The list of these instruments form the fundamental basis for the present work on astronomical archiving.

The main characteristics of the instruments listed (Table 1) and the coordinates of observatories will be useful in the case of creation of future global lists of all existing wide-field plates and their future data base.

The distribution of the wide-field instrument aperture versus years of the operation beginning is shown in Fig. 1. This information will of course be corrected when more details of the telescope parameters are received, because in some cases we have only preliminary information for them. The crosses in Fig. 1 denote the instruments not yet included in the first list of wide-field plate archives. The 4-m Ritchey-Chrétien Kitt Peak and 3.9-m Anglo-Australian telescopes, in operation from 1973 and 1975 respectively, are beyond the figure border.

3. A Preliminary List of Wide-field Plate Archives (WFPA)

In order to make the first WFPA list, more than 200 astronomical observatories/institutes all over the world were contacted and accordingly informed by means of a circular letter sent out in September 1991. We mainly used the directory of the addresses of professional observatories listed in the STARCAT (OBS.LIST) (1991), American Astronomical Society – Membership Directory (1991) and the Astronomical Almanac (1991). Our ambition was to have in these initial activities also those observatories and institutes which have no wide-field instruments, but which have participated in photographic work and have been connected with sky surveys or wide-field monitoring programmes. This campaign to inform the world-wide astronomical community also had as a goal to draw the attention of the individual astronomers who possess wide-field plate archive collections within the established rights of using observing materials.

As a result of this circular letter, 63 answers were received. They are summarized in Table 1, of which the successive columns indicate:

1 & 2 Location of Observatory/Institute and a brief description, mainly according to the list of observatories in the Astronomical Almanac (1992);

3 & 4 East Longitude and Latitude;

5 Elevation of the Observatory/Institute above sea level;

6 - 9 Telescope parameters: Clear aperture (m), diameter of the mirror (m), focal length (m) and scale (arcsec);

10 Type of the telescope(s) used: Sch - Schmidt, Ast - Astrograph, Cam - Camera, Rfl - Reflector; RCr - Ritchey-Chrétien.

11 Field of the telescope (degrees);

12 Year of the beginning of operation or the time of possession of the plate archives;

13 Information about the type of archive: Plates or (F)ilms;

14 & 16 Number of direct and objective prism plates/films;

15 & 17 Information about listings of the archived plates/films: (T)able form, (C)omputer

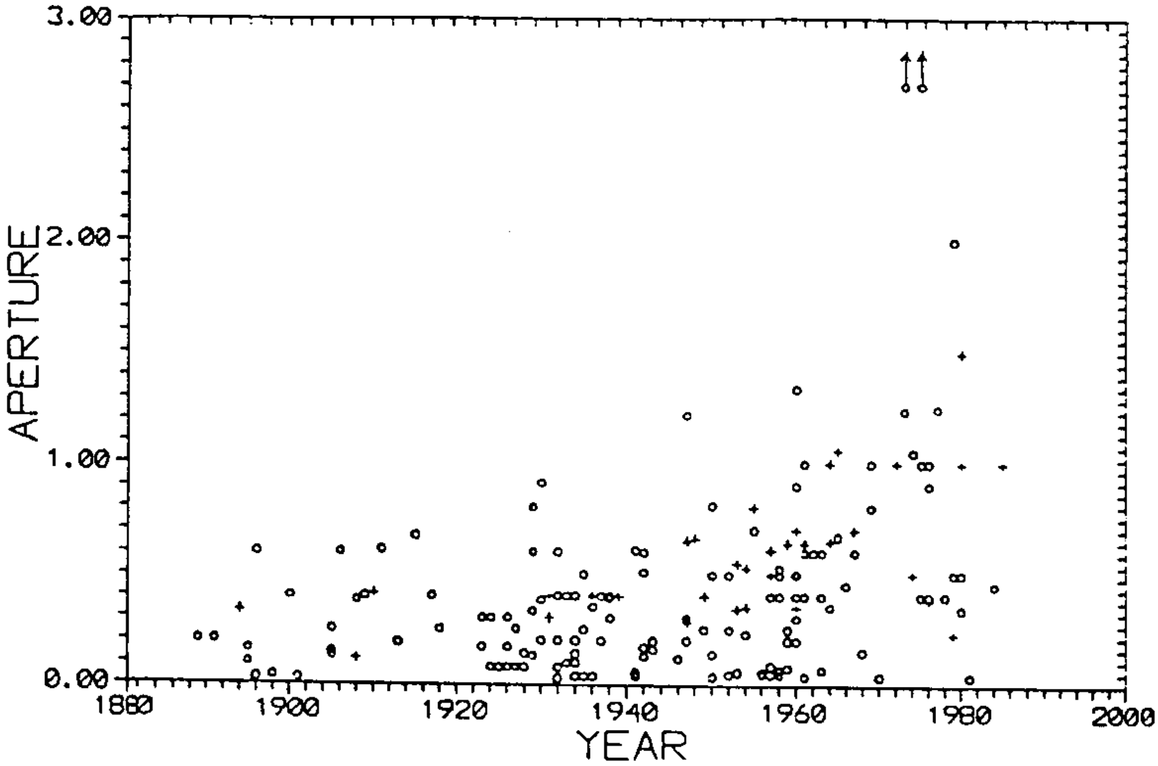

Figure 1. Distribution of the Wide-Field Instrument Aperture versus Year of the Operation Beginning. The 4-m Ritchey-Chrétien Kitt Peak and 3.9-m Anglo-Australian telescopes respectively in operation from 1973 and 1975, are beyond the figure border.

readable form, or (TC) — table form and not complete computer readable form;

18 Name of the astronomer responsible for the plate archive or of the director of the institute/observatory.

3.1 The Tables

3.1.1 Table 1

14 of the answers received were negative and 49 observatories/institutes listed declared that they possess in total more than 1.3 x 10^6 wide-field astronomical plates.

In Table 1 the considerable progress in the archiving of the observations in comparison with the situation 10 years ago is obvious. Today, 116 archives (connected with different telescopes) are in complete computer readable form (15) or in the process of preparation. The availability of 174 archives makes the beginning of work on creation of the wide-field data base much more attractive and realistic. From the separate archives listed in the Table, only 10 are not presented even in table form and their archiving is a separate question which must be taken up during a subsequent stage.

In Fig. 2 the distribution of the number of plates in the declared plate archives listed in Table 1 versus aperture of the wide-field telescope used is shown. Beyond the figure border there are the archive of the 4-m Ritchey-Chrétien Kitt Peak telescope (5000 plates) and the very rich Sproul, Harvard and Boyden (Harvard-Arequipa) collections, with 100,000, 60,000, and 48,000 plates respectively.

Table 1. First List of Astronomical Observatories/Institutes Possessing Wide-field Plate Archives.

Location	Description	East Long.	Lat.	Height (Sea Level)	Telescopes: Clear Apert.	Telescopes: Apert. Mir.	Telescopes: Focal Leng.	Telescopes: Scale "/mm	Type	Field Deg.	Year of Oper.	P / F	Plates/Films: Direct		Plates/Films: Sp.		Astronomer
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
Asiago,Italy,	Asiago Astroph. Obs	+ 11 31.7	+45 51.7	1045	0.67	0.92	2.15	96	Sch	5.3	1965		15050	TC	680	TC	R.Barbon
Asiago,Italy	Asiago Astroph. Obs	+ 11 31.7	+45 51.7	1045	0.40	0.50	1.00	206	Sch	6.8	1958	F	18301	TC	2006	TC	R.Barbon
Austin,Texas	Uni. Texas(Bloemfontain)	+ 26 24.3	-29 02.3	1771	0.25			167	Cam	15.0	19..				400	T	K.Henize
Basle,Schwitzerland	Astr. Inst(Palomar Obs)	-116 51.8	+33 21.4	1706	1.22	1.83	3.07	67	Sch	6.5	1947		1000	T			R.Fenkart
Brooklin,Indiana	Goethe Link Obs(Lovvell Obs)	- 86 23.7	+39 33.0	300	0.25		1.72	120	Ast	5.7			6000	T			B.Skiff
Brorfelde,Denmark	Copenhagen Univ. Obs	+ 11 39.9	+55 37.3	90	0.45	0.77	3.00		Shm	5.3	1966		1400	T	600	T	K.Augustesen
Bucharest,Romania	Bucharest Ast. Obs	+ 26 05.8	+44 24.8	81	0.38		6.00	34	Ast	2.0	1930		12000	T			G.Bocsa
Byurakan,Armenia	Byurakan Astroph. Obs	+ 44 17.5	+40 20.1	1500	1.00	1.50	2.13	97	Sch	4.0	1961		20000	T	1000	T	G.Oganian
Byurakan,Armania	Byurakan Astroph. Obs	+ 44 17.5	+40 20.1	1500	0.53	0.53	1.83	113	Sch	5.0	1958		20000	T			G.Oganian
Cambridge,Massachusetts	Harvard Collegve Obs	- 71 07.8	+42 22.8	24	0.03		0.15	1200	Rfr	60.0	1901		30000	TC			M.Hazen
Cambridge,Massachusetts	Harvard Collegve Obs	- 71 07.8	+42 22.8	24	0.04		0.30	600	Rfr	40.0	1898		32000	TC			M.Hazen
Cambridge,Massachusetts	Harvard Collegve Obs	- 71 07.8	+42 22.8	24	0.04		0.15	1200	Rfr	60.0	1936		11000	TC			M.Hazen
Cambridge,Massachusetts	Harvard Collegve Obs	- 71 07.8	+42 22.8	24	0.08		0.50	391	Rfr	22.0	1928		4000	TC			M.Hazen
Cambridge,Massachusetts	Harvard Collegve Obs	- 71 07.8	+42 22.8	24	0.20		1.30	163	Rfr	8.0	1889		60000	TC			M.Hazen
Cambridge,Massachusetts	Harvard Collegve Obs	- 71 07.8	+42 22.8	24	0.30		2.10	97	Rfr	5.0	1923		5000	TC			M.Hazen
Cambridge,Massachusetts	Harvard Collegve Obs	- 71 07.8	+42 22.8	24	0.40		2.10	98	Rfr	5.0	1909		26000	TC			M.Hazen
Cambridge,Massachusetts	Harvard Collegve Obs	- 71 07.8	+42 22.8	24	0.60		3.40	60	Rfl	1.6	1906		4000	TC			M.Hazen
Cambridge,Massachusetts	Oak Ridge St., Harvard Obs	- 71 33.5	+42 30.2	185	0.03		0.15	1200	Rfr	60.0	1932		11000	TC			M.Hazen
Cambridge,Massachusetts	Oak Ridge St., Harvard Obs	- 71 33.5	+42 30.2	185	0.04		0.40	580	Rfr	40.0	1961		7000	TC			M.Hazen

