Photometry with Estar Film

For the past 15 years or so, wide angle photographic surveys at red wavelengths have generally used Kodak IIIa-F emulsion on glass plates (with great success). Nevertheless newer photographic materials do exist and from time to time trials have been made in order to test their applicability for astronomical photography. A few years ago experiments were made at the UK Schmidt Telescope Unit, replacing the IIIa-F by Eastman-Kodak Estar 3415 emulsion. Although the emulsion was expected to provide higher efficiency, technical problems were encountered and the trials were discontinued. More recently, the UKSTU had made trials with the equivalent material as a film, now called Estar 4415 (see report by Ken Russell at the Edinburgh DOSS Meeting).

Visual inspection of these films suggested substantial gains in depth and resolution compared to normal IIIa-F plates, so we had two test films of an area in the Virgo Cluster scanned by COSMOS. (This involved mounting the films on a standard glass plate using a water/glycerin interface and sealing the edges so that they could be put in the COSMOS plate holder). These scans have enabled us to make some quantitative estimates of the effectiveness of these films for, in particular, galaxy photometry.

As a first test we scanned several 2048 by 2048 (half arc second 8μm) pixel areas centred on some relatively large but fairly low surface brightness galaxies (so there should be no problems of photographic or measurement saturation). We first converted the data from COSMOS transmission space to intensity space by way of measurements of the step wedges. We had available a CCD frame of one of the galaxies, so we were also able to directly check the effectiveness of the calibration curve by comparing the photographic and CCD intensities essentially on a pixel to pixel basis. We then determined intensity profiles for the galaxies by standard photometric techniques (using the GASP package). Repeating this for the second film we were able to check on the repeatibility of the measurements.

The profiles show excellent agreement with those from published work, but extend considerably further. For example, IC3374 is seen to have a profile which is closely exponential out to about 80″ along the major axis, whereas the published CCD profile by Gallagher and Hunter stops at 25″. Binggeli, Sandage and Tammann, in their Virgo Cluster Catalogue, quote a maximum observable radius of about 43″ on their photographic data from Las Campanas. Using the published data to absolutely calibrate our photographic profiles, we find that we can trace the profiles out to about 26.5 or 27 R magnitudes per square arc second (less than 0.4% of the sky background).

Note too that the sky noise per pixel is around 0.8%, so the observations are (at least) equivalent in depth to 5 to 10 minute observations with a standard CCD on a large telescope, but with the advantage of wide-field coverage. (For instance the AAT RCA count rate [in R] is quoted as 28 to 40 electrons per second per pixel for the sky, so has a Poisson noise of 0.8% after about 400 to 600 seconds; this of course ignores all other possible sources of noise in the CCD data).

Thus far, our photometry from the films indicate that they are indeed very suitable for galaxy photometry, having a high efficiency, which will enable us to see fainter objects than on normal photographic plates, and also low noise, which allows us to set lower limiting isophotes.

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