

The RMS Survey: The Luminosity Function of Massive YSOs in the Galactic Plane

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The Red MSX Source Survey

The Red MSX Source Survey identified ~2000 candidate Massive Young Stellar Objects (MYSOs) from the Mid-course Space Experiment (MSX) Point Source Catalogue using colour selection criteria^[1]. In order to identify contaminants which have similar mid-IR colours (UCHII regions, Evolved Stars, Proto-PNe, PNe) from the YSOs, and to gain information about these sources, we have undertaken a campaign of ground-based follow up observations^[2]. Kinematic distance information has been obtained for candidates using ¹³CO observations^[3,4]. Far-IR fluxes have been obtained for the majority of young sources from MIPS GAL and IRAS Galaxy Atlas data^[5].

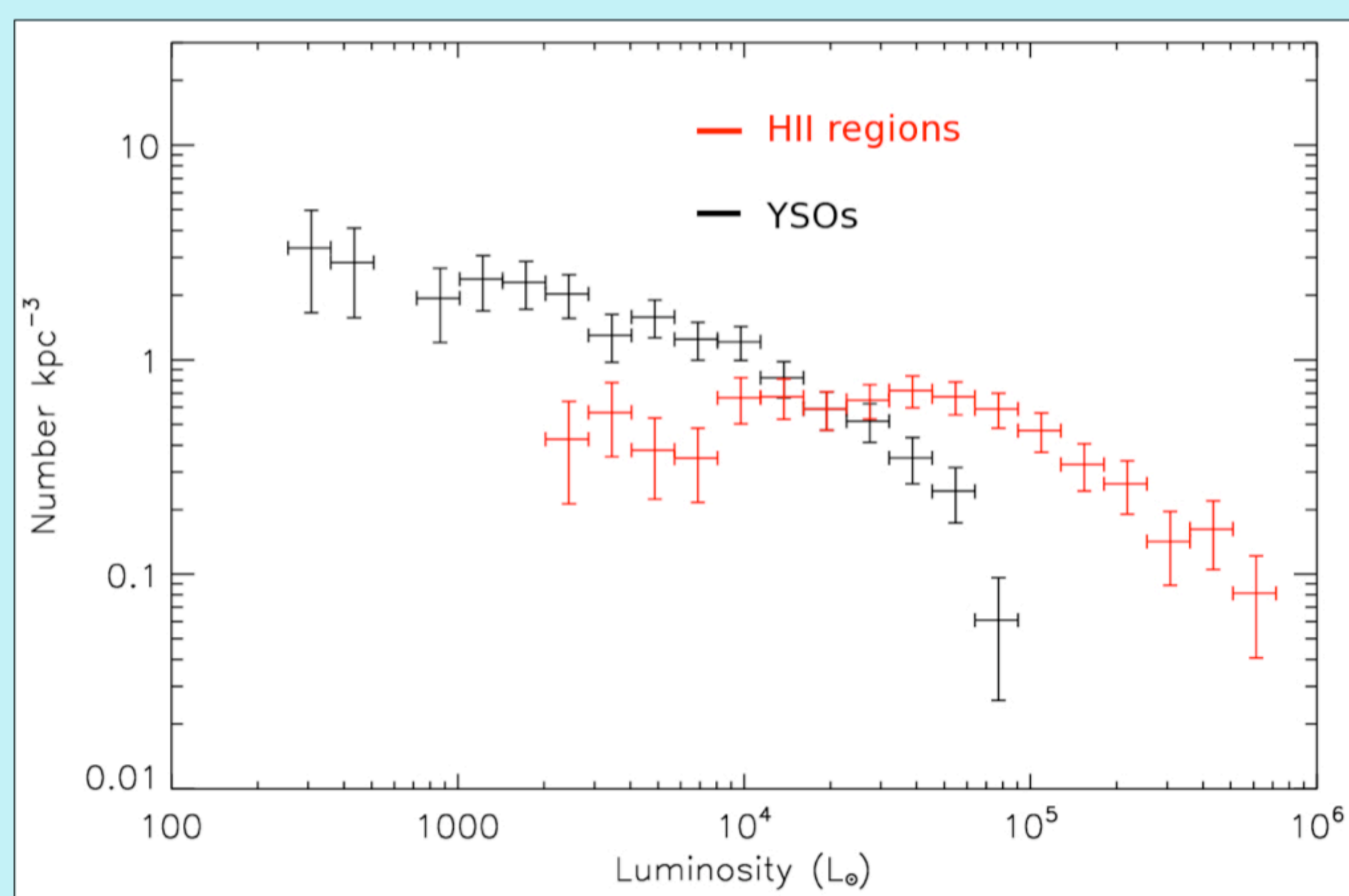


Figure 2: The Luminosity Function of YSOs and HII regions in the galactic plane.

