First Images from DFOSC

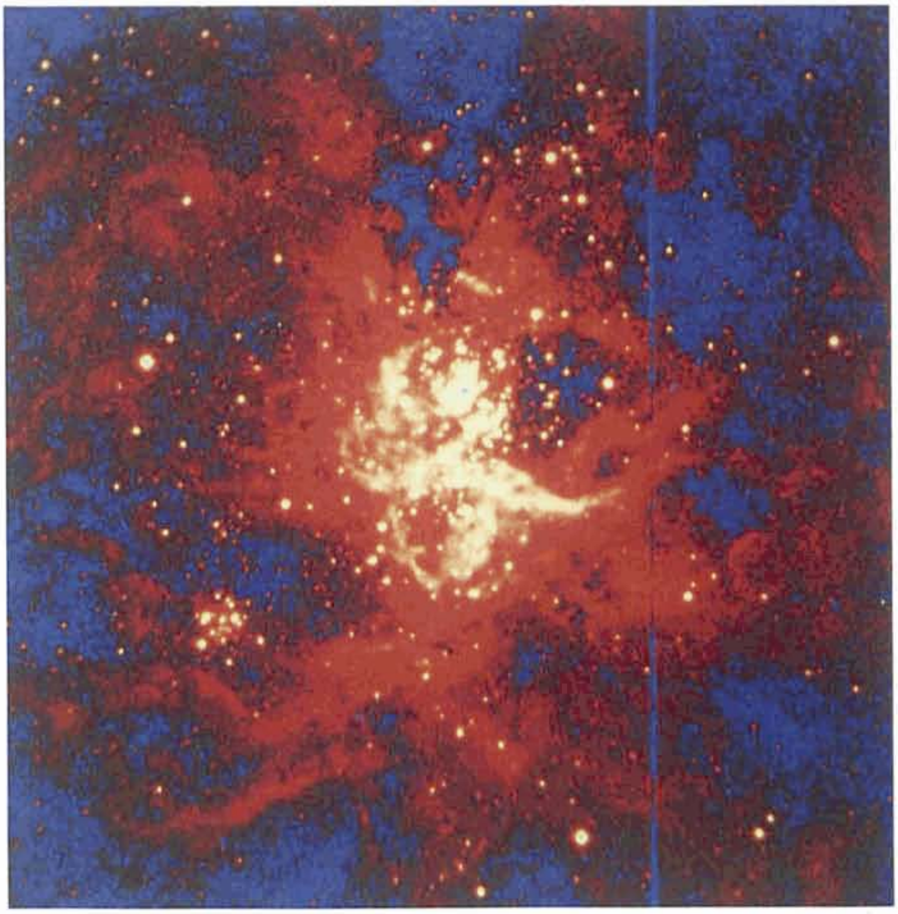
A new instrument for the Danish 1.54-metre telescope at La Silla has just been successfully tested. DFOSC (= Danish Faint Object Camera and Spectrograph) is similar in concept and performance to the ESO instruments EFOSC and EFOSC2, and it offers the same possibilities for direct imaging and low dispersion spectroscopy (including an echelle mode).

The image shown here, a 30-second, exposure of the 30 Doradus area in the Gunn r filtre, was obtained on Dec. 6, 1992 by Per Kjaergaard Rasmussen (PI) and Michael Andersen from the Copenhagen University Observatory. South is up and east is to the right. A logarithmic intensity scale has been used.

The detector is a 1000 x 1000 Thomson CCD which gives a 8.5 x 8.5 arcmin^2 field. The instrument will eventually be equipped with a 2000 x 2000 Ford CCD which will give a field of 13.7 x 13.7 arcmin^2.

DFOSC may possibly be offered to the ESO community later this year. A short description of the instrument will be published in a forthcoming number of *The Messenger.*

P. KJAERGAARD, Astronomical Observatory, Copenhagen University, Denmark



A New Fine-Grain Photographic Emulsion

T.A. BIRULYA[1], D.K. MIKHAILOV[2], P.V. SHEGLOV[1]

[1]Sternberg Astronomical Institute, Moscow University, Moscow, Russia; [2]"Slavitch" A.S., Moscow, Russia

Photographic observations continue to play an important role in astronomy in our part of the world, although we of course hope that in the future more and more CCD detectors may become available at observatories in the republics on the territory of the former Soviet Union. For certain purposes like accurate astrometry, however, the photographic emulsion is still superior to the digital detectors, thanks to its great stability and large area.

