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Editors/*Editores:*

Rui Azevedo & Paula Stella Teixeira

(newsletter@news.universebox.com)

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# 1 ABSTRACTS OF RECENTLY ACCEPTED PAPERS

## *Resumos de artigos aceites recentemente*

### **High Precision Photometry of Extreme KBO 2003 EL<sub>61</sub>**

Pedro Lacerda ; E-mail contact: [pedro@ifa.hawaii.edu](mailto:pedro@ifa.hawaii.edu)

Lacerda, P.<sup>1</sup>; Jewitt, D.<sup>1</sup>; Peixinho, N.<sup>2,1</sup>;

<sup>1</sup> Institute for Astronomy, University of Hawaii, USA;

<sup>2</sup> Grupo de Astrofísica, Universidade de Coimbra, Portugal;

We present high precision, time-resolved visible and near infrared photometry of the large (diameter  $\sim 2500$  km) Kuiper belt object (136108) 2003 EL<sub>61</sub>. The new data confirm rapid rotation at period  $P = 3.9155 \pm 0.0001$  hr with a peak-to-peak photometric range  $\Delta m_R = 0.29 \pm 0.02$  mag. and further show subtle but reproducible color variations with rotation. Rotational deformation of 2003 EL<sub>61</sub> alone would give rise to a symmetric lightcurve free of color variations. The observed photometric deviations from the best-fit equilibrium model show the existence of a large surface region with an albedo and color different from the mean surface of 2003 EL<sub>61</sub>. We explore constraints on the nature of this anomalous region set by the existing data.

Accepted by: The Astronomical Journal

<http://www.ifa.hawaii.edu/~pedro/pdfs/20080125LJP.pdf>

### **Blue Straggler Stars in Galactic Open Clusters and the effect of field star contamination**

André Moitinho ; E-mail contact: [andre@sim.ul.pt](mailto:andre@sim.ul.pt)

Carraro, G.<sup>1</sup>; Vazquez, R.A.<sup>2</sup>; Moitinho, A.<sup>3</sup>;

<sup>1</sup> ESO, Casilla 19001, Santiago 19, Chile;

<sup>2</sup> Facultad de Ciencias Astronómicas y Geofísicas de la UNLP, IALP-CONICET, Paseo del Bosque s/n 1900, La Plata, Argentina;

<sup>3</sup> SIM/IDL, Faculdade de Ciências de Universidade de Lisboa, Ed. C8, Campo Grande, 1749-016, Lisboa, Portugal;

We investigate the distribution of Blue Straggler stars in the field of three open star clusters.

The main purpose is to highlight the crucial role played by general Galactic disk fore-/back-ground field stars, which are often located in the same region of the Color Magnitude Diagram as Blue Straggler stars.

We analyze photometry taken from the literature of 3 open clusters of intermediate/old age rich in Blue Straggler stars, and which are projected in the direction of the Perseus arm, and study their spatial distribution and the Color Magnitude Diagram.

As expected, we find that a large portion of the Blue Straggler population in these clusters are simply young field stars belonging to the spiral arm. This result has important consequences on the theories of the formation and statistics of Blue Straggler stars in different population environments: open clusters, globular clusters or dwarf galaxies.

As previously emphasized by many authors, a detailed membership analysis is mandatory before comparing the Blue Straggler population in star clusters against theoretical models. Moreover, these sequences of young field stars (blue plumes) are potentially powerful tracers of Galactic structure which require further consideration.

Accepted by: Research Note in A&A

<http://lanl.arxiv.org/abs/0802.3557>

## Stellar populations in the Canis Major overdensity

André Moitinho ; E-mail contact: andre@sim.ul.pt

Carraro, Giovanni<sup>1</sup>; Moitinho, André<sup>2</sup>; Vázquez, Ruben A.<sup>3</sup>;

<sup>1</sup> ESO, Casilla 19001, Santiago 19, Chile;

<sup>2</sup> SIM/IDL, Faculdade de Ciências de Universidade de Lisboa, Ed. C8, Campo Grande, 1749-016, Lisboa, Portugal;

<sup>3</sup> Facultad de Ciencias Astronómicas y Geofísicas de la UNLP, IALP-CONICET, Paseo del Bosque s/n 1900, La Plata, Argentina;