Cambridge,Massachusetts	Oak Ridge St., Harvard Obs	- 71 33.5	+42 30.2	185	0.04		0.30	600	Rfr	40.0	1934	10000 TC		M.Hazen
Cambridge,Massachusetts	Oak Ridge St., Harvard Obs	- 71 33.5	+42 30.2	185	0.08		0.50	391	Rfr	22.0	1932	12000 TC		M.Hazen
Cambridge,Massachusetts	Oak Ridge St., Harvard Obs	- 71 33.5	+42 30.2	185	0.10		0.70	290	Rfr	15.0	1933	5000 TC		M.Hazen
Cambridge,Massachusetts	Oak Ridge St., Harvard Obs	- 71 33.5	+42 30.2	185	0.20		1.30	162	Rfr	8.0	1934	13000 TC		M.Hazen
Cambridge,Massachusetts	Oak Ridge St., Harvard Obs	- 71 33.5	+42 30.2	185	0.30		2.10	97	Rfr	5.0	1938	4000 TC		M.Hazen
Cambridge,Massachusetts	Oak Ridge St., Harvard Obs	- 71 33.5	+42 30.2	185	0.40		2.10	98	Rfr	5.0	1932	14000 TC		M.Hazen
Cambridge,Massachusetts	Oak Ridge St., Harvard Obs	- 71 33.5	+42 30.2	185	0.60		3.40	60	Rfl	1.6	1932	2000 TC		M.Hazen
Cambridge,Massachusetts	Oak Ridge St., Harvard Obs	- 71 33.5	+42 30.2	185	0.60		2.10	98	Sch	5.0	1942	5000 TC		M.Hazen
Cambridge,Massachusetts	Boyden St., Arequipa, Peru	- 71 33.0	-16 22.5	2451	0.03		0.30	600	Rfr	40.0	1896	16000 TC		M.Hazen
Cambridge,Massachusetts	Boyden St., Arequipa, Peru	- 71 33.0	-16 22.5	2451	0.08		0.30	700	Rfr	40.0	1924	2000 TC		M.Hazen
Cambridge,Massachusetts	Boyden St., Arequipa, Peru	- 71 33.0	-16 22.5	2451	0.20		1.10	179	Rfr	10.0	1891	48000 TC		M.Hazen
Cambridge,Massachusetts	Boyden St., Arequipa, Peru	- 71 33.0	-16 22.5	2451	0.25		1.20	167	Rfr	9.0	1918	7000 TC		M.Hazen
Cambridge,Massachusetts	Boyden St., Arequipa, Peru	- 71 33.0	-16 22.5	2451	0.60		3.40	60	Rfr	5.0	1896	14000 TC		M.Hazen
Cambridge,Massachusetts	Boyden St. Bloemfontain, SA	+ 26 24.3	-29 02.3	1387	0.04		0.40	580	Rfr	40.0	1970	1000 TC		M.Hazen
Cambridge,Massachusetts	Boyden St. Bloemfontain, SA	+ 26 24.3	-29 02.3	1387	0.04		0.30	600	Rfr	40.0	1935	12000 TC		M.Hazen
Cambridge,Massachusetts	Boyden St. Bloemfontain, SA	+ 26 24.3	-29 02.3	1387	0.04		0.15	1200	Rfr	60.0	1941	6000 TC		M.Hazen
Cambridge,Massachusetts	Boyden St. Bloemfontain, SA	+ 26 24.3	-29 02.3	1387	0.08		0.50	390	Rfr	22.0	1928	17000 TC		M.Hazen
Cambridge,Massachusetts	Boyden St. Bloemfontain, SA	+ 26 24.3	-29 02.3	1387	0.08		0.30	700	Rfr	40.0	1927	3000 TC		M.Hazen
Cambridge,Massachusetts	Boyden St. Bloemfontain, SA	+ 26 24.3	-29 02.3	1387	0.20		1.10	179	Rfr	10.0	1930	23000 TC		M.Hazen
Cambridge,Massachusetts	Boyden St. Bloemfontain, SA	+ 26 24.3	-29 02.3	1387	0.25		1.20	167	Rfr	9.0	1927	30000 TC		M.Hazen
Cambridge,Massachusetts	Boyden St. Bloemfontain, SA	+ 26 24.3	-29 02.3	1387	0.60		3.40	60	Rfr	5.0	1929	13000 TC		M.Hazen
Cambridge,Massachusetts	Boyden St. Bloemfontain, SA	+ 26 24.3	-29 02.3	1387	0.80		3.00	68	Sch	4.8	1929	7000 TC		M.Hazen
Cambridge,Massachusetts	Mt. John Obs., New Zealand	+170 28.0	-43 59.2	1029	0.04		0.40	580	Rfr	40.0	1981	2500 TC		M.Hazen
Campo Imperatore,Italy	Roma Astronomical Obs.	+ 13 33.6	+42 26.6	2200	0.60	0.90	1.83	113	Sch	6.0	1961	960 T	770 T	G.Baratta
Caussols,France	Calern Obs. CERGA	+ 06 55.6	+43 44.9	1272	0.90	1.52	3.16	65	Sch	5.2	1976	3000:TC		Ch.Pollas
Caussols,France	Meudon	+ 02 13.9	+48 48.3		0.40	0.60	1.00	206	Sch	10.0	1961 F	3293 T		Ch.Pollas
Caussols,France	Nice(Coted'Azur Obs)	+ 07 18.1	+43 43.4	372	2x0.40		2.00	103	Ast	8.0	1933			Ch.Pollas
Charlottesville,Virginia	Leander McCormick Obs	- 78 31.4	+38 02.0	264	0.67		9.82	21	Rfr	1.1	1915	14500 C		P.Ianna
Charlottesville,Virginia	Leander McCormick Obs	- 78 31.4	+38 02.0	264		1.00	13.75	15	Rfl	1.0	1975	5000 TC		P.Ianna
Charlottesville,Virginia	Leander McCormick Obs	- 78 31.4	+38 02.0	264	0.25		1.15	180	Ast	12.5	1935	4000		P.Ianna
Charlottesville,Virginia	Leander McCormick Obs	- 78 31.4	+38 02.0	264	0.66		10.86	19	Rfr	0.9	19..	7000 TC		P.Ianna
Coonabarabran,Australia	Anglo-Australian Obs.	+149 04.2	-31 16.4	1130		3.90	12.87	16	Rfl	1.3	1975			D. Malin
Coonabarabran,Australia	Anglo-Australian Obs.	+149 04.2	-31 16.4	1130	1.24	1.83	3.07	67	Sch	6.4	1973			D. Malin

Crakov,Poland	Jagellonian Ft.Skala St.	- 19 49.6	+50 03.3	314	2x0.15		0.57	360	Ast	13.0	1968	452	T	M.K.-Winiarska
Crakov,Poland	Jagellonian Ft.Skala St.	- 19 49.6	+50 03.3	314	0.35	0.37	3.44	60	Men	1.0	1964	4000	T	M.K.-Winiarska
Crakov,Poland	Astr. Inst(Palomar Obs)	-116 51.8	+33 21.4	1706	1.22	1.83	3.07	67	Sch	6.5		100	T	M.K.-Winiarska
Edinburg, Scotland	Saiding Spring Mtn.	+149 04.2	-31 16.4	1130	1.24	1.83	3.07	67	Sch	6.4	1973	10000	C	S.Tritton
Edinburg, Scotland	Saiding Spring Mtn.	+149 04.2	-31 16.4	1130	1.24	1.83	3.07	67	Sch	6.4	1973 F	750	T	S.Tritton
Edinburgh,Scotland	Royal Obs. Edinburg	- 3 11.0	+55 55.4	146		0.91	16.50	13	Rfl		1930	1500	T	S.Tritton
Edinburgh,Scotland	Royal Obs. Edinburg	- 3 11.0	+55 55.4	146					Sch		1962	3000	T	S.Tritton
Edinburgh,Scotland	Roma Astronomical Obs	+ 13 33.6	+42 26.6	2200	0.60	0.90	1.83	113	Sch	6.0	1967	2000	T	S.Tritton
ESO-Garching, Germany	Cerro La Silla(Chile)ESO	- 70 43.8	-29 15.4	2347	1.00	1.60	3.06	67	Sch	3.6	1969	10000	C	R.West
ESO-Garching, Germany	Cerro La Silla(Chile)ESO	- 70 43.8	-29 15.4	2347	0.40		4.00	51	Ast	2.2	1976	15100	T	R.West
Flagstaff,Arizona	Lovell Obs	-111 39.9	+35 12.2	2204	0.33		1.68	123	Cam	5.7	1929	10000	TC	B.Skiff
Flagstaff,Arizona	Lovell Obs	-111 39.9	+35 12.2	2204	0.13		0.92	225	Cam	6.3	1929	1200		B.Skiff
Flagstaff,Arizona	Lovell Obs	-111 39.9	+35 12.2	2204	DIFFERENT				Cam		1905	250		B.Skiff
Flagstaff,Arizona	Lovell Obs	-111 39.9	+35 12.2	2204	0.13		0.92	225	Cam	6.3	1905	250	T	B.Skiff
Flagstaff,Arizona	Lovell Obs	-111 39.9	+35 12.2	2204	DIFFERENT						1911			B.Skiff
Flagstaff,Arizona	Lovell Obs	-111 39.9	+35 12.2	2204	0.20		0.20	1031	Sch		1932 F	500.		B.Skiff
Flagstaff,Arizona	Lovell Obs	-111 39.9	+35 12.2	2204	0.45		3.60	57	Ast		1984	250	TC	B.Skiff
Floarac,France	Bordeaux Univ. Obs	- 31.7	+44 50.1	73	0.33		3.47	59	Ast	2.5		4000	TC	J.Colin
Floarac,France	Bordeaux Univ. Obs	- 31.7	+44 50.1	73	0.38				Cam			200	T	J.Colin
Floarac,France	Bordeaux Univ. Obs	- 31.7	+44 50.1	73	0.33		3.47	59	Ast	2.5		5000		J.Colin
Floarac,France	Bordeaux Univ. Obs	- 31.7	+44 50.1	73	0.33		3.47	59	Ast	2.5		4000	TC	J.Colin
Grosschvabhausen,Germany	Friederich-Schiler Univ.Obs	+ 11 29.0	+50 55.8	356	0.60	0.90	1.80	115	Sch	5.0	1963	1132	T	R.Schielicke
Heidelberg,Germany	Landessternvarte Obs	+ 8 43.3	+49 23.9	570	2x0.40		2.03	102	Ast	8.0	1900	10000	C	G.Klare
Herstmonceux,England	Royal Greenvich Obs	+ 0 20.3	+50 52.3	34	0.25		1.15	180	Cam	15.0	1905	206:	T	R.Catchpole
Herstmonceux,England	Royal Greenvich Obs	+ 0 20.3	+50 52.3	34	0.15		5.57	370	Cam	27.7	1905	100:		R.Catchpole
Herstmonceux,England	Royal Greenvich Obs	+ 0 20.3	+50 52.3	34	2x0.33				Ast	2.0		20000	TC	R.Catchpole
Kiev,Ukraina	Central Astr. Obs	+ 30 29.9	+50 27.2	184	0.40		2.00	103	Ast	8.0	1975	4900	T	L.Pakulyak
Kiso,Japan	Kiso Obs.	+137 37.7	+35 47.6	1130	1.05	1.50	3.25	63	Sch	5.2	1974	6700	C	Y.Nakada

