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NEW GENERATION OPTICAL AND NEAR-INFRARED SURVEYS OF THE GALACTIC PLANE

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RESUMEN

Se presenta un breve resumen de varios cartografiados del plano de la Galaxia que se están llevando a cabo, o planeando, en el óptico y en el cercano infrarrojo desde varios observatorios del hemisferio sur y norte. Se ilustra su potencialidad con los primeros resultados de IPHAS, el mapa del Plano Galáctico Norte en Hα.

ABSTRACT

Ongoing and future optical and near-infrared surveys focused on the study of the Galactic plane are briefly presented. Their potential is illustrated by the first results from IPHAS, the INT Photometric Hα Survey of the Northern Galactic Plane.

Key Words: Galaxy: disk — surveys

1. GALACTIC PLANE SURVEYS

In the next years, the study of the evolution of the Milky Way will largely benefit from several extensive surveys covering from the optical to the radio domain that are being carried out at different Observatories worldwide.

In the optical, a complete coverage of a narrow band of the Milky Way (5 degrees above and below the Galactic Plane) will be provided by the INT Photometric Hα Survey (IPHAS, see `http://www.iphas.org` and next section) and its bluer and/or Southern follow-ups (UVEX, VPHAS+[3], OmegaWhitesee[3]). These surveys put emphasis on the use of an Hα narrowband filter to detect short-lived but crucial phases of stellar evolution, like star formation (HII regions, T Tauri stars), massive stars evolution (Be/B[e] stars, Wolf-Rayet, Luminous Blue Variables), the final stages of evolution of low mass stars (planetary nebulae, see Mampaso et al. 2009), interacting binaries (cataclysmic variables, symbiotic stars), etc.

These optical surveys will be complemented in the near-infrared by the "UKIRT Infrared Deep Sky Surveys" (UKIDSS, see `http://www.ukidss.org`) in the North, and the "VISTA Variables in the Via Lactea" and the "VISTA Hemisphere Survey" (VVV[3] and VHS[3], respectively) in the South.

2. IPHAS

The INT Photometric Hα Survey (IPHAS) is an international collaboration which involves a number of institutes, mainly from the UK, Spain and The Netherlands. The aim of this imaging survey is to produce a complete, fully photometric, and spatially detailed Hα map of 1850 square degrees of the Galactic Plane between latitudes $-5°$ and $+5°$ that are visible from the Northern hemisphere.

The IPHAS survey is presented in Drew et al. (2005), and its home web page, with all the relevant links and references, is at `http://www.iphas.org`.

The IPHAS observations are done using the Wide Field Camera (WFC) at the 2.5 m Isaac Newton Telescope (INT) at the Observatorio del Roque de los Muchachos on La Palma, Spain. The WFC is installed at the prime focus of the telescope and consists of a mosaic of four 2k$\times$4k EEV CCDs, providing a field of view of 34$\times$34 arcmin^2 with a sampling of $0''.33$ per pixel. The IPHAS images are taken through three filters: a narrow-band Hα (λ_c = 6568 Å; FWHM = 95 Å) and two broad-band Sloan r, i filters, with matched 120, 30, and 10 s exposures, respectively. In this way, the magnitude range $13 \leq r \leq 20$ (the fainter end at 10σ) is covered for point sources.

The total observing time needed to complete the survey is 22 weeks of clear weather: it started on August 2003 and is now near its end. Pipeline data reduction and data distribution are handled by the Cambridge Astronomical Survey Unit. The products of the survey are a point sources photometric catalogue, whose Initial Data Release has been recently made available to the international commu-

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[3]See `http://www.eso.org/sci/observing/policies/PublicSurveys/sciencePublicSurveys.html`