We performed a photometric multicolour survey of the core of the Canis Major overdensity at , reaching  $V \sim 22$  and covering  $0.3 \times 1.0$  arcmin<sup>2</sup>. The main aim is to unravel the complex mixture of stellar populations toward this Galactic direction, where in the recent past important signatures of an accretion event have been claimed to be detected. While our previous investigations were based on disjointed pointings aimed at revealing the large-scale structure of the third Galactic Quadrant, we now focus on a complete coverage of a smaller field centred on the Canis Major overdensity. A large wavelength baseline, in the UBVRI bands, allows us to build up a suite of colour-colour and colour-magnitude diagrams, providing a much better diagnostic tool to disentangle the stellar populations of the region. In fact, the simple use of one colour-magnitude diagram, widely employed in all the previous studies defending the existence of the Canis Major galaxy, does not allow one to separate the effects of the different parameters (reddening, age, metallicity and distance) involved in the interpretation of data, forcing to rely on heavy modelling. In agreement with our previous studies, in the same general region of the Milky Way, we recognize a young stellar population compatible with the expected structure and extension of the Local (Orion) and Outer (Norma-Cygnus) spiral arms in the Third Galactic Quadrant. Moreover, we interpret the conspicuous intermediate-age metal-poor population as belonging to the Galactic thick disc, distorted by the effect of strong disc warping at this latitude, and to the Galactic halo.

Accepted by: MNRAS, 384, 224 (2008)

<http://arxiv.org/abs/0801.2084>

## Interior of a Schwarzschild Black Hole Revisited

Doran, Rosa<sup>1</sup>; Lobo, Francisco S. N.<sup>1</sup>; Crawford, Paulo<sup>1</sup>;

<sup>1</sup> Department of Physics, Centro de Astronomia e Astrofísica da Universidade de Lisboa, Campo Grande, Ed. C8, 1749-016 Lisboa, Portugal;

The Schwarzschild solution has played a fundamental conceptual role in general relativity, and beyond, for instance, regarding event horizons, spacetime singularities and aspects of quantum field theory in curved spacetimes. However, one still encounters the existence of misconceptions and a certain ambiguity inherent in the Schwarzschild solution in the literature. By taking into account the point of view of an observer in the interior of the event horizon, one verifies that new conceptual difficulties arise. In this work, besides providing a very brief pedagogical review, we further analyze the interior Schwarzschild black hole solution. Firstly, by deducing the interior metric by considering time-dependent metric coefficients, the interior region is analyzed without the prejudices inherited from the exterior geometry. We also pay close attention to several respective cosmological interpretations, and briefly address some of the difficulties associated to spacetime singularities. Secondly, we deduce the conserved quantities of null and timelike geodesics, and discuss several particular cases in some detail. Thirdly, we examine the Eddington-Finkelstein and Kruskal coordinates directly from the interior solution. In concluding, it is important to emphasize that the interior structure of realistic black holes has not been satisfactorily determined, and is still open to considerable debate.

Accepted by: Foundations of Physics, vol. 38, issue 2, pp. 160-187

<http://arxiv.org/abs/gr-qc/0609042>

# A FLAMINGOS Deep Near-Infrared Imaging Survey of the Rosette Complex. I. Identification and Distribution of the Embedded Population

Román-Zúñiga, Carlos G.<sup>1</sup>; Elston, Richard<sup>1</sup>; Ferreira, Bruno<sup>1</sup>; Lada, Elizabeth A.<sup>1</sup>;

<sup>1</sup> Astronomy Department, University of Florida, Gainesville, FL 32611;

We present the results of a deep near-infrared imaging survey of the Rosette complex made with FLAMINGOS at the 2.1 m telescope at Kitt Peak National Observatory. We studied the distribution of young embedded sources using a variation of the nearest neighbor method applied to a carefully selected sample of near-infrared excess (NIRX) stars that trace the latest episode of star formation in the complex. Our analysis confirmed the existence of seven clusters previously detected in the molecular cloud, and identified four more clusters across the complex. We determined that 60% of the young stars in the complex and 86% of the stars within the molecular cloud are contained in clusters, implying that the majority of stars in the Rosette formed in embedded clusters. Also, half of the young embedded population is contained in four clusters that coincide with the central core of the cloud, where the main interaction with the H II region is taking place. We compare the sizes, infrared excess fractions, and average extinction toward individual clusters to investigate their early evolution and expansion. In particular, the size and degree of central condensation within the clusters appear to be related to the degree of infrared excess and mean extinction in a way that suggests that the clusters form as compact entities and then quickly expand after formation. We found that the average infrared excess fraction of clusters increases as a function of distance from NGC 2244, implying a temporal sequence of star formation across the complex. This sequence appears to be primordial, possibly resulting from the formation and evolution of the molecular cloud and not from the interaction with the H II region. Instead, the main influence of the H II region could be to enhance or inhibit the underlying pattern of star formation in the cloud.