Kitt Peak,Arizona	National Rad. Astr. Obs	-111 36.9	+31 57.2	2084		4.00	11.10	19	RCr	1.3	1973	5000	T			W.Schoening
Kitt Peak,Arizona	National Rad. Astr. Obs	-111 36.9	+31 57.2	2084		0.90	6.80	30	RFl	1.5	1960	4000	T			W.Schoening
Kitt Peak,Arizona	Warner and Swasey Obs	-111 35.9	+31 57.6	2084	0.61	0.91	2.14	97	Sch	5.2	1941	8008	TC	14000	C	P.Pesch
Madrid,Spain	National Astr. Obs	- 3 41.1	+40 24.6	670	0.40		2.00	103	Ast	8.6	1976	2000	T			J.Lahulla
Mazelspoort,S. Africa	Boyden/Bloemfontein Obs	+ 26 24.3	-29 02.3	1771	0.81	0.90	3.03	68	Sch	4.8	1950					J.McFarland
Merida,Venezuela	Llano del Hato Obs	- 70 52.0	+ 8 47.4	3610	1.00	1.52	3.00	69	Sch	5.7	1976	1184	T			N.Calvet
Merida,Venezuela	Llano del Hato Obs	- 70 52.0	+ 8 47.4	3610	2x0.51		3.75	55	Ast	6.5						
Mitaka-Shi,Japan	Tokio Astr. Obs	+139 32.5	+35 40.3	62	0.20		1.27	162	Cam	9.2	1943	5000	C			T.Nakamura
Mitaka-Shi,Japan	Tokio Astr. Obs	+139 32.5	+35 40.3	62	0.16		0.79	261	Cam	15.0	1943	"	C			T.Nakamura
Moscow,Russia	Sternberg Astr. Obs	+ 37 32.7	+55 42.0	195	0.16				Cam	20.0	1895	10000	TC			V.Goranskij
Moscow,Russia	Sternberg Astr. Obs	+ 37 32.7	+55 42.0	195	0.10				Cam	20.0	1895	"	TC			S.Shugarov
Moscow,Russia	Sternberg Astr. Obs	+ 37 32.7	+55 42.0	195	0.40		1.60	129	Ast	10.0	1938	21000	TC			V.Goranskij
Moscow,Russia	Sternberg Astr. Obs	+ 37 32.7	+55 42.0	195	0.23		2.30	90	Ast	6.0	1954					
Moscow,Russia	Sternberg Astr. Obs	+ 37 32.7	+55 42.0	195	0.50	0.70	2.00	103	Men	4.5	1958	10000	C			S.Shugarov
Moscow,Russia	Sternb. South St.	+ 34 01.0	+44 43.7	550	0.40		1.60	129	Ast	10.0	1958					
Moscow,Russia	Sternb. South St.	+ 34 01.0	+44 43.7	550	0.50	0.70	2.00	103	Men	4.5	1960					
Mount Kanobili,Georgia	Abastumani Astr. Obs	+ 42 49.5	+41 45.3	1580	0.40		7.60	27	Rfr	1.8	1937	7056	T			D. Chipashvili
Mount Kanobili,Georgia	Abastumani Astr. Obs	+ 42 49.5	+41 45.3	1580	2x0.20		1.00	206	Ast	13.7	1937	1396	T			D. Chipashvili
Mount Kanobili,Georgia	Abastumani Astr. Obs	+ 42 49.5	+41 45.3	1580	0.39	0.44	0.63	330	Sch	8.3	1938 F	30398	T			D. Chipashvili
Mount Kanobili,Georgia	Abastumani Astr. Obs	+ 42 49.5	+41 45.3	1580	0.70	0.98	2.10	98	Men	4.9	1955	20193	T	...	T	D. Chipashvili
Mount Kanobili,Georgia	Abastumani Astr. Obs	+ 42 49.5	+41 45.3	1580		1.25	16.00	13	RCC	0.6	1977	2090	T			D. Chipashvili
Mount Kanobili,Georgia	Abastumani Astr. Obs	+ 42 49.5	+41 45.3	1580	2x0.40		3.00	69	Ast	5.8	1978	4400	T			D. Chipashvili
Mt.Hamilton,California	Lick Obs	-121 38.2	+37 20.6	1290	2x0.51		3.75	55	Ast	6.0	1942	11000	T			A.Klemola
Mt.Hamilton,California	Lick Obs	-121 38.2	+37 20.6	1290	0.13		0.89	233	Cam	18.8	1942		T			A.Klemola
Mount Wilson,California	Mount Wilson(Hale) Obs	-118 03.6	+34 13.0	1742	0.25				Cam	15.0	1952			200	T	K.Henize
Nantucket,Massachusetts	Maria Mitchell Obs	- 70 06.3	+41 16.8	20	0.19		0.86	240	Cam	16.9	1913	8400				E.Friel
Palomar Mt.,California	Palomar Obs	-116 51.8	+33 21.4	1706	1.22	1.83	3.07	67	Sch	6.5	1947	30000	T			R.Brucato

Palomar Mt.,California	Palomar Obs	-116 51.8	+33 21.4	1706	0.46	0.60	0.91	227	Sch			F	10000: C		E.Helin
Palomar Mt.,California	Palomar Obs	-116 51.8	+33 21.4	1706	0.20		0.20	1031	Sch						
Piikkiö,Finland	Turku-Tuorla Obs	+ 22 26.8	+60 25.0	40	0.50	0.60	1.03	200	Sch	5.5	1980		200 T		L.Takalo
Piikkiö,Finland	Turku-Tuorla Obs	+ 22 26.8	+60 25.0	28		0.50	1.03	200	Rfl	6.7	1935		5000:T		L.Takalo
Piikkiö,Finland	Turku-Tuorla Obs	+ 22 26.8	+60 25.0	28		0.34	0.69	299	Rfl	10.5	1980		5000:T		L.Takalo
Pivnice,Poland	Pivnice Astr. Obs	+ 18 33.3	+53 05.8	91	0.60	0.90	1.81	114	Sch	4.5	1962		755 C	2071 C	J.Papaj
Pivnice,Poland	Pivnice Astr. Obs	+ 18 33.3	+53 05.8	91	0.20				Ast		1949		6000 C		A.Strobel
Poznan,Poland	Poznan Univ. Astr. Obs	+ 16 52.7	+52 23.8	85	0.12		0.53	389	Cam	13.0	1946		797 T		K.Kurzinska
Poznan,Poland	Poznan Univ. Astr. Obs	+ 16 52.7	+52 23.8	85	0.20		3.00	69	Ast	3.5	1947		934 T		K.Kurzinska
Poznan,Poland	Poznan Univ. Astr. Obs	+ 16 52.7	+52 23.8	85	0.30		1.50	138	Ast	6.9	1947		1200 T		K.Kurzinska
Riga,Latvia	Radio-Astroph. Obs	- 24 24.0	+56 47.0	75	0.80	1.20	2.40	86	Sch	5.7	1969	F	19000 T	1700 T	A.Alksnis
Rozhen,Bulgaria	National Astr. Obs	+ 24 45.0	+41 43.0	1760	0.50	0.70	1.72	120	Sch	4.5	1979		6060 C	70 C	M.Tsvetkov
Rozhen,Bulgaria	National Astr. Obs	+ 24 45.0	+41 43.0	1760		2.00	16.00	13	RCr	1.0	1979		1800 TC		M.Tsvetkov
Rozhen,Bulgaria	ESO, La Silla	- 70 43.8	-29 15.4	2347	0.40		4.00	52	Ast	2.2	1985		100 T		M.Tsvetkov
Rozhen,Bulgaria	Byurakan Astroph. Obs	+ 44 17.5	+40 20.1	1500	1.00	1.50	2.13	97	Sch	4.0	1973		400 T	50 T	M.Tsvetkov
Rozhen,Bulgaria	Byurakan Astroph. Obs	+ 44 17.5	+40 20.1	1500	0.53	0.53	1.83	113	Sch	5.0	1973		150 T		M.Tsvetkov
Saint Michel,France	Obs. de Haute-Prvence	+ 05 42.8	+43 55.9	655	0.62	0.90			Sch	4.4			7054 TC		P.Veron
Saint Michel,France	Obs. de Haute-Prvence	+ 05 42.8	+43 55.9	655	0.30	0.41			Sch	7.7		F	5442 TC		P.Veron
San Juan Obs., Argentina	Felix Aguilar Obs.	- 68 37.2	-31 30.6	700	0.50		3.41	55	Ast	6.0			6000:T		C.Lopez
SAO,Russia	Byurakan Astroph. Obs	+ 44 17.5	+40 20.1	1500	1.00	1.50	2.13	97	Sch	4.0	1961			3000 T	J.Stepanian
Sera la Nave,Sicily	Catania Astr. Obs	+ 14 58.4	+37 41.5	1735	0.33		3.47	59	Ast	2.7			500:T		S.Cristaldi
Sera la Nave,Sicily	Catania Astr. Obs	+ 14 58.4	+37 41.5	1735	0.44	0.61	1.22	169	Sch	4.2			1000 T		S.Cristaldi
Sonneberg,Germany	Sonneberg Obs	+ 11 11.5	+50 22.7	640	0.17		1.20	170	Cam	9.4	1923		7970 TC		H-J.Braeuer
Sonneberg,Germany	Sonneberg Obs	+ 11 11.5	+50 22.7	640	0.14		0.70	300	Cam	10.8	1928		6241 TC		H-J.Braeuer
Sonneberg,Germany	Sonneberg Obs	+ 11 11.5	+50 22.7	640	0.40		1.60	130	Ast	10.8	1938		1658 TC		H-J.Braeuer
Sonneberg,Germany	Sonneberg Obs	+ 11 11.5	+50 22.7	640	0.40		2.00	100	Ast	8.3	1960		6855 TC		H-J.Braeuer
Sonneberg,Germany	Sonneberg Obs	+ 11 11.5	+50 22.7	640	0.40		1.60	130	Ast	10.8	1938		10197 TC		H-J.Braeuer
Sonneberg,Germany	Sonneberg Obs	+ 11 11.5	+50 22.7	640	0.50	0.70	1.72	120	Cam	4.3	1952		8500 TC		H-J.Braeuer

