Astronomical Data Analysis Software and Systems IX
ASP Conference Series, Vol. 216, 2000
N. Manset, C. Veillet, and D. Crabtree, eds.

Data Mining from the EROS Survey: the Current Status

J.-B. Marquette

Institut d'Astrophysique de Paris, 98bis Boulevard Arago, 75014 Paris, France

Abstract. The EROS (Expérience de Recherche d'Objets Sombres) experiment is a French collaboration between astronomers and particle physicists to search for the baryonic dark matter of the Galactic Halo by gravitational microlensing. A brief description of the experiment and the relational database managing the tens of thousands of CCD images is given. The pertinence of these data for stellar variability studies is highlighted together with some prospects for the future.

1. Introduction

Since the original paper by Paczyński (1986), the gravitational microlensing has become a powerful probe of the Galactic structure. As a contribution to these efforts, the EROS French collaboration has chosen to search for microlensing effects towards the Magellanic Clouds (Palanque-Delabrouille et al. 1998; Afonso et al. 1998), the Galactic bulge and in four regions of the Galactic plane located at a large angle from the Galactic Centre (Derue et al. 1999). The EROS II microlensing events towards the Galactic bulge are triggered and an alert web site is available[1].

2. Description of Experiment and Database

Started in early 90's, the EROS I stage was using Schmidt plates and a 40-cm telescope mounted on the back of the GPO at the ESO Observatory in La Silla, Chile (Aubourg et al. 1993; Beaulieu et al. 1995a). Since mid-1996, the EROS II stage is operational and deals also with the search of supernovæ (Hamilton et al. 1999; Hardin et al. 1999) and nearby brown dwarfs (Goldman et al. 1999) in same regions. All EROS II directions of observations are summarized in Figure 1

in galactic coordinates, where the acronyms in the Galactic plane are those described by Derue et al. (1999) while SN/NR indicates search fields for supernovæ and brown dwarfs.

The EROS II two colour CCD wide-field imager (Bauer & de Kat 1998) is mounted at the Cassegrain focus of the 1-m Marly telescope at ESO Observatory, La Silla. A beam-splitting dichroic cube with a CCD camera mounted behind

[1] `http://www-dapnia.cea.fr/Phys/Spp/Experiences/EROS/alertes.html`

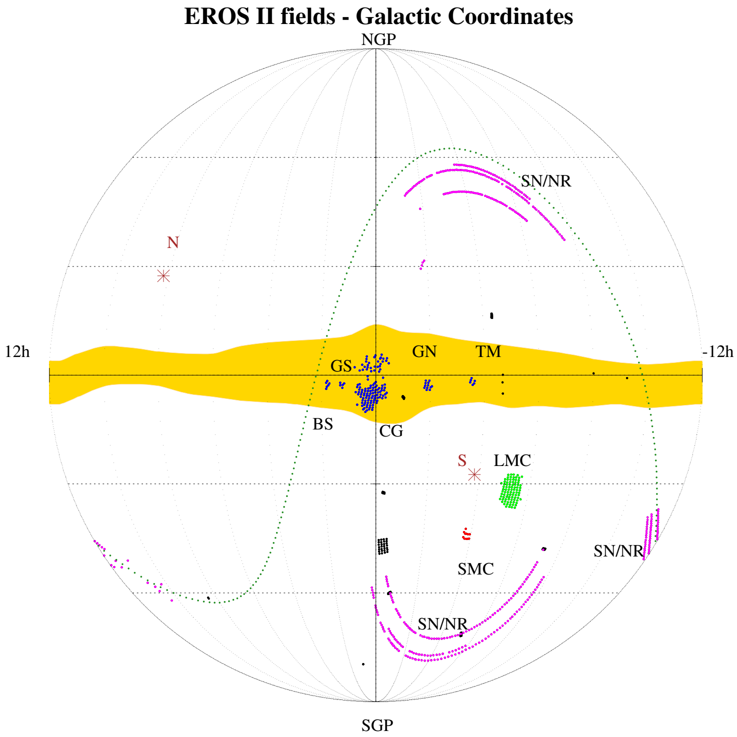

Figure 1. The EROS II directions of observations.

each channel allows simultaneous imaging in wide pass-bands (420-650 nm, so-called "blue", and 650-900 nm, so-called "red") in a field of 0.7°(right ascension) x 1.4°(declination). Each camera contains a mosaic of 8 Loral 2048 x 2048 thick CCD's and typical global image quality (atmospheric seeing + instrument) is 2 arcsec FWHM for a pixel size of 0.6 arcsec. Images are stored on DLT tapes which are shipped to the CCPN (IN2P3 computing center, CNRS) in Lyon, France, where data processing occurs. The dedicated photometry package PEIDA used in EROS experiment to produce individual light curves is described in details by Ansari (1996). Figure 2 shows the fields accumulated since early 1996.

As a typical crowded field contains a set of $\approx$ 300,000 stars, the relational database in CCPN is now managing tens of thousands of images and tens of millions of light curves. The final amount of date is estimated to several TB.