Accepted by: The Astrophysical Journal, Volume 672, Issue 2, pp. 861-887

<http://arxiv.org/abs/0709.3004>

## The Nature of the Dense Core Population in the Pipe Nebula: A Survey of NH<sub>3</sub>, CCS, and HC<sub>5</sub>N Molecular Line Emission

Rathborne, J. M.<sup>1</sup>; Lada, C. J.<sup>1</sup>; Muench, A. A.<sup>1</sup>; Alves, J. F.<sup>2</sup>; Lombardi, M.<sup>3</sup>;

<sup>1</sup> Harvard-Smithsonian Center for Astrophysics, 60 Garden Street, Cambridge, MA 02138;

<sup>2</sup> Calar Alto Observatory, Centro Astronómico Hispano Alemán, Calle Jesús Durbán Remón 2-2, 04004 Almeria, Spain;

<sup>3</sup> European Southern Observatory, Karl-Schwarzschild-Strasse 2, 85748 Garching, Germany;

Recent extinction studies of the Pipe Nebula ( $d=130$  pc) reveal many cores spanning a range in mass from 0.2 to 20.4  $M_{\text{solar}}$ . These dense cores were identified via their high extinction and comprise a starless population in a very early stage of development. Here we present a survey of NH<sub>3</sub> (1,1), NH<sub>3</sub> (2,2), CCS (21-10), and HC<sub>5</sub>N (9,8) emission toward 46 of these cores. An atlas of the 2MASS extinction maps is also presented. In total, we detect 63% of the cores in NH<sub>3</sub> (1,1), 22% in NH<sub>3</sub> (2,2), 28% in CCS, and 9% in HC<sub>5</sub>N emission. We find the cores are associated with dense gas ( $\sim 10^4$  cm<sup>-3</sup>) with  $9.5 \text{ K} \leq \text{TK} \leq 17 \text{ K}$ . Compared to C<sup>18</sup>O, we find the NH<sub>3</sub> line widths are systematically narrower, implying that the NH<sub>3</sub> is tracing the dense component of the gas and that these cores are relatively quiescent. We find no correlation between core line width and size. The derived properties of the Pipe cores are similar to cores within other low-mass star-forming regions: the only differences are that the Pipe cores have weaker NH<sub>3</sub> emission and most show no current star formation as evidenced by the lack of embedded infrared sources. Such weak NH<sub>3</sub> emission could arise due to low column densities and abundances or reduced excitation due to relatively low core volume densities. Either alternative implies that the cores are relatively young. Thus, the Pipe cores represent an excellent sample of dense cores in which to study the initial conditions for star formation and the earliest stages of core formation and evolution.

Accepted by: The Astrophysical Journal Supplement Series, Volume 174, Issue 2, pp. 396-425

<http://arxiv.org/abs/0708.3660>

## Near-infrared reddening of extra-galactic GMCs in a face-on geometry

Kainulainen, Jouni<sup>1,2</sup>; Juvela, Mika<sup>2</sup>; Alves, Joao<sup>3</sup>;

<sup>1</sup> European Southern Observatory, Karl-Schwarzschild-Str. 2, 85748 Garching bei München, Germany;

<sup>2</sup> Observatory, PO Box 14, 00014 University of Helsinki, Helsinki, Finland;

<sup>3</sup> Calar Alto Observatory, Centro Astronómico Hispano Alemán, Calle Jesús Durbán Remón 2-2, 04004 Almería, Spain;