Sonneberg,Germany	Sonneberg Obs	+ 11 11.5	+50 22.7	640	0.14	0.24	860	Cam	38.2	1928	11166	TC	H-J.Braeuer
Sonneberg,Germany	Sonneberg Obs	+ 11 11.5	+50 22.7	640	0.17	1.20	860	Cam	38.2	1926	10275	TC	H-J.Braeuer
Sonneberg,Germany	Sonneberg Obs	+ 11 11.5	+50 22.7	640	0.17	1.20	860	Cam	38.2	1942	1325	TC	H-J.Braeuer
Sonneberg,Germany	Sonneberg Obs	+ 11 11.5	+50 22.7	640	0.08	0.37	560	Cam	18.7	1925	119	TC	H-J.Braeuer
Sonneberg,Germany	Sonneberg Obs	+ 11 11.5	+50 22.7	640	0.08	0.20	1030	Cam	34.3	1926	193	TC	H-J.Braeuer
Sonneberg,Germany	Sonneberg Obs	+ 11 11.5	+50 22.7	640	0.10	0.25	830	Cam	27.6	1934	7035	TC	H-J.Braeuer
Sonneberg,Germany	Sonneberg Obs	+ 11 11.5	+50 22.7	640	0.06	0.21	980	Cam	32.7	1941	3655	TC	H-J.Braeuer
Sonneberg,Germany	Sonneberg Obs	+ 11 11.5	+50 22.7	640	0.35	1.40	150	Rfl	3.3	1936	382	TC	H-J.Braeuer
Sonneberg,Germany	Sonneberg Obs	+ 11 11.5	+50 22.7	640		0.18	1150	Cam	38.3	1950	48	TC	H-J.Braeuer
Sonneberg,Germany	Sonneberg Obs	+ 11 11.5	+50 22.7	640		0.18	1180	Cam	39.3	1950	204	TC	H-J.Braeuer
Sonneberg,Germany	Sonneberg Obs	+ 11 11.5	+50 22.7	640	0.50	0.17	1250	Cam	41.7	1950	2569	TC	H-J.Braeuer
Sonneberg,Germany	Sonneberg Obs	+ 11 11.5	+50 22.7	640	0.14	0.70	300	Cam	15.0	1950	1423	TC	H-J.Braeuer
Sonneberg,Germany	Sonneberg Obs	+ 11 11.5	+50 22.7	640	0.04	0.18	1150	Cam	38.3	1950	1424	TC	H-J.Braeuer
Sonneberg,Germany	Sonneberg Obs	+ 11 11.5	+50 22.7	640	0.30	0.30	690	Sch	11.5	1960	5300	TC	H-J.Braeuer
Sonneberg,Germany	Sonneberg Obs	+ 11 11.5	+50 22.7	640	0.20	"	"	"	"	"	"		H-J.Braeuer
Sonneberg,Germany	Sonneberg Obs	+ 11 11.5	+50 22.7	640	0.06	0.21	980	Cam	32.7	1953	3194	TC	H-J.Braeuer
Sonneberg,Germany	Sonneberg Obs	+ 11 11.5	+50 22.7	640	0.05	0.25	830	Cam	27.7	1956	11700	TC	H-J.Braeuer
Sonneberg,Germany	Sonneberg Obs	+ 11 11.5	+50 22.7	640	0.05	0.25	830	Cam	30.0	1956	11797	TC	H-J.Braeuer
Sonneberg,Germany	Sonneberg Obs	+ 11 11.5	+50 22.7	640	0.05	0.25	830	Cam	30.0	1956	11794	TC	H-J.Braeuer
Sonneberg,Germany	Sonneberg Obs	+ 11 11.5	+50 22.7	640	0.06	0.21	980	Cam	30.0	1956	2781	TC	H-J.Braeuer
Sonneberg,Germany	Sonneberg Obs	+ 11 11.5	+50 22.7	640	0.05	0.25	830	Cam	30.0	1957	10691	TC	H-J.Braeuer
Sonneberg,Germany	Sonneberg Obs	+ 11 11.5	+50 22.7	640	0.09	0.30	690	Cam	30.7	1957	682	TC	H-J.Braeuer
Sonneberg,Germany	Sonneberg Obs	+ 11 11.5	+50 22.7	640	0.05	0.25	830	Cam	30.0	1958	10479	TC	H-J.Braeuer
Sonneberg,Germany	Sonneberg Obs	+ 11 11.5	+50 22.7	640	0.07	0.30	830	Cam	30.0	1958	8612	TC	H-J.Braeuer
Sonneberg,Germany	Sonneberg Obs	+ 11 11.5	+50 22.7	640	0.07	0.30	830	Cam	30.0	1958	8604	TC	H-J.Braeuer
Sonneberg,Germany	Sonneberg Obs	+ 11 11.5	+50 22.7	640	0.05	0.25	830	Cam	30.0	1958	8392	TC	H-J.Braeuer
Sonneberg,Germany	Sonneberg Obs	+ 11 11.5	+50 22.7	640	0.05	0.25	830	Cam	30.0	1958	8385	TC	H-J.Braeuer
Sonneberg,Germany	Sonneberg Obs	+ 11 11.5	+50 22.7	640	0.05	0.25	830	Cam	30.0	1958	8416	TC	H-J.Braeuer
Sonneberg,Germany	Sonneberg Obs	+ 11 11.5	+50 22.7	640	0.05	0.25	830	Cam	30.0	1958	8001	TC	H-J.Braeuer
Sonneberg,Germany	Sonneberg Obs	+ 11 11.5	+50 22.7	640	0.05	0.25	830	Cam	30.0	1958	8014	TC	H-J.Braeuer
Sonneberg,Germany	Sonneberg Obs	+ 11 11.5	+50 22.7	640	0.05	0.25	830	Cam	30.0	1958	8014	TC	H-J.Braeuer
Sonneberg,Germany	Sonneberg Obs	+ 11 11.5	+50 22.7	640	0.05	0.25	830	Cam	30.0	1958	8069	TC	H-J.Braeuer
Sonneberg,Germany	Sonneberg Obs	+ 11 11.5	+50 22.7	640	0.07	0.25	830	Cam	30.0	1963	925	TC	H-J.Braeuer
Sonneberg,Germany	Sonneberg Obs	+ 11 11.5	+50 22.7	640	0.07	0.25	830	Cam	30.0	1963	942	TC	H-J.Braeuer
Sonneberg,Germany	Sonneberg Obs	+ 11 11.5	+50 22.7	640	0.07	0.25	830	Cam	30.0	1963	906	TC	H-J.Braeuer
Sonneberg,Germany	Sonneberg Obs	+ 11 11.5	+50 22.7	640	0.07	0.25	830	Cam	30.0	1963	890	TC	H-J.Braeuer
Sonneberg,Germany	Potsdam Obs.	+ 13 04.0	+52 22.9	107	0.40	5.50	38	Rfr	1.3	1917	1436	TC	H-J.Braeuer
Sonneberg,Germany	La Paz,Bolivien	- 66 07.5	-16 30.6		0.30	1.50	138	Cam	11.5	1926	915	TC	H-J.Braeuer

Sonneberg,Germany	Windhoek, SW Afrika	+ 17 03.8	-22 35.4	1685	0.14		0.24	860	Cam	43.0	1934	1975	TC	H-J.Braeuer
Sonneberg,Germany	SW Afrika	DIFFERENT			0.05		0.17	1250	Cam	41.7	1952	1912	TC	H-J.Braeuer
Sonneberg,Germany	Boyden Stat., S. Africa	+ 26 24.3	-29 02.3	1387	0.25		1.25	170	Ast	9.4	1959	490	TC	H-J.Braeuer
Sonneberg,Germany	Boyden Stat., S. Africa	+ 26 24.3	-29 02.3	1387	0.20		1.00	210	Ast	11.7	1959	314	TC	H-J.Braeuer
Sonneberg,Germany	Boyden Stat., S. Africa	+ 26 24.3	-29 02.3	1387	0.08		0.30	690	Cam	38.3	1959	95	TC	H-J.Braeuer
Sonneberg,Germany	Heidelberg, Koenigstuhl	+ 8 43.3	+49 23.9	570	0.40		1.95	110	Ast	9.2	1957	1184	TC	H-J.Braeuer
Swarthmore,Pennsylvania	Sproul Obs	+ 75 21.4	+39 54.3	63	0.61		10.93	19	Rfr	0.7	1911	100000	TC	W.Heintz
Tautenburg,Germany	Karl Schwarzschild Obs	+ 11 42.8	+50 58.9	331	1.34	2.00	4.00	52	Sch	3.4	1960	7000	C	S.Marx
Uccle,Belgium	Royal Obs. of Belgium	+ 4 21.5	+50 47.9	105	0.38		3.50	59	Ast	2.0	1908	1160	T	P.Paguet
Uccle,Belgium	Royal Obs. of Belgium	+ 4 21.5	+50 47.9	105	0.30		1.50	138	Cam	9.0	1924	1800	C	P.Paguet
Uccle,Belgium	Royal Obs. of Belgium	+ 4 21.5	+50 47.9	105	2x0.40		2.00	103	Ast	8.0	1934	8000	C	P.Paguet
Uccle,Belgium	ESO, La Silla	- 70 43.8	-29 15.4	2347	0.40		4.00	52	Ast	2.2	1976	4300	TC	P.Paguet
Xingiglong, China	Beijing Astr. Obs	+117 34.5	+40 23.7	870	0.60	0.90	1.80	115	Sch	5.5	1963	3000	C	W.Junjie
Xingiglong, China	Beijing Astr. Obs	+117 34.5	+40 23.7	870	2x0.40		3.00	69	Ast	8.0	1963			

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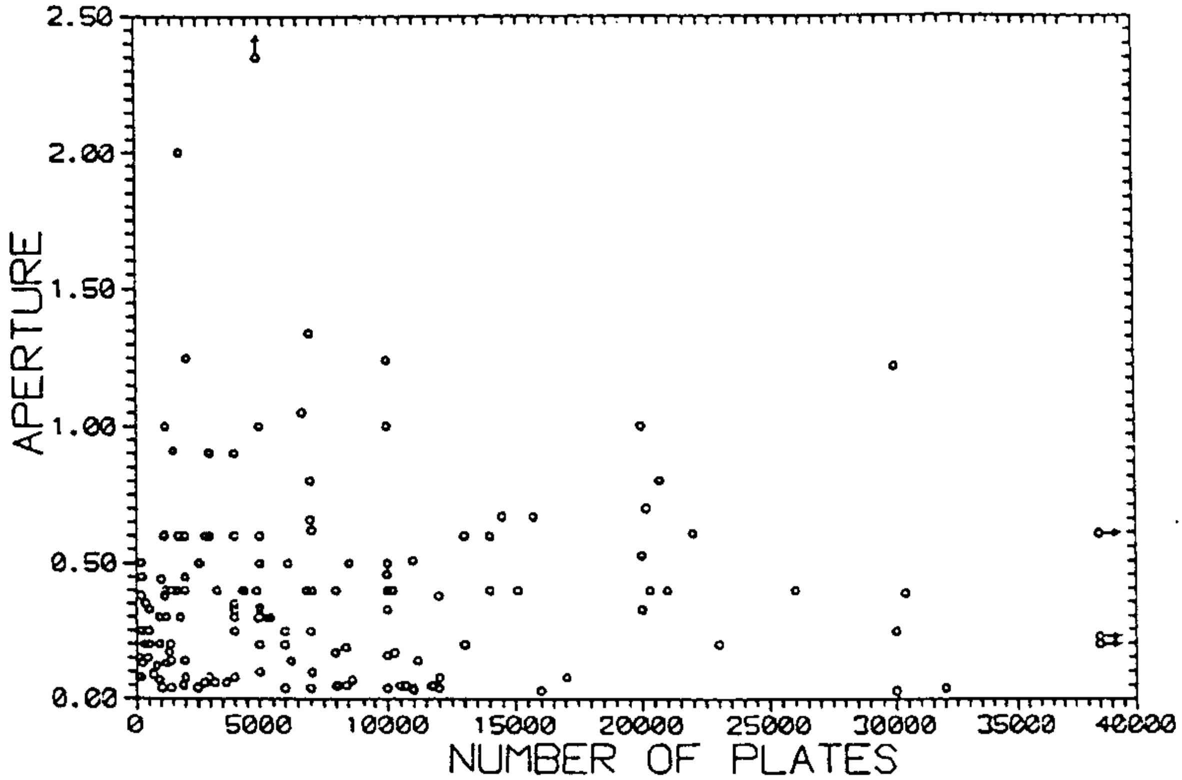

Figure 2. Distribution of the Number of Plates in the Declared Plate Archives listed in Table 1 versus Aperture of the Wide-field telescope used. Beyond the figure border there are the archive of the 4-m Ritchey-Chrétien Kitt Peak telescope (5000 plates) and the very rich Sproul, Harvard and Boyden (Harvard-Arequipa) collections, with 100,000, 60,000 and 48,000 plates respectively.

