nism that links infall with outflow, but everybody agrees that mass loss is a necessary by-product of the star-formation process, as a star gradually builds up the mass it will have when it eventually reaches the main sequence. HH jets are the visible component of the supersonic mass loss that accompanies the birth of a star, and as such give us indirect information on the very first evolutionary phases of new-born stars.

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A Supernova Found by EROS, Followed with the 1.5-m Danish, and Pictured and Characterised at the 3.6-m Telescope

EROS COLLABORATION

Since 1990, EROS (Expérience de Recherche d'Objets Sombres) has been conducting a search for unseen galactic objects via gravitational microlensing. Our system was upgraded in July 1996 with the installation of the 1-metre Marly telescope in the GPO dome instrumented with two wide-field CCD cameras. The greater part of the observing time is devoted to the search for microlensing events by observing the Magellanic Clouds, the Galactic bulge and the Galactic disk. However, during times when these targets are low in the sky, EROS observes fields at high galactic latitudes in order to search for supernovae at medium redshifts and to measure stellar proper motions. We report here our first supernova discovery (IAU Circular No. 6605).

The new EROS camera consists of two CCD mosaics mounted behind a dichroic cube allowing simultaneous observations in red (750 ± 100 nm) and in visible (560 ± 100 nm) passbands. Each mosaic consists of eight 2048×2048 pixel CCDs and covers a 1.4×0.7 deg^2 field.

We search for supernovae by comparing an image of a given field with a reference image of the same field taken at least one month before. Each observation consists of two 5-minute exposures that are combined to form a ten-minute exposure after identification of cosmic rays. A new image is aligned geometrically and photometrically with the reference image, and the image of superior seeing is processed to match the PSF of the other image. The two images are then subtracted and candidate supernovae are identified in the frame thus obtained. The combined ten-minute exposure makes it possible to identify supernovae up to V = 21.5. The semi-automatic analysis software allows the identification of candidate supernovae during the day following observations.

During the new moon period in March 1997, we searched for supernovae in 8 deg^2 using reference images taken in February. One supernova (SN 1997bl) was found at V = 21.5 in a galaxy of V = 18.5 (see Fig.1).

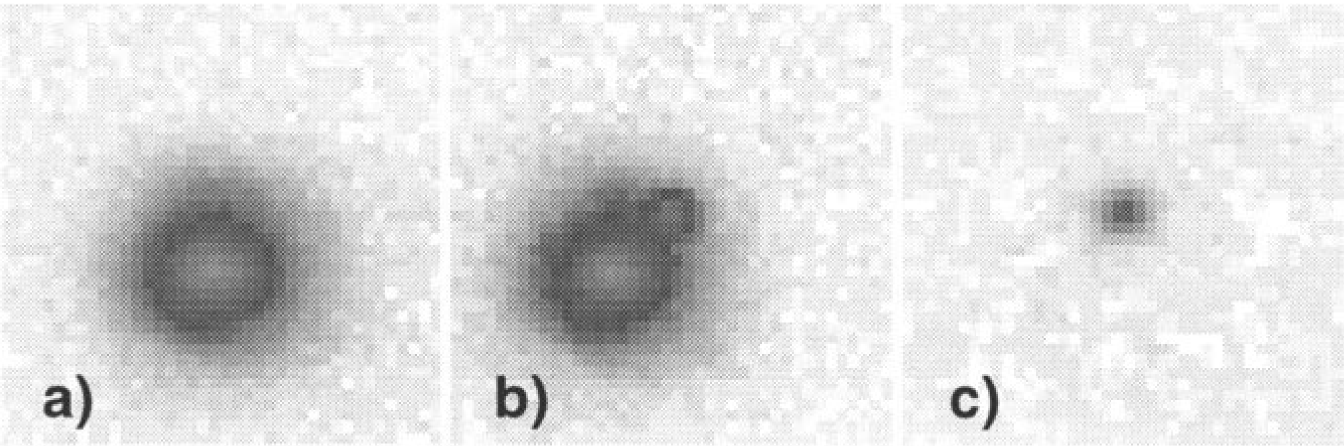

Figure 1: Panel (a) shows the image of the host galaxy, taken on February 3, 1997. Panel (b) shows the image of the host galaxy with the supernova, taken on March 7, 1997. Panel (c) shows the same image as (b) after subtracting the host galaxy image (a). Note that these images are not matched in seeing.

