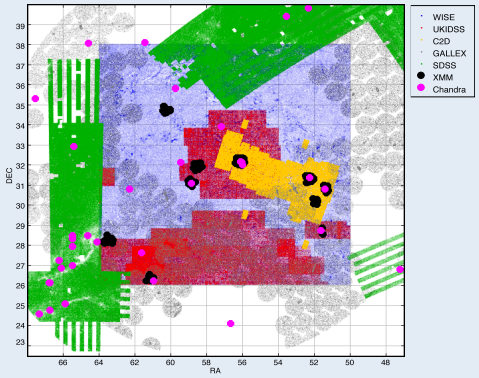
A WISE Census of the Perseus OB2 Association

Mohaddesseh Azimlu, August Muench, J. Rafael Martinez-Galarza

Harvard-Smithsonian Center for Astrophysics

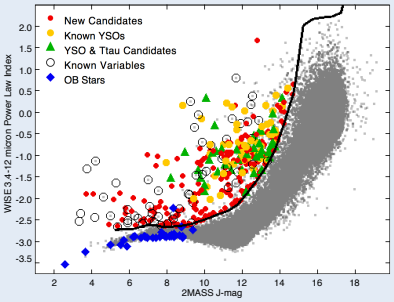
Overview

We have performed a WISE based survey to identify young stellar objects throughout a 12° × 12° degree area around the Perseus OB2 association (Per OB2). Per OB2, which is at a distance of ~300 pc, is the second closest OB association to the Sun with an age of less than 15 Myr. We constructed a panchromatic census of this region using WISE, Spitzer and all other optical/infrared all sky surveys. If available, we folded in X-ray data that can help to confirm the young but diskless members and to distinguish young sources from background extragalactic objects.



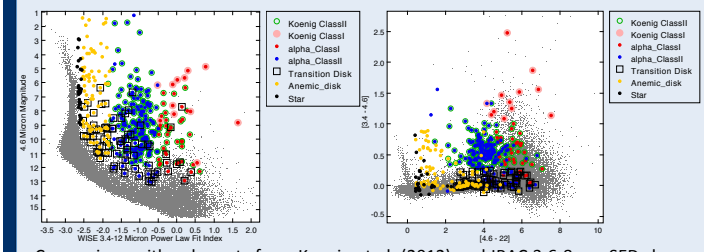
We used this panchromatic census to construct spectral energy distributions (SEDs) of about 1 million 2MASS and more than 1.5 million WISE point sources to look for signatures of disk infrared excess emission as a means to identify young stars.

Fitting Power Law SEDs and Sample Selection



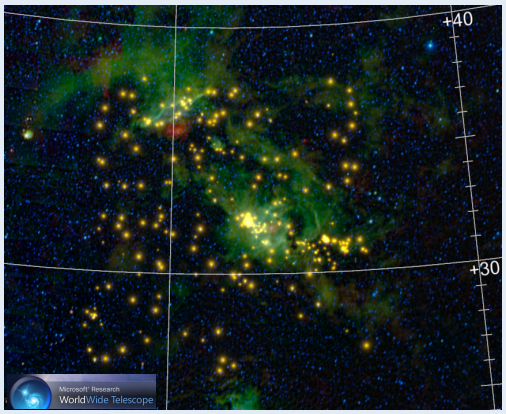
We made a quick check on the SED by a power-law fitting to WISE data. This simple check provides us with information about presence of a disk and the evolutionary stage of young stellar objects (YSOs). All the sources with 3.6-12 micron slope, 5σ above the Gaussian peak within each bin of 0.5 2MASS J magnitude was selected as a candidate. We found 699 candidates, which 354 survived visual inspection.

Comparing with other YSO identification methods



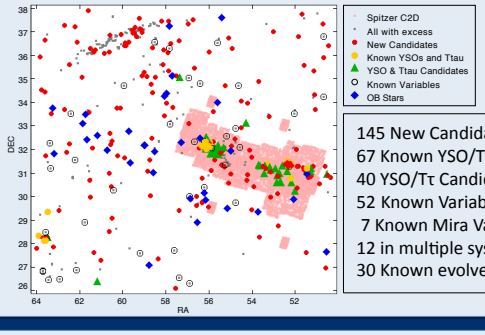
Comparison with color-cuts from Koenig et al, (2012) and IRAC 3.6-8 μm SED slope (α) from Lada et al. (2006) and Muench et al., (2007). Reasonable match between two methods and our candidates. However anemic disks are missed by color cuts, while faint sources are missed by our SED power-law fit. Transition disks are selected by Koenig color-cuts. Stars and anemic disks are selected based on SED slope α and defined as α < -2.56 and -2.56 < α < -1.8 respectively.

Spatial Distribution of Candidates



354 manually inspected candidates overlaid on WISE multi-color image:
Blue=3.4 μm
Cyan=4.6 μm
Green=12 μm
Red=22 μm

The YSO candidate brightness (yellow dots) presents the 3.4-12 μm power law index.

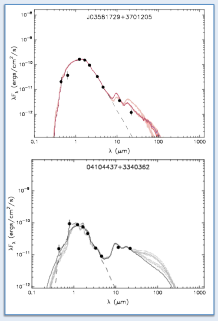


145 New Candidates
67 Known YSO/Tτ/Red sources
40 YSO/Tτ Candidate
52 Known Variable Stars
7 Known Mira Variables
12 in multiple systems
30 Known evolved stars

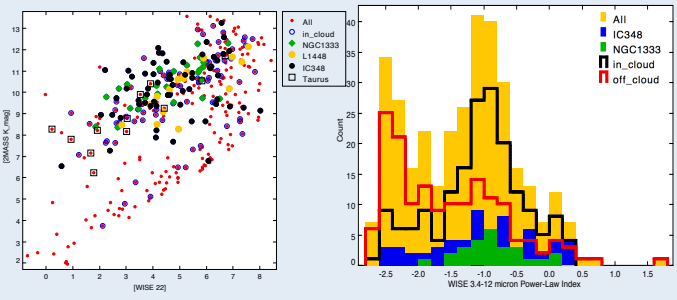
Sample SEDs

We used "Online SED Fitter" by Robitaille et al. (2007) to fit SED models and here we present two selected new candidates. We identified a group of bright stars which are statistically redder than field stars with the same brightness and may have weak disks (top plot).

In next step we consider the probability of fitted models rather than the best fit or the smallest χ^2 to derive the proto-star and disk physical parameters. Distribution of models however, are very sensitive to flux error and estimated extinctions. Please look at Poster 1H027, ***A NEW BAYESIAN SED FITTING METHOD FOR YSOS*** by Rafael Martinez-Galarza.



Bright Dusty Stars?



Distribution of the WISE 3.4-12 micron power law index appears as double peaked. As expected, the sources which lie within the Perseus molecular cloud have younger disks and therefore larger SED slopes. The same duality is seen in 2MASS Kmag vs. WISE 22 μm magnitude. The lower group in the left plot are usually bright with smaller slopes but they have statistically significant excess emission in longer wavelengths. They are mostly out of Perseus cloud and have low extinctions.

References

Koenig X. P., et al., 2012, ApJ, 744, 130
Lada C., et al. 2006, AJ, 131, 1574
Muench A., et al., 2007, AJ, 134, 411
Robitaille, T. P., et al., 2007, ApJS, 169, 328

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