

THE EROS-2 ARCHIVE: IMPLEMENTATION AND APPLICATIONS

J.B. Marquette¹, E. Lesquoy^{1,2}, J.P. Beaulieu¹ and P. Tisserand^{2,3}

Abstract. We present the strategy adopted to make the EROS-2 data publicly available. Applications based on these data are presented as well.

Keywords: magellanic clouds, galactic center, spiral arms, EROS-2, surveys, photometry, light curves, metallicity

1 Introduction

The EROS-2 (Expérience de Recherches d'Objets Sombres) has observed in a wide field configuration more than 200 square degrees towards the Magellanic Clouds, the Galactic center and the Spiral arms in order to probe the baryonic dark matter in the Galactic halo. The photometric data were acquired between July 1996 and February 2003 using the MARLY telescope at La Silla (1 m Ritchey- Chrétien, f/5.14), with a dichroic beam-splitter; this allowed simultaneous imaging to be completed in two non-standard broad passbands, the so-called EROS filters B_E (420-720 nm, blue channel) and R_E (620-920 nm, red channel). Each camera consisted of a mosaic of eight 2K 2K LORAL CCDs with a pixel size of 0.6 arcsec, and a field of view of 0.7 deg (right ascension) times 1.4 deg (declination). It resulted a unique set of more than 87 million stellar light curves and a collection of about 15 Tb of science images which are worth publishing for public uses.

2 Architecture

It is planned to have three levels:

1. The light curves were transferred at the Time Series Center of the Harvard University (Cambridge, Massachusetts, USA; PI: Pavlos Protopapas) for future availability through a web interface shared with other surveys like MACHO or OGLE2. More details on the TSC and its projects can be found at the URL <http://timemachine.iic.harvard.edu/>
2. The catalogues describing the 87 million stellar objects will be published in the near future through the CDS (Strasbourg). The paper describing these catalogues is in preparation.
3. The science images obtained during the 7 years of observation were transferred on a dedicated RAID system at the IAP for systematic astrometric calibration and filtering process. They will be published in the future on a VO system to be defined.

¹ Institut d'Astrophysique de Paris, CNRS, UMR7095, UPMC Univ Paris 06, 98bis Bd Arago, F-75014, Paris, France

² CEA, DSM, DAPNIA, Centre d'Etudes de Saclay, F-91191 Gif-sur-Yvette Cedex, France

³ Research School of Astronomy & Astrophysics, Mount Stromlo Observatory, Cotter Road, Weston ACT 2611, Australia

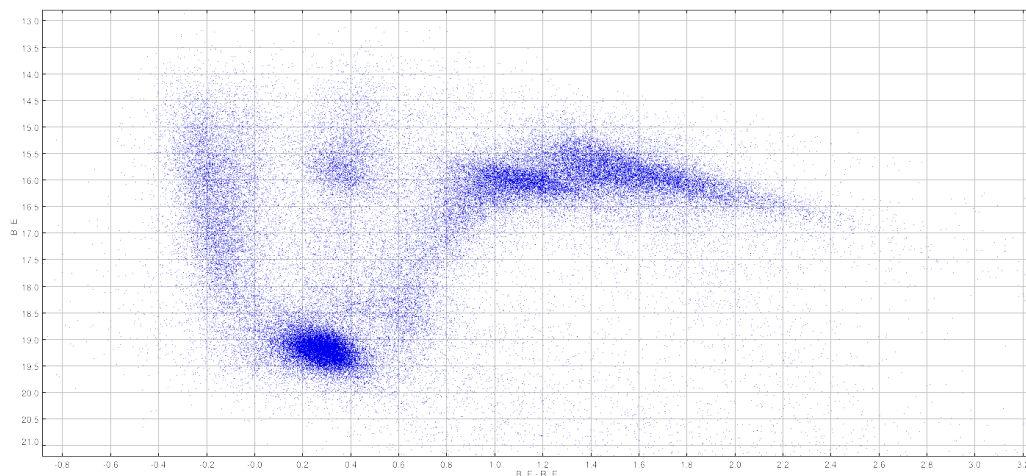


Fig. 1. Color-magnitude diagram (B_E vs. $B_E - R_E$) of the variables identified in the LMC (71620 objects are visible).

3 Applications

We have used the EROS-2 database for various applications, some of them are detailed below:

1. Search for periodic variables: we have conducted a systematic search of periodic objects using a dedicated pipeline based on a periodogram method (Analysis of Variance, see Schwarzenberg-Czerny (2003)). The figure 1 shows a color-magnitude diagram (B_E vs. $B_E - R_E$) of the variables identified in the LMC (71620 objects are visible). These objects will be published in the catalog paper cited above.
2. R Coronae Borealis: we have conducted a systematic search of R Coronae Borealis objects in the database. R Coronae Borealis stars (RCB) are a rare type of evolved carbon-rich supergiant stars that are increasingly thought to result from the merger of two white dwarfs, called the Double degenerate scenario. This scenario is also studied as a source, at higher mass, of type Ia Supernovae (SnIa) explosions. Therefore a better understanding of RCBs composition would help to constrain simulations of such events (Tisserand et al. 2004, 2008, 2009).
3. Double mode Cepheids: We have conducted a systematic search of double mode Cepheids (beat Cepheid, BC) in the Magellanic Clouds (Marquette et al. 2009). A double mode Cepheid pulsates either in the first overtone and fundamental modes (FO/F), or in the second and first overtone modes (SO/FO). It is clearly established that the period ratio (higher to lower mode) of the FO/F pulsators is around 0.72, while that of SO/FO objects is near 0.80. For the FO/F pulsators it is well known that the period ratio depends on the metallicity Z . We identify 74 FO/F BCs in the LMC and 41 in the SMC, and 173 and 129 SO/FO pulsators in the LMC and SMC, respectively; 185 of these stars are new discoveries. For nearly all the FO/F objects we determine minimum, mean, and maximum values of the metallicity.

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