Luminosity Functions of YSOs and HII Regions

Luminosities were obtained from SED fits (e.g. see figure 1) for 282 YSOs and 293 HII regions with far-IR fluxes and uniquely assigned kinematic distances. Using the mean ratio of MSX 21 μ m flux to total flux from the SEDs and the flux and spatial limits of the RMS survey ($F_{\text{MSX } 21\mu\text{m}} \geq 2.75 \text{ Jy}$, $|b| \leq 5^\circ$, $10^\circ \leq l \leq 350^\circ$), the volume of the galaxy observed by the survey was calculated as a function of luminosity. This was weighted by the observed distribution of luminous RMS sources in l and b and used to obtain the local luminosity function for YSOs and HII regions in the galactic plane (see figure 2) for the first time.

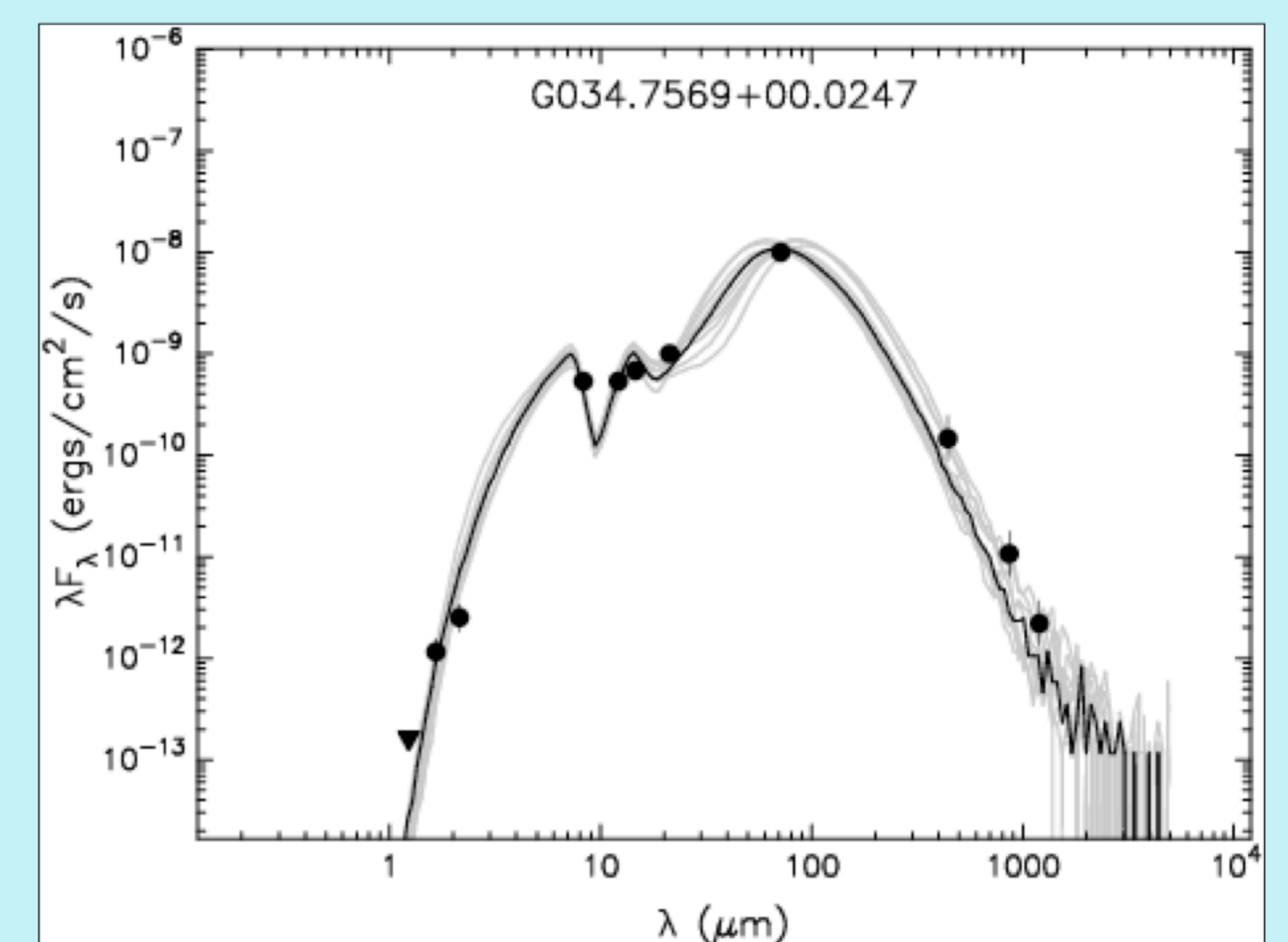


Figure 1: Fits to the SED of an MYSO using the model fitter of [6]. The triangle is an upper limit. The solid line shows the fit with the lowest χ^2 .

Lifetime of the MYSO and HII region Phases

Using a similar approach to Wood & Churchwell (1989, [7]), given the luminosity function and lifetime of local main-sequence OB stars, the lifetime of the YSO and HII region phases can be calculated as a function of luminosity. This was undertaken using the OB luminosity function of Reed (2001, [8]) and using fits to the data of Crowther (2005, [9]) to convert from absolute magnitude to luminosity.