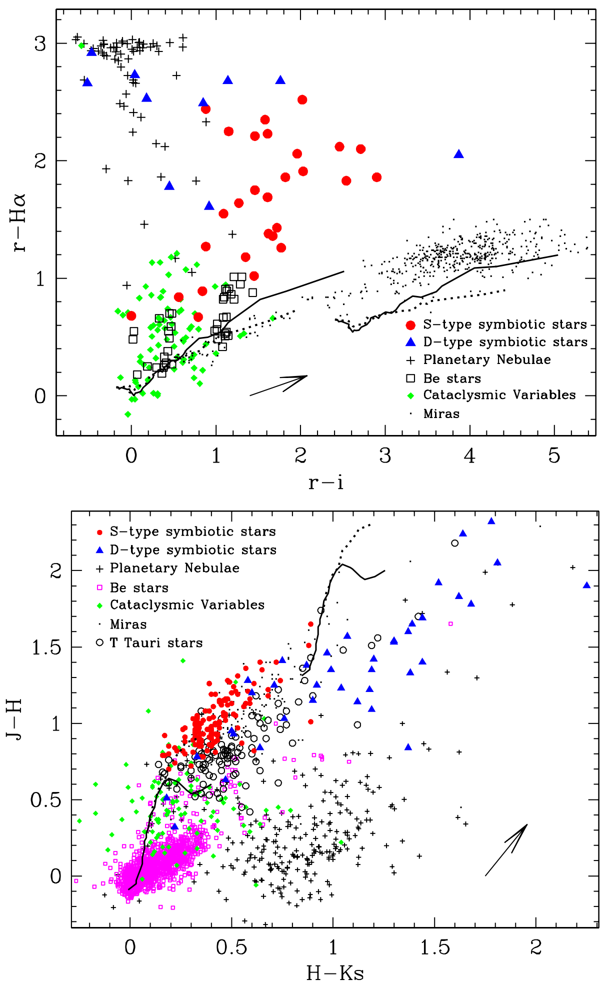

Fig. 1. Top: IPHAS colour-colour diagram for different classes of objects. The locus of unreddened main-sequence and RGB stars is indicated by the solid and dotted lines, respectively. Two sequences are shown, corresponding to reddening values $E(B-V) = 0$ (left) and 4 (right), respectively. The arrow indicates the reddening vector for normal stars: its length corresponds to 3 mag extinction in V. Bottom: 2MASS colour-colour diagram for the same classes of objects. Symbols are the same as in the upper panel, albeit smaller owing to the larger number of objects. In addition, T Tauri stars are indicated by empty circles. Figure adapted from Corradi et al. (2008).

nity (Gonzalez-Solares et al. 2008, `http://casu.ast.cam.ac.uk/ag/portal/`), as well as a catalogue of extended ionized nebulae (Corradi et al., in preparation).

The IAU-registered nomenclature adopted by IPHAS for point sources is *IPHAS JHH-MMSS.ss+DDMMSS.s*, encoding the J2000 object coordinates into the name, and for extended nebulae it is *IPHASX JHHMMSS.ss+DDMMSS.s*.

2.1. *Analysis of IPHAS data*

The main tool to analyse IPHAS stellar data is the $r - \mathrm{H}\alpha$ vs. $r - i$ colour-colour diagram, which is presented and discussed in Drew et al. (2005). It is shown in the upper panel of Figure 1 for normal stars and various classes of Hα emitters. The figure is adapted from Corradi et al. (2008), to which the reader is referred for more details. In the diagram, the $r - \mathrm{H}\alpha$ axis basically indicates increasing values of the equivalent width of the Hα line *in emission*, while $r - i$, for normal stars, is essentially a sequence of increasing spectral types and/or reddening. In the figure, the locus of main-sequence and RGB stars is indicated by the solid and dotted lines, respectively (Drew et al. 2005).

Considering the shifts in the diagram caused by variable interstellar extinction (especially important in the Galactic Plane) and by the unavoidable presence of photometric errors (especially for faint sources), the ability of distinguishing Hα emitters from normal stars using IPHAS colours clearly improves with the strength of the Hα emission. In addition, there is a non-negligible overlap between certain classes of Hα emitters. For instance, T Tauri stars are not indicated in the upper panel of the figure because they are spread all over the diagram above the sequence of normal stars, and thus they can be confused with other Hα emitters on the basis of the IPHAS colours only. However, the diagnostic capability of the IPHAS colour-colour diagram is further improved if it is combined with near-IR data. When the 2MASS magnitudes are added (cf. Figure 1, lower panel), most of the Hα emitters can be indeed efficiently distinguished, with only few exceptions (Corradi et al. 2008).

To conclude, the example of IPHAS shows that new generation surveys, especially when correlated to each other, are a powerful tool to shed light into many crucial aspects of stellar evolution in the Milky Way, and hence into the evolution of the Galactic system as a whole.

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