It would clearly be very useful to further improve the photographic emulsions which are available for astronomers. For this reason, astronomical photographical plates with quasi-T AgBr crystals have been experimentally produced during the past four years and progressively improved at the "Slavitch" A.S. factory near Moscow. This emulsion is fine grain and must be hypersensitized by hydrogen soaking before the observations. It is coated on accurately polished glass of 2.6 mm thickness for astrometric purposes, and is also available on 1.3 and 1.7 mm thick glass at sizes up to 30×30 and 30×36 cm. The hypersensitizing of these plates was made by T.A. BIRULYA at the Sternberg Institute.

Several research programmes are now underway at the Sternberg Astronomical Institute with these plates. For instance, Dr. Yurij Shokin has been using them during the past four years with the 23-cm astrometric refractor (f–2300 mm) at the field station of the Sternberg Institute at Mount Majdanak (Uzbekistan) to greatly improve the positional accuracy of the reference stars and hence the Martian moons, Phobos and Deimos. He has also used them for the determination of the positions of optical counterparts of radio sources.

The achievable astrometric accuracy has been compared with that obtainable on ORWO ZU-21 plates which were used earlier for these programmes. A certain improvement is noted, especially when the very stable, 2.6 mm thick plates are used; these are much flatter than the ZU-21 coated on 1.6-mm glass, then bending resulting from the gelefication of the emulsion.

Dr. Goransky has also used the new plates to obtain photographs of the Andromeda Nebula by means of a 50-cm Maksutov camera (f=2000 mm), located at the Sternberg station on Crimea. With