3.1.2 Table 2

For more completeness 34 observatories/institutions with wide-field instruments not included in the first list are counted in Table 2. We hope that later this year they will also make available the necessary information for their plate archives.

The comparison of our list with B. Hauck's list shows, that in spite of our more specific task — archiving of wide-field plates only — the quantity of the astronomical plates is almost the same.

3.1.3 Table 3

In Table 3 is given the list of institutes which are included in Hauck's list and 10 years ago declared that they have photographic archives, but which have not (yet) been included in our list.

One of the most probable reasons is that in some cases the plate archive is mainly spectroscopic. If so, it will be desirable that they describe their archives and contact Dr. E. Griffin who is now in charge of the parallel project concerning the spectroscopic plate archives under the auspices of the IAU Commission 29.

Table 2. The Institutes and Observatories with Wide-field Instruments not yet included in the first list of WFPA.

Observatory	Wide-field Telescopes			Type	Field Size	Year	Remarks
	Clear Apert.	Apert. Mir.	Focal Length				
1	2	3	4	5	6	7	8
Alma-Ata, Kazakhstan	0.50	0.57	1.20	Men	4.5	1950	
Alma-Ata, Kazakhstan	0.50	0.90	1.80	Men	6.0	1974	
Alma-Ata, Kazakhstan		1.00	13.50	RCC	0.7	1980	Assy-Trugen St.
BBAO, New Zealand/USA	0.20		2.06	Ast	5.0		U.S. NSF, Antarctica
Bosscha Obs. Indonesia	0.51	0.71	1.27	Sch	5.0	1960	
Cambridge, USA	0.41		2.10	Ast	7.0	1910	
Castel Gandolfo, Vatican	0.64	0.98	2.40	Sch	4.5	1961	
Castel Gandolfo, Vatican	0.40		2.00	Ast	8.0	1936	
Cerro Tololo, IAO/AURA	0.61	0.91	2.13	Sch	5.0	1967	Portage Lake Obs.
Cerro Roble Obs, Chile	0.70	0.97	2.10	Men	5.0	1967	Pulkova South St.
Crimean Astr. Obs. Russia	2x0.12			Ast		1908	
Crimean Astr. Obs., Russia	0.64	0.70	0.90	Men	4.5	1959	
Crimean Astr. Obs., Russia	2x0.40		1.60	Ast	10.0	1949	
Derbyshire Obs.	0.35		1.02	Sch	6.0	1976	Bakewell Obs.
Dyer Obs., USA	0.55	0.58	2.08	Sch	5.5	1953	Nashville
Engelgardt Obs., Russia	0.30			Rfr		1931	Kazan Uni. Obs.
Engelgardt Obs., Russia	0.35			Men		1954	Kazan Uni. Obs.
Hamburg Obs., Germany/USA	0.23		2.06	Ast	5.0		

1	2	3	4	5	6	7	8
Hartebeespoort Obs, NL.	2x0.40		2.25	Ast	7.5	1939	Leiden South St.
Hoher List Obs., Germany	0.34	0.50	1.37	Sch	5.0	1953	Bonn Uni. Obs.
Hoher List Obs., Germany		1.06	14.00	RCC		1965	Bonn Uni. Obs.
Las Campanas Obs., Chile		2.00	16.00	RCC	1.5		Carnegie Inst. Obs.
Leningrad Uni. Obs., Russia	0.50	0.57	1.20	Men	4.5		Branch, Armenia
Maidanek, Uzbekistan		1.50	12.0	RCC	1.5		Sternberg Inst. St.
Metsahovy, Finland	0.50	0.90	1.70	Sch			
Mt. Stromlo, Australia	0.50	0.65	1.73	Sch	3.6	1957	
MPI, Calar Alto, Germany	0.80	1.20	2.40	Sch	5.5	1955	
MPI, Heidelberg, Germany	0.25	0.40	0.90	Sch			
Nainital Obs., India		1.00	13.50	RCC	0.7	1980	Utarr Pradesh Obs.
Nassau Stat., Cleveland, USA	0.61	0.91	2.14	Sch	5.2	1957	
Nrdt. Kavkaz St., Russia	0.40		2.0	Ast	8.0	1976	Kazan Uni. St.
Nrdt. Kavkaz St., Russia	0.38			Sch		1976	Kazan Uni. St.
Piszkesteto St., Hungary	0.61	0.90	1.80	Sch	5.0	1963	Konkoly Obs.
Piszkesteto St., Hungary		1.00	13.50	RCC	0.8	1972	Konkoly Obs.
Pulkovo Obs., Russia	0.28		1.50	Cam		1947	
Pulkovo Obs., Russia	0.65		10.50	Rfr		1947	
Pulkovo Obs.	0.15		2.04	Ast	5.0		
Pulkovo St. Bolivia	0.23		0.23	Ast	6.0	1979	
Purp. Mount. Obs., China	2x0.40		2.00	Ast		1963	Nanking Obs.
Purp. Mount. Obs., China		1.00	13.50	RCC	0.7	1985	Nanking Obs.

1	2	3	4	5	6	7	8
Schemaha Obs., Azerbaidzhan	0.35		1.20	Men	4.2	1960	
Schemaha Obs., Azerbaidzhan		0.70	2.82	Rfl		1960	
Stockholm Obs. Sweden	0.65	1.00	3.00	Sch	7.0	1964	Saltsöbaden Obs.
Stockholm Obs., Sweden	0.40		1.98	Ast	8.0	1931	
Tachkent Obs., Uzbekistan	0.33		3.40	Ast	2.0	1894	
Tonantzintla Obs., Mexico	0.66	0.76	2.17	Sch	5.0	1948	
Uppsala Obs., Sweden	1.00	1.35	3.00	Sch	4.5	1964	Kvistaberg
Yunnan Obs., China	2x0.40		2.00	Ast	8.0	1963	Kunmin Obs

Table 3. List of Observatories/Institutes possessing Plate Archives (B. Hauck, 1982) not included in our list.

Observatory/Institute	No. of Plates	Person in Charge
Institut für Astronomie (Tuerkenschanzstr) Wien	3100	A. Schnell
David Dunalp Obs, Richmond Hill, Ontario	46000	C. Bolton
Dominion Astrophysical Obs., Victoria	110,000	E. Lee
Observatoire de Toulouse, France	9012	R. Nadal
Max Plank Institut für Astronomie, Heidelberg	Yes	
Bosscha Observatory, Lembang, Java	7000	B. Hidayat
Osservatorio Astronomico Universitario, Bologna, Italy	19000	F. Bonoli
Osservatorio Astronomico di Brera, Milano, Italy	9000	E. Antonello
Sterrewacht Leiden, Huygens Laboratorium Leiden, NL	30,000	A. Schoemaker
Lund Observatory, Lund, Sweden	3000	
Uppsala Astronomical Observatory, Uppsala, Sweden	Large	
Uni. Michigan Dept of Astronomy, MI, USA	8000	W. Hiltner
Institute for Astronomy, Honolulu, Hawaii	3500	W. Bonsack
Canada-France-Hawaii, Telescope Corporation	300	Director

Observatory/Institute	No. of Plates	Person in Charge
Mount Wilson and Las Campanas Observatory, Pasadena, CA, USA	Yes	Director
Yerkes Observatory, Williams Bay, Wisconsin	150,000	K. Gudworth
SAO, Russia	3300	J. Glagolevskij

3.1.4 Table 4

The data of direct photographic plate archives from Jaschek's (1988, 1989) lists are summarised in Table 4. In this more complete list 68 institutes/observatories declared more than 1.5 x 10^6 photographic astronomical plates. 20 of the archives are in a complete (12) and not complete (8) computer readable form. 24 of the observatories and institutes denoted with "*" are included also in the first list of wide-field plate archives. Among the observatories and institutes not included in our list but present in Jaschek's more than 50% are from Europe.

Table 4. List of Observatories/Institutes possessing direct photographic plate archives according to Jaschek's questionnaires published in *Inform. Bull. B. CDS*, v. 34 and v. 36 (1988, 1989).

Quest. No.	Observatory/Institute	No. of Direct Plates	Years of Operation	Comp. Read. Form	Director or Archivist
1	2	3	4	5	6
1*	Sonneberg Observatory	210,000	1925	no	W. Wenzel
3	University Obs. Goettingen	2500:	1930-40	no	W. Denizer
4*	Warner & Swasey Obs. Case West. Res. Uni.	15000	1941-	no	C. Stephenson
5	M.A.M.A., Paris	yes			J. Guibert
6*	Turku University Observatory	10,000	1935-	no	M.-O. Saare
7*	Lowell Observatory	22000	1895-	yes	B. Skiff
9*	Okayama Astroph. Obs./Tokyo Astr. Obs.	20,000	1960-	no	T. Sasaki
10	Astronomical Inst. "Anton Pannekoek"	1000:	1925-	no	R. Takens
11	Astronomical Inst. "K.U. Leuven"	6500	1957-	no	P. Smeyers
12*	CERGA, France	1900:	1976-	yes	J.-L. Heudier
13	Van Vleck Observatory	30,000	1922-	no	A. Upgren
14	Institute for Astronomy, Vienna	2200:	1909-	yes 20%	W. Weiss
15	Dipartimento di Astr., Uni. di Bologna	----	1939-	yes	M. Zuccoli
17*	Leander McCormick Observatory	50,000:	1914-	yes (~25Mb)	Ph. Ianna
18*	Kiso Observatory, Uni. of Tokyo	5500	1975-	yes	K. Ishida
19	Yerkes Observatory, Uni. of Chicago	15,000	:1900-	no	K. Cudworth
21	University of Hamburg	----	1900-	yes (part)	H. Wendker
22	Astronomiska Observatoriet, Uppsala	14,000:	:1899-	yes	C. Lagerkvist