Abridged

We describe the near-infrared reddening signature of giant molecular clouds (GMCs) in external galaxies. In particular, we examine the E(J-H) and E(H-K) color-excesses, and the effective extinction law observed in discrete GMC regions. We also study the effect of the relative scale height of the GMC distribution to the color-excesses, and to the observed mass function of GMCs. We perform Monte Carlo radiative transfer simulations with 3D models of stellar radiation and clumpy dust distributions, resembling a face-on geometry. The scattered light is included in the models, and near-infrared color maps are calculated from the simulated data. The effective near-infrared reddening law, i.e. the ratio E(J-H)/E(H-K), has a value close to unity in GMC regions. The ratio depends on the relative scale height of GMCs,  $\xi$ , and for  $\xi$  values 0.1...0.75 we find the typical ratios of 0.6...1.1. The effective extinction law turns out to be very flat in GMC regions. We find the ratios of apparent extinctions of  $A(H)/A(K)=1.35...1.55$  and  $A(J)/A(H)=1.15$ . The effect of the scattered flux on the effective reddening law, as well as on the effective extinction law, is significant. Regarding the GMC mass function, we find no correlation between the input and observed slopes of the mass functions. Rather, the observed slope reflects the parameter  $\xi$  and the dynamical range of the mass function. We estimate that only a fraction of 10...20% of the total mass of GMCs is recovered, if the observed color-excess values are transformed to masses using the Galactic reddening law. In the case of individual clouds the fraction can vary between 0...50 %.

Accepted by: A&A

<http://arxiv.org/abs/0802.1321>

## The ELODIE survey for northern extra-solar planets. IV. HD 196885, a close binary star with a 3.7-year planet

Correia, A. C. M.<sup>1,2</sup>; Udry, S.<sup>2</sup>; Mayor, M.<sup>2</sup>; Eggenberger, A.<sup>2,3</sup>; Naef, D.<sup>4</sup>; Beuzit, J.-L.<sup>3</sup>; Perrier, C.<sup>3</sup>; Queloz, D.<sup>2</sup>; Sivan, J.-P.<sup>5</sup>; Pepe, F.<sup>5</sup>; Santos, N. C.<sup>2,6</sup>; Ségransan, D.<sup>5</sup>;

<sup>1</sup> Departamento de Física da Universidade de Aveiro, Campus Universitário de Santiago, 3810-193 Aveiro, Portugal;

<sup>2</sup> Observatoire de Genève, 51 Ch. des Maillettes, 1290 Sauverny, Switzerland;

<sup>3</sup> Laboratoire d'Astrophysique de Grenoble, Université Joseph Fourier, BP 53, 38041 Grenoble Cedex 9, France;

<sup>4</sup> European Southern Observatory, Casilla 19001, Santiago 19, Chile;

<sup>5</sup> Laboratoire d'Astrophysique de Marseille, Traverse du Siphon BP 8, 13376 Marseille Cedex 12, France;

<sup>6</sup> Centro de Astrofísica da Universidade do Porto, Rua das Estrelas, 4150-762 Porto, Portugal;

**Aims.** We aim to significantly increase the number of detected extra-solar planets in a magnitude-limited sample to improve our knowledge of their orbital element distributions and thus obtain better constraints for planet-formation models. **Methods:** Radial-velocity data were taken at Haute-Provence Observatory (OHP, France) with the ELODIE echelle spectrograph. **Results:** We report the presence of a planet orbiting HD 196885 A, with an orbital period of 1349 days. This star was previously suggested to host a 386 -day planet, but we cannot confirm its existence. We also detect the presence of a stellar companion, HD 196885 B, and give some constraints on its orbit.

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<http://adsabs.harvard.edu/abs/2008A%26A...479..271C>

## 2 MEETINGS AND CONFERENCES

### *Reuniões e encontros*

#### **Milli-arcsecond astrophysics with VSI, the VLTI spectro-imager in the ELT era**

Paula Teixeira ; E-mail contact: pteixeira@cfa.harvard.edu

Nowadays, compact sources like surfaces of nearby stars, circumstellar environments of stars from early stages to the most evolved ones and surroundings of active galactic nuclei can be investigated at milli-arcsecond scales only with the VLT in its interferometric mode. We propose a spectro-imager, named VSI (VLTI spectro-imager), which is capable to probe these sources both over spatial and spectral scales in the near-infrared domain. This instrument will provide information complementary to what is obtained at the same time with ALMA at different wavelengths and the extreme large telescopes.

<http://lanl.arxiv.org/abs/0801.2694>