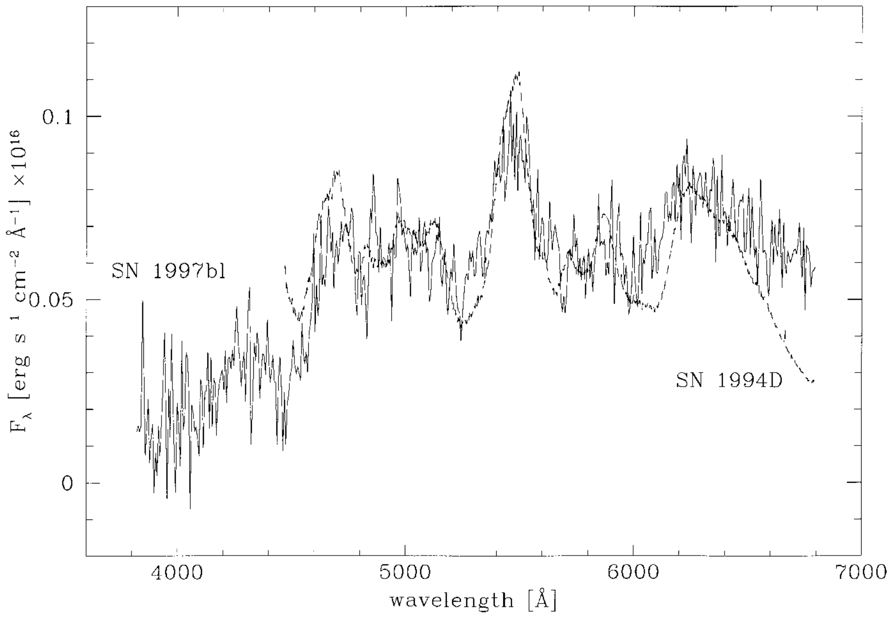

Figure 2: Spectrum of SN 1997bl. Superimposed on the spectrum is that of type Ia supernova SN 1994D 12 days after maximum.

novae at high redshift ($z \geq 0.3$) with the aim of constraining the deceleration parameter by comparing peak magnitudes with those at lower redshifts.

One of the goals of the EROS supernova programme is to study in detail correlations between SN Ia peak magnitudes with other features of the light curves and spectra. This intermediate-*z* supernova search will also nicely complement the search for nearby SN which have been and still are the target of intensive studies with ESO-La Silla telescopes, in the framework of a long-term programme, started as ESO Key Programme (Turatto et al., 1990, in *The Messenger* No. 60, p. 15).

At the very moment these lines were written, EROS discovered its second supernova (SN 1997bt, IAUC 6628), at V = 19.5 (see Fig. 4). The host galaxy is classified as number 2915 in the LCRS Survey, with a redshift of 0.06.

Our requests for follow-up observations using other telescopes at La Silla were warmly received and we thank the observers for their donation of valuable telescope time. Spectra were taken at La Silla with the 3.6-m telescope (Ruiz) and with the 2.2-m (Lehmann). The preliminary reduction of these data identified the supernova as one of type I (IAUC 6605). With a more careful reduction of the 3.6-m data, S. Benetti eventually classified the supernova as type Ia about 10 days after maximum, with the parent galaxy having a redshift of 0.19 (Fig. 2).

Photometric measurements were made with the Danish 1.5-m telescope (Gastro, Tirado and Delfosse). Finally, a superb image using direct imaging was obtained (Benetti and Guisard) at the Cassegrain focus of the 3.6-m telescope (Fig. 3). This is one of the best images produced so far with the 3.6-m and it demonstrates the improvement in image quality accomplished since last year. The image is a 5-minute exposure, the outside seeing was 0.55″ (FWHM) and the seeing measured on the image is 0.65″ (FWHM).