1	2	3	4	5	6
23*	Swartmore College Obs. Depart. Ph. & Astr.	100,000:	1912-	yes	W. Heintz
24*	Lick Observatory	6000:	1890-1930	no	M. Walker
25	Observatoire de Paris	5600:	1887-1953	no	S. Debarbat
27*	Jena University Observatory	2000:	1963-	no	W. Pfau
28	Hida Observatory, Planetary Section	1300:	1972-	no	T. Akabane
29	David Dunalp Observatory	60,000:	1935-	no	C. Bolton
31*	Tautenburg, Karl-Schwarzschild Obs.	6000	1960-	yes	S. Narx
33	University of South Africa, Pretoria	100:	1984	no	W. Wargau
36	Inst. & Obs. San Fernando, Spain	5186	1891-	no	L. Quijano
37	Dept. Cel. Astr. & Geopf., La Plata, Argentina	120:	1974-	no	J. Muzzio
42	Astr. Inst. Uni. Bern, Switzerland	10,000F	1949-	no	
46	Armagh Observatory	1100	1899-	no	C. Butler
47	USNO, Time Service Department, Washington	32,000	1915-	yes	D. McCarthy
50	USNO, Equatorial Division, Washington	71,000	1951-	no	R. Harrington
52	Flagstaff Station, U.S. Naval Observatory	5000	1963-	yes (part)	H. Ables
54*	Felix Aguilar Observatory, Yale South. St.	5600	1965-	no	C. Lopez
55	Institut für Physics der Erde, Potsdam	2700	1972-	no	
60	Kawasan Observatory, University of Kyoto	4600	1958-	no	K. Iwasaki
62	Astronomy Department, University of Illinois	100:x	1967-	no	K. Yoss
63	Manuel Foster Obs. Uni. Catolica, Santiago	4100	1928-	no	N. Vogt
67	Obs. de Nice, Satellites Artificiales	1300 P/F	1967-75	no	G. Helmer
71	Obs. de Nice, Petites Planets et Comets	10,000	1935-61	no	F. le Guet Tully
74	Centre de Rech. en Astro. & Geophys., Alger	5000:	1885-1960	no	H. Benhallou
75	Astr. Inst. Slovak Academy of Sciences	6300	1943-	no	J. Svoren
82*	Obs. Royal Belgique	12443	1900-	yes	J. Dommanget
83*	Anglo-Australian Observatory	1800	1974-	yes (not comp)	W. Lupton
84	Engelhardt Astr. Obs., Kazan	10,000	1962-	no	O. Belkovich
86	Astroph. Obs. Babelsberg, Potsdam	1000:x	1924-45	no	K. Tiersch
87	Astroph. Obs. Babelsberg, Potsdam	16,000:	1886-1967	no	W. Dick
90*	Harvard College Observatory	400,000	1885	no	M. Hazen
95	Leyden Observatory	13,000:	1910-	no	R. De Poole
96*	Beijing Astronomical Obs.	2000:	1970-	no	Y. Xiang
97*	Felix Aguilar Obs, San Juan, Argentina	50	1977-86	no	Z. Lopez-Garcia
98*	Royal Obs. Edinburgh, UKSTU	13000:	1973-	yes	D. Morgan
99	Max Planck Inst. für Astr., Heidelberg	900:	1976-	yes	Th. Neckel

1	2	3	4	5	6
101*	NOAO, Kitt Peak National Obs.	6000:	1973-	yes	W. Schoening
102*	Abastumani Astr. Obs., Georgia	20,000	1937-	no	E. Kharadze
103	Technische Universität, Dresden	650	1976-	no	K. Steinert
107	Royal Astronomical Society, London	4000:	1800-?	no	P. Hinkley
108	Dyer Observatory, Vanderbilt University	3000:	1955-	no	A. Heiser
109	Bosscha Observatory, ITB., Indonesia	5000:	1948-	no	B. Hidayat
111*	Royal Greenwich Observatory, RGO Archives	130,000:	1646-?	no	A. Perkins
113	Lunar & Planetary Laboratory, Arizona	8000:	1949-65	no	E. Whitaker
114*	Main Astronomical Observatory, Kiev	1300	1949-	no	N. Kharchenko
116	Astronomical Observatory Beograd	2100	1957-59	no	J. Arsenijevic
117	Astronomical Observatory Torun, Poland	18,000	1949-	yes	A. Strobel
118	Astronomical Observatory Beograd	3000	1936-	yes	D. Olevic
129*	South African Astronomical Observatory	8300	1948-	no	T. Evans
134	Riverview College Obs. Lane Cove, Australia		1930-60	no	L. Drake
137	Central Astronomical Observatory, Pulkovo	80,000:	1839-	yes (part)	E. Polyakov
139	Obs. Astronomico de la Uni., Valencia	350	1985-88	no	A. Lopez

*) Included in the first list of Wide-field Plate Archives

4 The WFPA Data Base

The preparation of a list of wide-field plate archives is a necessary step for the creation of the future data base. It is our opinion that the programme should be carried out in three stages:

1. Preparation of a list of the wide-field archives — 1992/93;

2. Computerizing the data base for individual plates in plate archives all over the world — 1993/96.

3. Establishing a Data Bank with digitized wide-field plates — after 1996.

The first stage was begun with the preparation of the first list of Wide-field Plate Archives. It must of course still be made more accurate and complete. We hope to come closer to the goal after sending out and also publishing the second circular letter in the Newsletter No. 2 of the WGWFI. Once it is reasonably complete and has been thoroughly verified, we believe that it may be reasonable to include this list in the STARCAT (1991) and SIMBAD (1992) data bases.

In parallel to this work it is now reasonable to begin with the next stage — the creation of the data base with the data of the individual plates in the plate archives. We expect to do so on the basis of existing ESO/STECF standard. For this purpose it is necessary to create first a global catalogue of all known plates. The form of such a catalogue should present the main information from the separate catalogues of the different observatories in united computer-readable form. Having in mind the recommendation of B. Hauck (1982a) about the information, which ought to be in this catalogue, it would appear that the global catalogue should contain the following information for the general plate parameters:

1. Information about the observatory and the telescope used:
2. Plate/film designation;
3. Equatorial coordinates (R.A., D.) of the field centre (Equinox);
4. Size of the plate or angular size;
5. U.T. date or Julian Date and Local Sidereal Time (LST);
6. Plate type: Direct plate, Multiple exposure, Stellar Tracks or Objective Prism (dispersion), Exposure time, Hypersensitization;
7. Type of emulsion used and filter;
8. Plate storage and availability of the plate, whether it has been copied and/or digitised, and
9. Comments (Quality, Defects, etc.)

It will be advantageous that the organization and the future use of this catalogue will be made according to the conventions adopted for one or more of the existing data bases, e.g. in ESO/STARCAT and Strasbourg (Ochsenbein, 1986; Murtagh, 1988a; Albrecht and Egert, 1991). The modification of the used data base management system (DBMS) will play an important rôle in the efficient progress of the creation of this global catalogue.

The main problem on the way towards the creation of the global catalogue will be to convert the files of existing plate archives from table-forms to computer-readable forms. Since some wide-field plate archives have until now mainly been available in table-form, special attention must be given to this problem. Some observatories have indicated that they have no possibilities at this moment to convert their table-form archives to computer-readable ones. However, the Bulgarian Wide-Field Image Group has some experience and possibilities in preparing the computer-readable plate archives of the Rozhen Observatory and could contribute in this direction. The increasing possibilities of the Network communications among the astronomical institutes all over the world, and the increased use of better and better text scanners for the exchange of the information about wide-field astrophotographs would undoubtedly contribute much towards the compilation of a global catalogue for the future data base.

The last and most important stage (and certainly the most time- and money-consuming!) of the present project is the creation of the DATA BANK for Wide-field Plate Archives. This part of the project organization can only be started after detailed discussions and the availability of firm financial support. Once realized, it will have brought us all the way through to the practical use and rapid retrieval of information contained within the astronomical WFPA.

Only advanced automatization and robotization will bring us to the realization of the DATA BANK access which must then be accessible to all members of the astronomical community. Storage of the information on optical disks, creation of special software for processing the digitized observational material, transfer of the data after processing to the user are only some basic steps which must be passed on the long way towards the DATA BANK of WFPA. The fast progress in the fields of digitization, the development of ever faster computers and data exchange accessories form the basis of our hope that we are now much closer than we have ever been to this final part of the project.

By analysing the data from the Tables above, we can roughly estimate that the total number of all expected wide-field plates is about $2 \cdot 10^6$. If the digitized information on a medium-size wide-field plate is 200 MB, then the total information content of these plates will be about 400 TB (terabytes) or no more than 1 PB (10^{15} bytes). A very rough — and perhaps optimistic! — estimate of the total time needed for the digitization process of all existing wide-field plates is about 2.5 - 5.0 years of uninterrupted work!

To organize, support and access such a large DATA BANK is a question for the future. In this connection the archiving experience at STScI-Baltimore and STECF - ESO during the creation and data retrieval from the Guiding Star Catalogue are good examples from which we can learn how to proceed.

5. Conclusions and Comments

In the present paper we bring some facts and expose some of our ideas on the way towards the creation of a Data Base of Wide-field Plate Archives. At the beginning of the project, the first list of wide-field plate archives has now been compiled. 49 observatories and institutes confirm that they possess a total of 174 WFPA related to different instruments. 15 of them are in fully computer readable form and 101 are in the process of preparation — the basis of a future data base.

At least 34 observatories/institutes possessing 51 wide-field instruments have not declared their wide-field plate archives.

From 68 institutes which declared they had possessed photographic plate archives about 5 years ago, 45 are not included in the first list of wide-field plate archives.

The future progress of the WFPA work will depend on the speed with which the global catalogue of all wide-field plate archives can be achieved, and later on the means which will be available to produce the DATA BANK with all digitized wide-field plates. The rough estimate of the total number of all wide-field plates in existence is about $2 \cdot 10^6$ bytes and the total digitized information for the future DATA BANK may be close to 10^{15} bytes (1 PB).

The creation of the future data base will be closely related to the solution of the major problem of different formats used for plate-digitization. The recent, rapid development of computer techniques and the improved possibilities with the UNIX operating system appear to indicate that the FITS format is probably not the best solution for the future digitization and archiving work of the IAU WG on Wide-field Imaging.

6. Acknowledgements

I would like to thank Richard West for useful suggestions and comments about the WFPA project. I gratefully acknowledge travel grants and financial support for participation in the OC meeting in Baltimore received through the NASA, IAU and ESO, and personal help of Dr. B. Lasker. Many thanks to all colleagues who provided the data for the first wide-field plate archive list.

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Photographic Spectroscopy

I am one of the few members of the former IAU Working Group on Astronomical Photography who still practise photographic spectroscopy, and although the revamped WG is now fairly specific about where it believes the majority interests lie I hope nevertheless for exchanges of information about photography itself, the activity which we do still have in common. I was therefore particularly interested to read the first Newsletter from the WGWFI because it brought to the fore an important and topical *Spectroscopic* issue, namely archiving data.

The need to preserve observational data in some form is as acute, if not more so, in the realm of spectroscopy as it is in direct imaging, though since the WGWFI has a subcommittee devoted to that end there is no need to rehearse here the potential scientific benefits. A new Working Group on Spectroscopic Data Archives has recently been set up and is currently seeking formal recognition by the IAU; its brief, according to IAU Recommendation C13 published last July, is "to establish agreed means of archiving and distributing spectroscopic data". The organization of the new WG is a little unorthodox, in that it consists of a nucleus of 'workers', rather than a standard OC, but its rank and file membership is open without restriction; we cannot therefore circulate our wider membership with newsletters and the like, but trust that we will be able to gain an effective publicity through the media of allied and sympathetic — or even hostile — specialist groups.