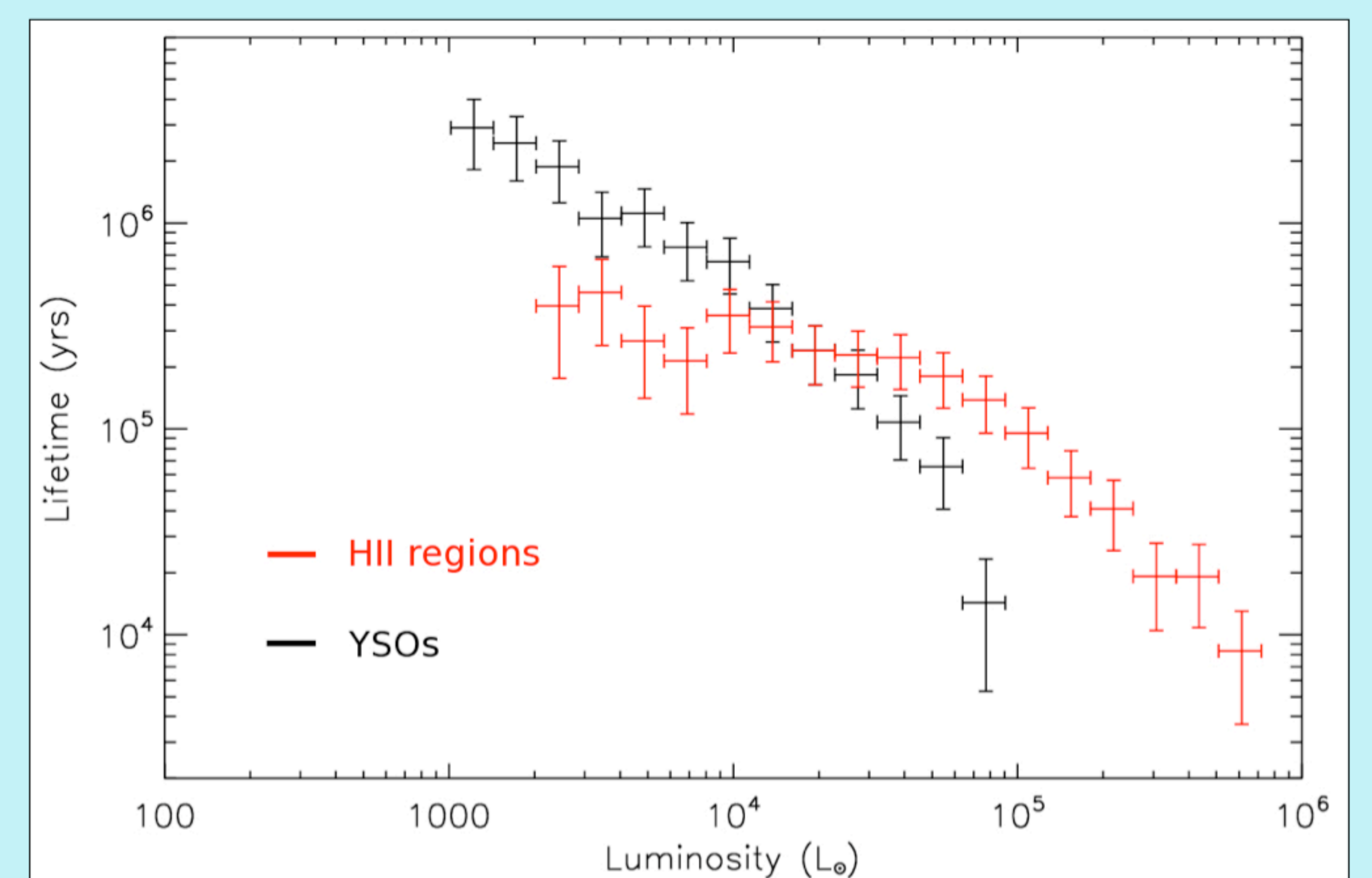


Figure 3: The lifetime of YSOs and HII regions in the galactic plane.

Key Remarks

- We have obtained the luminosity function for YSOs and HII regions in the galactic plane for the first time.
- This has led to the first determination of the YSO and HII regions phase lifetimes as a function of luminosity.
- We detect few MYSOs with $L > 6 \times 10^4 L_\odot$.
- Our database is available to the general community from the RMS Survey web page: <http://www.ast.leeds.ac.uk/RMS>
- These results will be discussed in more detail in upcoming publications currently in preparation.

References

- [1] – Lumsden et al., 2002, MNRAS, 336, 621
- [2] – Urquhart et al., 2008a, ASPC Conf. Ser., 387, 381
- [3] – Urquhart et al., 2007, A&A, 474, 891
- [4] – Urquhart et al., 2008b, A&A, 487, 253
- [5] – Mottram, 2008, PhD. Thesis, University of Leeds
- [6] – Robitaille et al., 2007, ApJS, 169, 328
- [7] – Wood & Churchwell, 1989, ApJ, 340, 265
- [8] – Reed, 2001, PASP, 113, 537
- [9] – Crowther, 2005, IAU Symp. 227, 389