Properties and Clustering of Objects at Large Redshift

Quasar Variability from Microlensing

A large scale programme to detect quasars from their variability has yielded a sample of some 1000 quasars with light curves covering 17 years. This paper argues that the variability observed is best explained as a result of microlensing by compact substellar objects along the line of sight. This in turn implies that the density of such objects must be at least 0.1 of the critical density, sufficient to account for the 'missing' baryonic matter.

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A Study of Optical Long-Term Variability of Quasars

The optical long-term behaviour of a sample of quasars has been investigated on plates from the archive of the Tautenburg 134 cm Schmidt telescope. The basic sample consists of 28 quasars and quasar candidates (from published catalogues) in a field centred on M3 which were identified on deep plates by their coordinates. More than 100 *B*-plates were inspected and magnitudes were measured on about 60 photometric plates covering a time interval of nearly 30 years. A final sample was constructed from the 18 objects with $\langle B\rangle \leq 19\overset{m}{.}5$ which is about 1 to 2 mag below the limit of a deep exposure plate. The standard deviation σ_B was used as an indicator of variability. 50% of the final sample objects were classified as variable by the *F*-test with $\alpha = 0.02$. For the brightest object in our sample, Q1340+289 ($\langle B\rangle = 17\overset{m}{.}2$, $z = 0.90$), the comparison of our data with published measurements on 40-50 year old Harvard plates reveals a dimming by about 2 mag; no flare-like activity is seen in our data. The other bright object, Q1337+283 ($B = 17\overset{m}{.}5$, $z = 2.52$), shows no sign of any variability.

We further measured plates from the north ecliptic pole to study the temporal behaviour of Q1808+676 = Kaz 102 ($z = 0.138$). This object is found to become brighter by $\Delta B \approx 0.5$ mag over the last 15 years. It shows 'anti-flares' of $\Delta B \geq 0.1$ mag.

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Search for Quasar Candidates using the MAMA Microdensitometer

In order to get a better understanding of the physics, evolution and spacetime distribution of quasars, it is still necessary to increase the number of known objects, especially nowadays in the high redshift range. A prime interest is the possibility, provided large, deep and homogeneous quasar surveys are produced, to address the distribution of matter in the Universe at intermediate redshifts; this is especially important to make a link between the high local degree of structure and the homogeneous Universe of widely used cosmological models.

Two deep ($B \sim 21$) and homogeneous surveys for quasars are being conducted in collaboration with Centre d'Analyse des Images (Paris, France); one of them covers a wide 300-square-degree region around the North Galactic Pole and the other one deals with three southern 40-square-degree fields (NGC 450, NGC 520, ESO 300). Quasar candidates are systematically selected, using photometric criteria, among exhaustive catalogues of objects produced from Schmidt plates with the MAMA microdensitometer. The candidates selected are to be confirmed by multi-object spectroscopy.

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The Second Byurakan QSO Survey

From the Second Byurakan Survey (SBS) we have produced the new complete sample of bright QSOs.

The observations were obtained using 1.5, 3 and 4 degree objective prisms with the 40-52 inch Schmidt telescope at the Byurakan Observatory. The total sky coverage area of SBS is 1000 square degree from R.A. 07.40-17.15 and Dec. +49-+61.

In all in SBS are selected about 3000 objects — 1600 stellar objects and about 1400 galaxies down to a limiting magnitude $B < 19.5$.

Spectroscopy was made on the 6m telescope of SAO (Russia), 2.6m telescope of BAO (Armenia) and 4.5m MMT (USA). Photometry on the 0.9m Burrell-Schmidt at Kitt Peak and 1.2m at Wipple Observatory.

A new estimate of surface density and luminosity function for bright QSOs in the magnitude range $15.5 < B < 17.5$ on the basis of new complete sample of bright QSOs are discussed.

The surface density of bright QSOs in magnitude range $16.0 < B < 17.0$ will be corrected by a factor of 2.