The broad aim of the new WG is to build meaningful archives of spectra that can be made globally accessible. Its concern is not only with digital data from ground-based and space instruments but also with photographic spectra, wherever they are stored. The description 'meaningful' carries with it the implication that spectra can be used most efficiently and effectively by astronomers from different disciplines if they (the spectra) have already been stripped of their instrumental signatures and rendered detector-independent; though it will be necessary at the start to save all the *raw* data as they come off the telescope, in due course the *archived* data should be only those which are as completely reduced as the astronomer responsible would like. The WG will seek to achieve those ends by dint of gentle persuasion through the users — the astronomers — themselves, proffering the suggestion that that sort of archiving should prove immensely cost-effective and could therefore be subsumed by an observatory's operations as one of its essential facets.

At its first meeting held a few weeks ago the new WG tried to define the scope, and more especially the limits, of the various tasks which were perceived to lie within its brief. One grey area under discussion was that of objective prism spectra: should they be included as 'spectra', or would they not best be treated as 'wide-field' products and handled by people who are already experienced in the necessary techniques? When the matter of digitising Schmidt plates was discussed by Harvey MacGillivray in the WGWFI Newsletter he addressed the same question, and an ensuing correspondence with the Chairman has led to the resolve of the WGWFI's OC to keep spectra taken on wide-field plates strictly within the gamut of the WGWFI. However, since many observatory plate vaults contain both direct and spectroscopic plates, it would clearly be to the advantage of *all* the parties concerned (including at least a subgroup nominated by Commission 5 to catalogue historical collections of plates) if all the approaches to the relevant managements to investigate, examine, catalogue and possibly negotiate the ultimate re-housing of the contents were made at one and the same time. It will therefore be of considerable mutual benefit to the relevant WGs if they cooperate closely in this matter, and keep one another informed in general over the trials, tribulations and even successes of their respective efforts at establishing agreed means of archiving and distributing data.

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Universal Microphotometer with a Rotating Slit

A two-coordinate universal microphotometer (UMF) is now operating at the Astronomical Institute of the Ondrejov Observatory. In addition to ordinary scanning functions, this device may for convenience also be used in some unique modes of work to solve special astronomical and astrophysical tasks. The uniqueness of the UMF consists in the possibility of independent rotation of the measuring slit around its optical axis. In addition, the UMF table with the scanned transparent image can follow a general curve defined either analytically or experimentally by at most 30 points selected at the picture. Together with classical tasks like scanning of spectrograms in rectangular coordinates X and Y, this device allows the effective digitisation of various non-standard transparent images.

The UMF was used e.g. for measuring of the spectrograms from slitless spectrographs even in cases when the angle between the dispersion vector and spectral lines was a general function of coordinates X and Y in the plane of spectrogram (e.g. meteoric spectra). Another special application is e.g. scanning of solar eclipse pictures along solar disc concentric circles with the slit rotating in such a way as to be always perpendicular to the solar radius direction.

Other principal parameters of the UMF are as follows: the size of a measured transparent plate or a film frame to be measured is to be up to 115 x 230 mm; the precision of keeping a sampling position in a rectangular raster is 0.001 mm, while for sampling along a general curve this precision

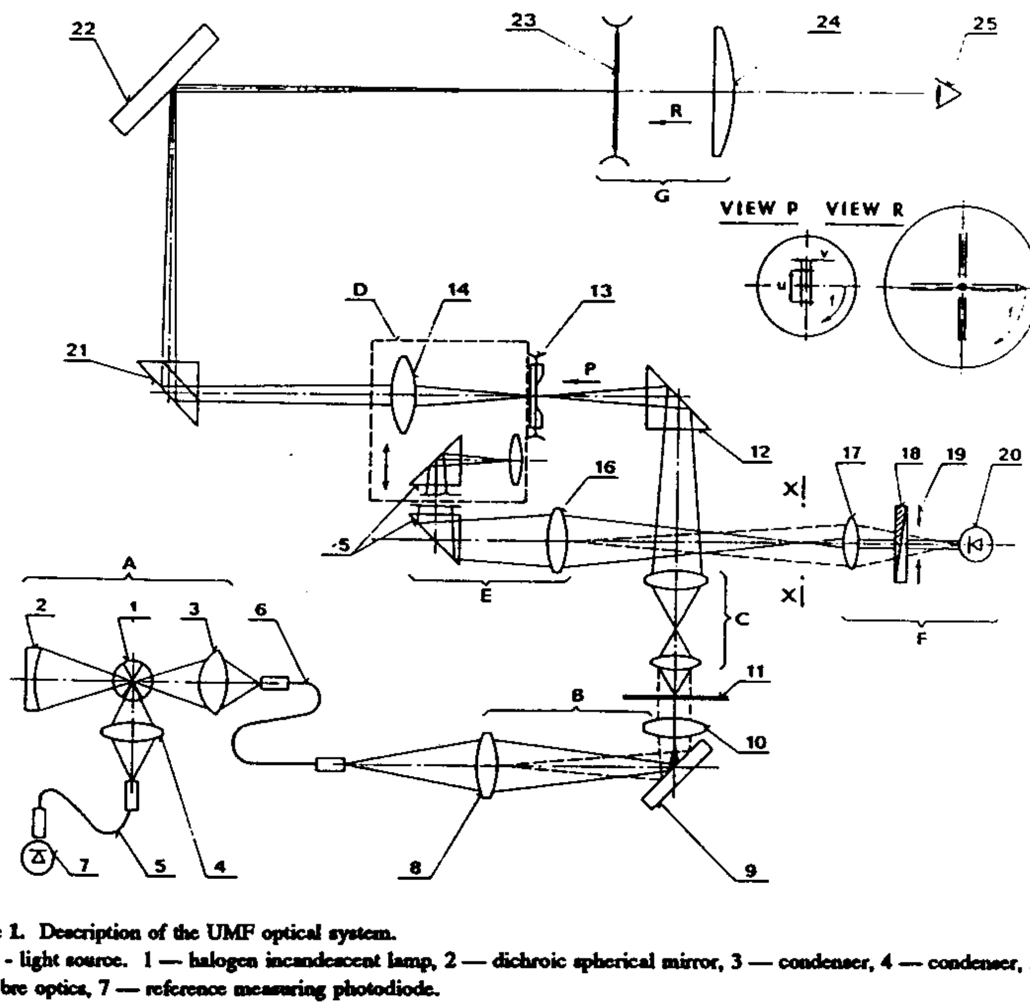

Figure 1. Description of the UMF optical system.
Part A - light source. 1 — halogen incandescent lamp, 2 — dichroic spherical mirror, 3 — condenser, 4 — condenser, 5 — fibre optics, 6 — fibre optics, 7 — reference measuring photodiode.
Part B — illumination optics. 8 — objective, 9 — plane mirror, 10 — objective, 11 — research sample (transparent frame).
Part C — projection objective. 12 — prism system, 13 — three-parametric slit.
Part D — optical way changer. 14 — objective, 15 — prism system, 16 — objective.
Part F — photometric head. 17 — eyepiece, 18 — neutral wedge, 19 — electromagnetic shutter, 20 — measuring photodiode.
Part G — rotating focusing screen for observation of field of view. 23 — rotating focusing screen, 24 — condenser, 25 — observer's eye.

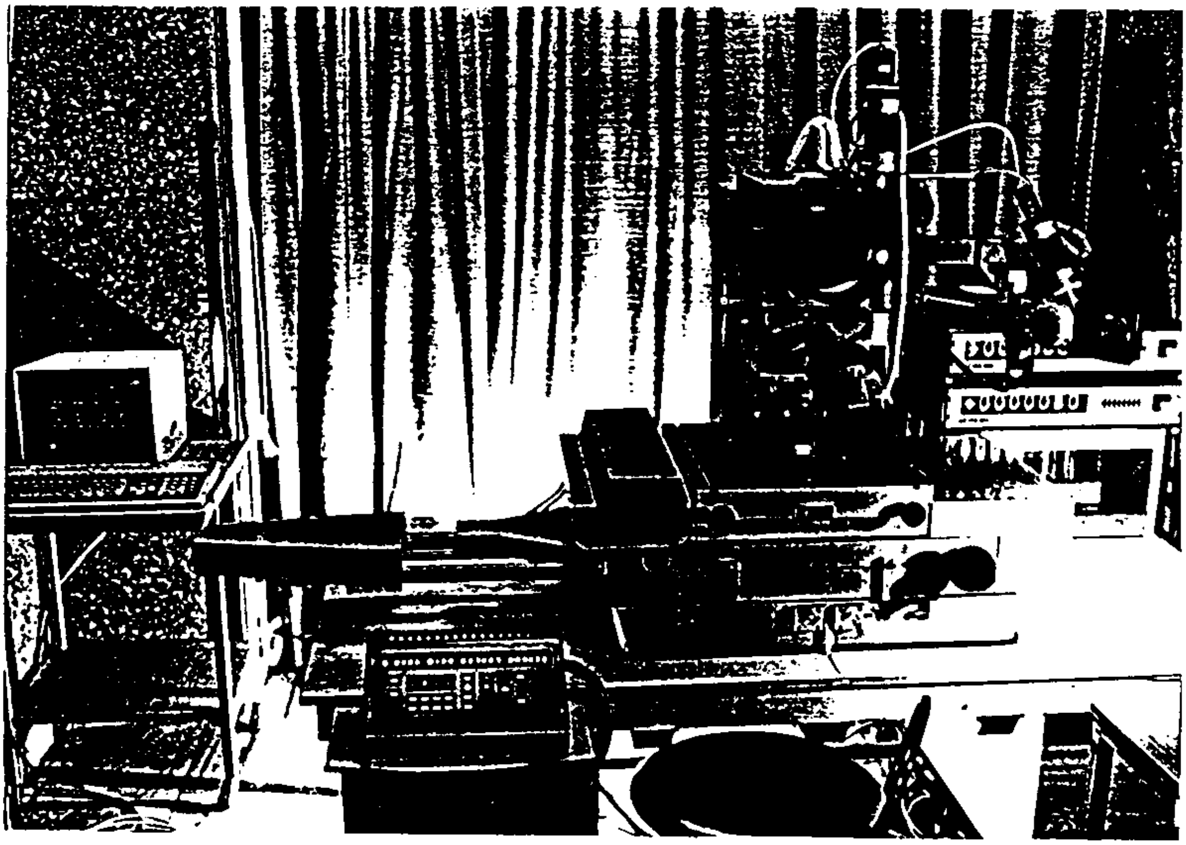

Figure 2. General view of the UMF.

is 0.0025 mm; the slit can be set up independently in both dimensions starting with the size of 0.003 x 0.003 mm up to 15 x 15 mm with the precision of about 5%; the angle of the slit can be set up with the precision of 5 arcmin; a halogen incandescent lamp 24V/150W with a stabilized flux is used as a source of light; the digitizer uses 12 bit A/D converter; the size of a non-interrupted measured field is limited by the 450 kB RAM capacity of the real time processor unit.

The universal microphotometer was adapted from the ordinary ZKM 250-05D measuring microscope made by Carl Zeiss Jena. Development, construction and mechanical works were performed at the Astronomical Institute Ondrejov. Electronic control demands were suggested and prepared at the Astronomical Institute Ondrejov. The electronics were developed and realized by Vilati, Budapest.