The EROS data contain a significant fraction of variables objects which are noise for the search of microlensing events but are goldmine for stellar variability studies. The EROS I data have already produced identification of Cepheids (Beaulieu et al. 1995b) and eclipsing binaries (Grison et al. 1995) in the bar of the Large Magellanic Cloud. This work has been pursued in the EROS II stage with the discovery of a slope change in the Period-Luminosity relation of the classical Cepheids in Small Magellanic Cloud with periods lower than 2 days

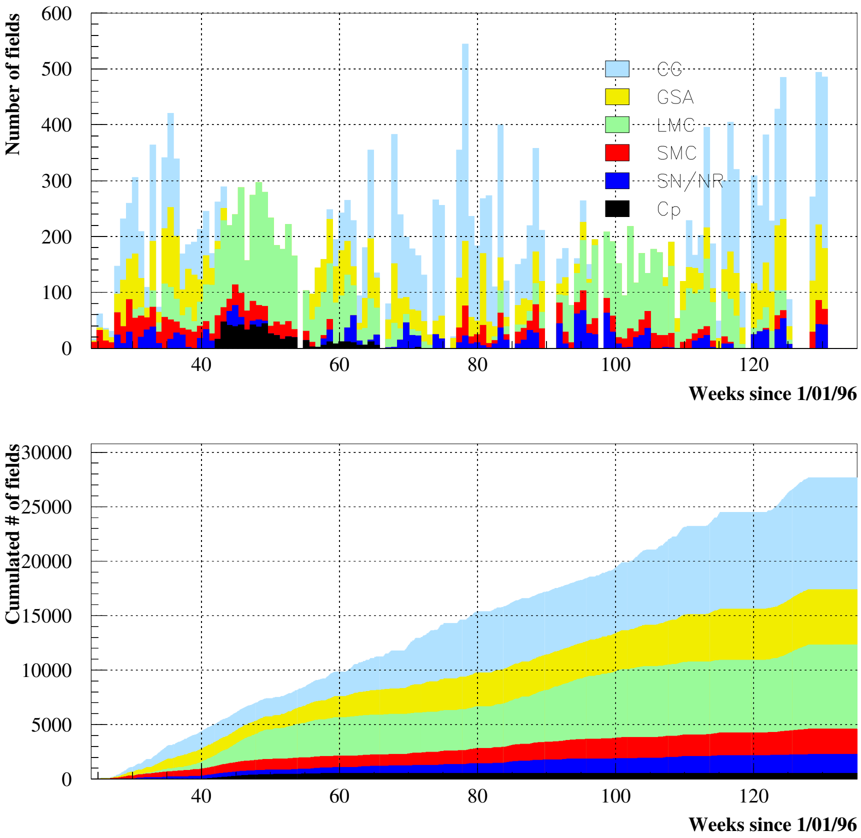

Figure 2. Observed EROS II fields since 01-01-1996. CG=Galactic Centre; GSA=Spiral Arms; LMS/SMC=Magellanic Clouds; SN/NR=supernovæ /brown dwarfs; Cp=Specific Cepheid campaign.

(Bauer et al. 1999). In the same way, the first discovery of pre-main sequence stars in Magellanic Clouds (Beaulieu et al. 1996) and the recent detection of a slow nova in the Small Magellanic Cloud (de Laverny et al. 1998) show evidently that exploration of the EROS database (for both I and II stages) is far from to be achieved.

3. Future Prospects

In order to improve the usability of the EROS data, it should be necessary to develop a GUI user interface, and the present volume certainly contains a lot of recommendations and language references we should have to address. A web access is also highly desirable for which the CDS in Strasbourg could be of great help. Cross-identification with stellar objects in other surveys (e.g. ISOGAL, DENIS, see Omont et al. 1999) will also certainly become another use of EROS data in the next few years.

Acknowledgments. EROS data are based on observations collected at the European Southern Observatory, La Silla Chile.

References

Afonso, C. et al. (EROS collaboration) 1998, A&A, 337, L17

Ansari., R. 1996, Vistas in Astronomy, 40, 519

Aubourg, E. et al. (EROS collaboration) 1993, Nature, 365, 623

Bauer, F., & de Kat, J. 1998, in Optical Detectors for Astronomy, eds. J.W. Beletic & P. Amico (Boston: Kluwer Academic Publishers), 191

Bauer, F. et al. (EROS collaboration) 1999, A&A, 348, 175

Beaulieu, J. P. et al. (EROS collaboration) 1995a, A&A, 299, 168

Beaulieu, J. P. et al. (EROS collaboration) 1995b, A&A, 303, 137

Beaulieu, J. P. et al. (EROS collaboration) 1996, Science, 272, 995

Derue, F. et al. (EROS collaboration) 1999, A&A, 357, 87

Goldman, B. et al. (EROS collaboration) 1999, A&A, 351, L5

Grison, P. et al. (EROS collaboration) 1995, A&AS, 109, 447

Hamilton, J. C. et al. (EROS collaboration) 1999, in preparation

Hardin, D. et al. (EROS collaboration) 1999, in preparation

de Laverny, P. et al. (EROS collaboration) 1998, A&A, 335, L93

Omont, A. et al. 1999, A&A, 348, 755

Paczyński, B. 1986, ApJ, 304, 1

Palanque-Delabrouille, N. et al. (EROS collaboration) 1998, A&A, 332, 1