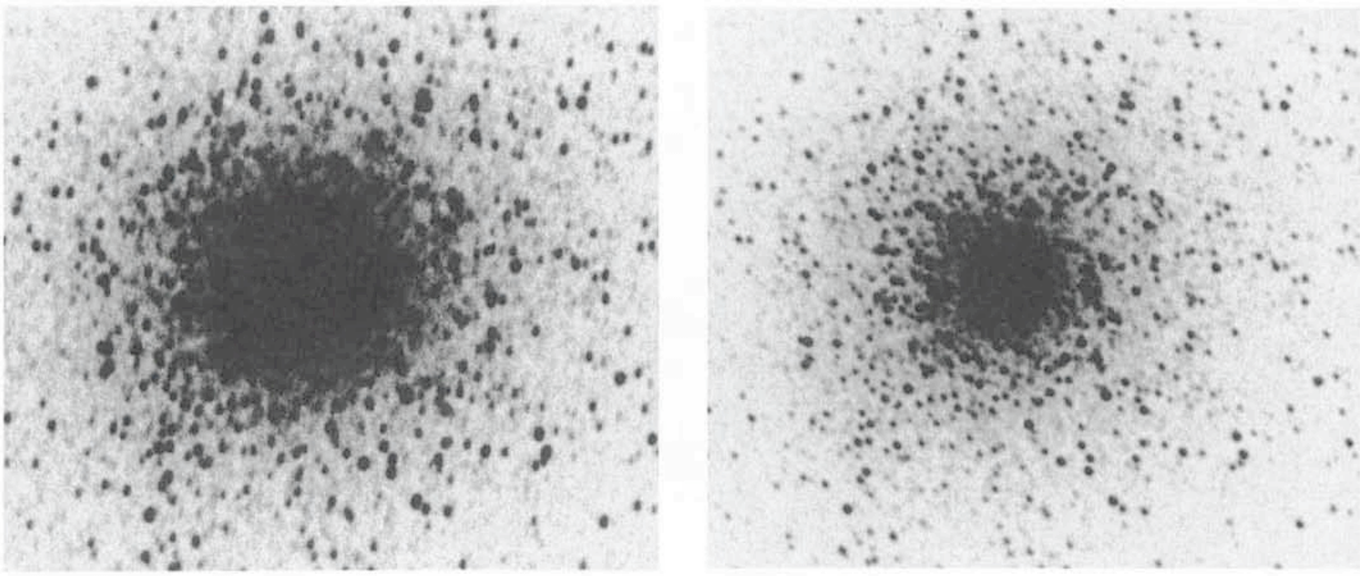


Figure 1: *A comparison between the new T-emulsion (right) described in this article, and the ORWO ZU-21 (left) which was much used before. Both photos were obtained by A. Martys with the 50-cm Maksutov telescope at the Crimean field station of the Sternberg Astronomical Institute and show the central part of the globular cluster Messier 13. The photographic reproductions from the original plates were made by H.-H. Heyer at the ESO Headquarters.*

an exposure of 60 min under good conditions and through a B filtre, he reaches a limiting stellar magnitude which according to Dr. Sharov is near 19.5, and the plates show many individual stars on the nebular background.

With the same instrument, Dr. A. Martys took several T-plates of the globular cluster M13 for plate evaluation and they were compared to ZU-21 plates. The new plates reach a limiting magnitude of about 20.5 in a 60-min exposure.

Using the new emulsion, Dr. N. Chernykh of the Crimean observatory reached magnitude 18 in 30 min with the Zeiss astrograph (D=40 cm, f=160 cm) and measured the positions of (4179) Toutatis even though it was very close to the horizon. On ORWO ZU-21 this asteroid could not be found.

At the Tashkent Observatory (Uzbekistan), Drs. A. Latypov and E. Mirmachmudov made some tests in May 1991 of the new emulsion with the Carte du Ciel astrograph (D=33 cm, f=344 cm). This astrograph is subject to heavy light pollution, since the observatory which was founded in 1873 is now situated near the centre of a town of 2 million inhabitants. Still, with an exposure of 20 min, they measured images of stars down to 15.5; measurable images of Pluto were also obtained. During March 1991, Dr. Bronnikova at Pulkova Observatory used the Carte du Ciel astrograph there to photograph Pluto with the new plates. Measurable images of the planet (15.5 pg) were obtained with an exposure of 30 minutes, also under heavy light pollution conditions. So, the new T-crystal plates appear to be useful for the revitalization of the Carte du Ciel astrographs, of which several have excellent first epoch collections.

At the 6-metre telescope, Dr. Yu. Glagolewsky has used the new plates for coudé spectroscopy with a Zeeman analyser. He reports that the graininess of the new plate is much finer than of the Kodak 103aO plate, improving the limiting magnitude.

CORRECTION

On the Dead-Time Constant in Photon-Counting Systems

In *The Messenger* **68**, page 52, I drew attention to a practical method to determine the dead-time constant τ in photoelectric photometry. In that paper n_τ, the number of photons which arrive in a time interval shorter than τ, was calculated to be

$$n_\tau = N \int_0^\tau \lambda e^{-\lambda t} dt,$$

where N is the total number of photons arrived during the measurement time and λ is the arrival frequency of the photons. This equation was derived from the Bose-Einstein statistics. However, this approach is not valid since to observe the effects of Bose-Einstein clumping it is necessary to use much faster equipment and much more monochromatic light than we have in ordinary astronomical photometry. Actually, the arrival of photons can be considered as independent events and Poisson statistics can satisfactorily fit the distribution of intervals between an event and the next one, as R. D. Evans makes clear in his fundamental textbook *The Atomic Nucleus* (1955, Mc Graw Hill Publ.).

In such a distribution, the probability that the duration of an interval will be between t and t + dt is

$$dP_t = \lambda e^{-\lambda t} dt.$$

The number of intervals greater than t_1 but less than t_2 is obtained by integrating

$$n = N \int_{t_1}^{t_2} dP_t = N \int_{t_1}^{t_2} \lambda e^{-\lambda t} dt.$$

Resolving for $t_1 = 0$ and $t_2 = \tau$ we obtain the same equation as with the Bose-Einstein approach. Of course, the subsequent approximations are again valid, leading to the same practical formula.

Thanks are due to Andy Young who prompted these remarks on the incorrect approach.

E. PORETTI,
Osservatorio Astronomico di Brera, Milano, Italy