If it is possible to organise a proper follow-up, this programme will develop in a large systematic supernova search. We believe that we can discover supernovae in the range z = 0.05 to 0.2 at the rate of about 1 per two hours observing time, allowing us to obtain a sample of ∼ 100 supernovae over a period of 3 years.

Besides being interesting objects in their own right, the value of supernovae as distance indicators useful for cosmological parameter determinations has been demonstrated by previous systematic searches (Hamuy et al.). Two programmes (Leibundgut et al., Kim et al.) are currently searching for super-

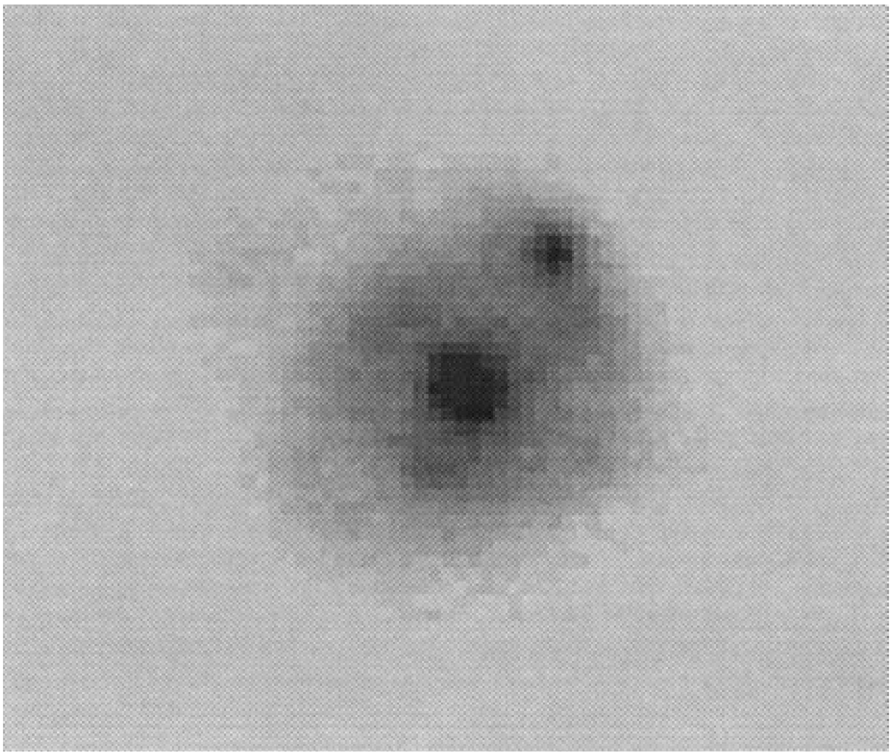

Figure 3: SN 1997bl's host galaxy, as taken by S. Benetti and S. Guisard. The spiral arms can easily be made out, and the supernova clearly stands out from the core of the galaxy.

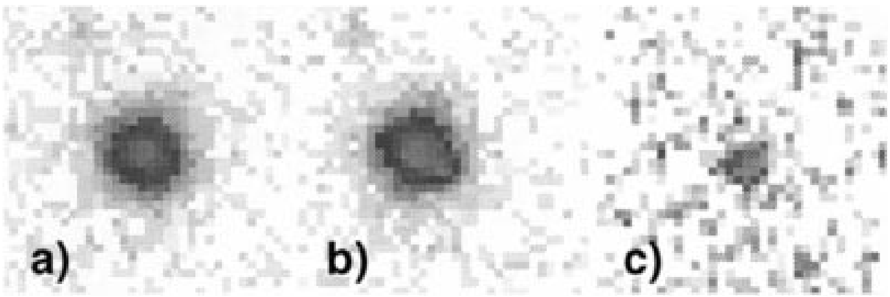

Figure 4: SN 1997bt. Panel (a) shows the image of the host galaxy, taken on February 3, 1997. Panel (b) shows the image of the host galaxy with the supernova, taken on March 31, 1997. Panel (c) shows the same image as (b) after subtracting the host galaxy image (a).