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The 1993 Meeting in Potsdam

At the invitation from the Potsdam Observatory, the IAU WG on Wide-Field Imaging is organising a major, international meeting, **'Astronomy from Wide-Field Imaging' in Potsdam, Germany,** in the period **August 23 – 27, 1993.**

The meeting will be held at the **Residence Hotel** in Potsdam, capital of the Land of Brandenburg. It is situated about 10km south of the city of Berlin and therefore easy to reach by air, train and road.

Potsdam will celebrate its millennium in 1993 and many visitors are expected to come during the summer. The chosen dates, in the late European summer, should guarantee very pleasant weather, and may induce some of the participants to combine their travel to this meeting with a visit to those areas of Europe that have become easily accessible after the political changes of the past years. Moreover, the central location of the meeting venue will facilitate the participation of astronomers from Central and Eastern Europe.

Pre-bookings for about 200 participants have been made in hotels in the immediate neighbourhood of the meeting place. Very advantageous accommodation is available for a significant number of participants at the Potsdam Observatory guesthouse. It is expected that pre- and/or post-conference tours will be organised to the observatories of Tautenburg (the world's largest Schmidt telescope) and Sonneberg (long-time base of sky patrols) in the neighbouring Land of Thuringia.

To expedite the preparations, the WG OC has decided to act as the Scientific Organising Committee (SOC) of this meeting. The Local Organising Committee (LOC) consists of H. Lorenz (Chairman), D. Breuer, K. Fritzer, S. Marx and D. Reimers.

The SOC has made an application for official IAU sponsorship within the series of IAU Colloquia with Commission 9 as the main sponsoring Commission. Co-sponsorship has been sought from IAU Commissions 5, 24, 25, 27, 28 and 33. The IAU Executive Committee will decide about this in September 1992.

Substantial local funds are being raised; Potsdam is located in the earlier East Germany and various possibilities for support exist within the German re-unification and reconstruction schemes. It is therefore hoped that financial means will become available for the support of a significant number of participants.

The WG members were provisionally informed about this meeting in a letter from the Editor of the WG Newsletter in early June 1992. Further announcements are planned as follows:

September 1992	First Announcement, Calls for Papers and distribution of Conference Poster
February 1993	Second Announcement with Preliminary Programme
May 1993	Final Announcement with Definitive Programme

The early response has been very good and there have been many positive reactions to this meeting. The SOC is now in the process of inviting the review speakers. The Call for Papers, to be sent out in September, will give all details about the submission of contributed papers and posters, etc.

A preliminary programme, showing the status in July 1992, will be found below. It indicates the themes of the review talks and the most important subjects to be covered with contributed papers during the individual sessions. It is not excluded that further consultations will result in minor changes and shifts of emphasis.

As will be seen, the first two days are mainly devoted to *techniques* and the last three days mainly to *science*. It is provisionally intended to have about two – three invited half-hour review talks plus six 15-min contributed talks per half day. There will be ample time for discussion. About 100 — 150 poster papers are expected. There will be facilities for computer demonstrations (workstations) and network links to Data Centres.

The Conference Proceedings will be edited by H. MacGillivray, B. Lasker, D. Malin and R.

West, and published by a commercial publisher, most likely Kluwer, and in a format similar to the Proceedings of the 1991 Edinburgh Conference 'Digitised Optical Sky Surveys'.

PRELIMINARY PROGRAMME (Status July 1992)

MONDAY AUGUST 23

Data from Sky Surveys and Patrols

Review: The Diversity of Sky Surveys and Patrols.
Integrating overview of present and future projects and their main scientific goals.

Contributed Papers:
Future POSS-type sky surveys
Renaissance of sky patrols

1. Photography and Digitization

Review: Present and Future Photographic Materials and Methods.
Sensitization, limiting magnitudes, enhancement, availability problems.

Contributed Paper:
New photographic emulsions with higher DQE

Review: Progress in Digitization Techniques.
Survey of existing machines, their individual forces/weaknesses; possibilities for technical improvements.

Contributed Papers:
All-sky digitization projects
Projects to search and catalogue specific objects

2. Digital Detectors

Review: Surveys with Digital Detectors.
Overview of current projects; CCD Mosaics; observing techniques; stability problems.

Contributed Papers:
Flat fields
Accuracy: photometric and astrometric
Photography vs. CCDs: Which detector for which purpose?

Poster Contributions:
On all topics listed, with particular attention to individual projects, now being developed, including (1) Sky Surveys, and (2) Digitization Projects.

TUESDAY, AUGUST 24

Data Processing

1. Image Processing and Calibration

Review: Image Processing and Calibration.
Overview of (1) the identification of objects from photographic and CCD data, (2) the resolution of blends, the processing of the identified images to extract the parameters required for calibrations, and (3) the procedures used for object-typing, photometry, and astrometry, including those operations leading to colours and proper motions.

Contributed Papers:

- New problems and approaches in object recognition and blend resolution
- Algorithms for the calculation of image features
- Object classification and calibration
- Generation of colours and proper motions, and other work involving the combination of multiple observations
- Problems in the creation, organization, and intercomparison of catalogues

Poster Contributions:
Will be encouraged on all listed topics, but with particular attention to (1) reports from the institutions doing scanning and catalogue construction, and (2) contributions related to reference data for calibration and testing, e.g. new photometric and astrometric references, hand-classified test areas, special astrometric test regions, etc.

2. Data Organization and Archiving

Review: Data Organization and Archiving.
(1) Overviews the data base requirements for various kinds of cataloguing projects, as well as the algorithmic approaches used or proposed for solving them and then (2) addresses the current situation and the ten-year prospect for addressing these requirements in hardware accessible to the astronomical community.

Contributed Papers:

- Present work on moderately sized catalogues (SAO, HIPPARCOS, etc.)
- Experiments and proposals for larger catalogues ($10^7 - 10^9$ objects)
- Algorithms and institutional arrangements for access, distribution, compression, and archive management

Poster Contributions:
Will be encouraged on all topics, but with particular attention to (1) engineering and vendor specific technical presentations, i.e. manufacturers archival recommendations and live-time predictions, (2) details of implementations already in use, perhaps including demonstrations, and (3) new, speculative, or evolving technologies.

WEDNESDAY AUGUST 25

Solar System Work

Review: Overview of Current Minor Planet and Comet Search Programmes.
Detection limits for moving objects; completeness; identification problems.

Contributed Papers:

Detection and surveillance of Comets
Tail studies, including time sequences

Review: Near-Earth Object Searches
IAU and NASA WG; observational prospects; what other information may be gained through these programmes?

Contributed Papers:

Minor Planet searches; strategies; distant objects (Chiron etc.)
Interplanetary dust

Poster Contributions:
Will concentrate on individual projects.

Afternoon Boat Tour around Potsdam

THURSDAY AUGUST 26

Galactic Work

1. Galactic Structure

Review: Stellar Distribution
The automated starcounts completed in the early 1980s revolutionised our view of the structure of the Milky Way system, in particular through the inferred presence of an extended (or thick) disk component. However, many questions remain, and this review will aim to summarise the most recent investigations, both photographic and CCD-based, of the distribution of the different stellar populations in the Milky Way.

Contributed Papers:
*** TBD

Review: Kinematics of Field Stars
Following the application of automated techniques to starcounting, several groups have used similar methods to determine accurate proper motions over large solid angles, probing such questions as the rotational properties of the halo and the nature of the extended disk population. This review will discuss the results of those surveys and their impact on our understanding of the structure and evolution of the Galaxy.

Contributed Papers:
***TBD

Review: Galactic Clusters
Star clusters offer unique probes of both stellar evolution and of the evolution of star formation within the Galaxy. This review will summarise the results derived from the most recent studies of Galactic clusters, with the emphasis on open clusters.

Poster Contributions:
On individual programmes.

2. Resolved Systems

Review: the Magellanic Systems
As the nearest irregular systems, and with their substantial regions of continuing star formation, the Magellanic Clouds have proved an outstanding laboratory for studying star formation — in particular massive stars — while the general stellar distribution can probe both the evolution of the two systems and the effects of mutual (and Galactic) gravitational perturbations. This review will summarise the impact of large-scale surveys on our knowledge of the structure and evolution of these two systems.

Contributed Papers:
***TBD

Review: Dwarf Spheroidals
Our Galaxy possesses a retinue of dwarf spheroidal systems, of which the most insignificant — the Sextans dwarf — was detected as part of the APM digitised survey. This review will summarise our current understanding of the structure, dynamics and possible origin of these systems.

Contributed Papers:
***TBD

Review: Local Group
External studies of nearby spiral systems can often be extremely revealing about processes which can only be observed partially within our own Galaxy. This review will discuss the application of wide-field imaging studies in these systems, and summarise the impact both on galactic studies — star formation and stellar populations — and on extragalactic matters — such as the distance scale.

Contributed Papers:
***TBD

Poster Contributions:
Will concentrate on individual programmes.

FRIDAY AUGUST 27

Extragalactic Work

The purpose of this day of the meeting is to indicate how our understanding of the structure of galaxies and of the large-scale structure of the Universe has become enlightened through wide-field imaging. The talks will concentrate on the properties and large-scale distribution of galaxies and of quasars.

1. Global Properties of Nearby Galaxies

Review: Global Properties of Nearby Galaxies
Overview of (1) morphological and physical properties of extended nearby galaxies (2) combined photometric investigations on large scale photographic plates and CCD-images (3) basic galaxy manifolds and their relation to galaxy formation.

Contributed Papers:
Differences between dwarf and giant systems
Structures at faint light levels
Fundamental plane properties and the formation processes

Poster Contributions:
Expected on all the subjects listed above, especially on (1) detailed investigations of individual galaxies (2) contributions to large scale distributions and streamings of galaxies.

2. Properties and Distribution of Galaxies and Clusters

Review: Properties and Distribution of Galaxies and Clusters.
Overview of (1) galaxies as the basic systems in the universe and the current survey programmes (2) clustering properties of galaxies and the implementation for new survey projects (3) evolution of the galaxy population.

Contributed Papers:
Distribution of galaxies, groups of galaxies and clusters
Detection limits and selection effects
Theoretical models of the evolution of galaxies

Poster Contributions:
The poster and the additional oral contributions will reflect the progress in galaxy surveys in different wavebands and the new observing strategies on wide-field imaging for medium deep spectroscopic surveys.

3. Large Scale Structure

Review: Large Scale Structure of the Universe.
Overview of (1) distribution of matter in the early universe (2) observed properties of the background light in different wavebands (3) implementation on cosmology and the physics of the early universe.

Contributed Papers:
The observational constraints on cosmology
Objects at large redshifts

Poster Contributions:
Posters and short contributions will be accepted to all subjects listed above, but with particular attention to (1) observational progress in deep CCD surveys (2) modelling of the large scale structure and (3) the constraints on the structure of the early universe.

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b) The letter in parenthesis after each name (i.e. M or C) indicates whether the person is a full Member (M) or Consultant (C) to the WG.

c) The numbers immediately following the e-mail address indicate the stated fields of interest of the person, i.e.

1= Sky Surveys and Patrols
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4= Archival and Retrieval of Wide-Field Data

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