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The Hamburg/ESO Survey — Slitless Spectroscopy at High Resolution

In extragalactic survey work, in particular QSO surveys, reaching faint magnitudes with slitless spectroscopy can only be achieved with very low spectral resolution. We demonstrate a very different approach: digitised objective-prism plates taken at rather high dispersion (450 Å/mm at H_γ) can provide excellent material to conduct a wide-angle spectral survey. One prerequisite is the ability to process a large number of fields in a short time. In Hamburg we have developed such techniques, including plate scanning and automated selection of peculiar objects. The Hamburg/ESO survey, based on plates taken with the ESO Schmidt telescope, aims at performing a complete QSO survey over 5000 deg^2 in the magnitude range $13 \lesssim B \lesssim 17$. The spectral resolution allows quasar candidates to be selected by the absence of typical stellar absorption line patterns, without demanding colour excess or emission lines to be present. The survey is also a rich source for other object classes which can be efficiently identified and classified already in the objective prism spectra.

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The Hamburg Quasar Survey

A machine based search for quasar candidates has been developed at Hamburg (Hagen et al., 1993). Our aim is to provide bright quasars to make follow-on studies on the physics of quasars and the cosmic matter in front of them (Reimers et al., 1989; Reimers et al., 1992; Hagen et al., 1992). In selected fields we pursue completeness down to 17.5th B-magnitude.

The survey plates are taken with the Schmidt telescope on Calar Alto equipped with a 1.7 deg objective prism yielding a dispersion of 140 nm/mm at H-Gamma. Two prism plates and one direct plate are taken for every 5.5 deg x 5.5 deg Schmidt field with galactic latitude greater than 20 deg and positive declination. All exposures are made on Kodak IIIa-J emulsion.

Complete scans of prism plates are made perpendicular to the direction of dispersion in a low resolution mode. In this mode the range from the emulsion cut off at 540 nm to 340 nm has 15 measured pixel with increasing resolution. Online background recognition yields to 90 to 95% data reduction. Direct plates are scanned with 1.7" x 1.7" slit with the same background reduction. All digitized data are stored on magneto-optical disks.

The continua of all low resolution spectra are fitted with polynomials of 2nd degree. The slopes at 440 nm are plotted gainst the density sum, and all spectra above a density sum dependent slope with a signal-to-noise ratio of at least 10, and below the density where saturation effects appear, are selected as quasar candidates. This means for plates with average quality a range from 13th to 17.5th magnitude and about 500 candidates for high galactic latitudes up to 2000 for low latitudes. These candidates are scanned in high resolution mode (10 time higher than low resolution) and are interactively classified on a vector graphics screen. In every field typically 5 to 10 quasar candidates remain besides hot subdwarf stars and narrow emission line objects.

Candidates are verified by follow-up slit spectroscopy with the 2.2m telescope at the DSAZ on Calar Alto, Spain

References

Hagen, H.-J., Engels, D., Groote, D. and Reimers, D., 1993. 'The Hamburg Quasar Survey: I. Schmidt observations and plate digitization', in preparation.

Hagen, H.-J., Cordis, L., Engels, D., Groote, D., Haug, U., Heber, U., Koehler, T., Wisotzky, L. and Reimers, D., 1992. 'HS 1946+7658: the most luminous QSO so far', *A. & A.*, **253**, L5.

Reimers, D., Clavel, J., Groote, D., Engels, D., Hagen, H.-J., Naylor, T., Wamsteker, W. and Hopp, U., 1989. 'The luminous quasar HS 1700+6416 and the shape of the 'big bump' below 500 A', *A. & A.*, **218**, 71.

Reimers, D., Vogel, S., Hagen, H.-J., Engels, D., Groote, D., Wamsteker, W., Clavel, J. and Rosa, M.R., 1992. 'The O/C abundance ratio in absorbing gas clouds at high redshift', *Nature*, **360**, 561.

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