A SIGNIFICANT POPULATION OF CANDIDATE NEW MEMBERS OF THE RHO OPHIUCHI CLUSTER

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ABSTRACT

We present a general method for identifying the pre-main-sequence population of any star-forming region, unbiased with respect to the presence or absence of disks. We have applied this technique to a new, deep, wide-field, near-infrared imaging survey of the ρ Ophiuchi cloud core to search for candidate low mass members. In conjunction with published Spitzer IRAC photometry, and least squares fits of model spectra (COND, DUSTY, NextGen, and blackbody) to the observed spectral energy distributions, we have identified 948 candidate cloud members within our 90% completeness limits of \( J = 20.0, \) \( H = 20.0, \) and \( K_s = 18.5. \) This population represents a factor of ~3 increase in the number of known young stellar objects (YSOs) in the ρ Ophiuchi cloud. A large fraction of the candidate cluster members (81% ± 3%) exhibit infrared excess emission consistent with the presence of disks, thus strengthening the possibility of their being bona fide cloud members. Spectroscopic follow-up will confirm the nature of individual objects, better constrain their parameters, and allow an initial mass function to be derived.

J, H, and Ks Observations

• IRIS2 on the Anglo-Australian 4.0 meter telescope
• IRIS2 plate scale 0.45 arcsec/pixel
• Filters used: IRIS2 J (1.245 μm), Ks (2.144 μm), H = CH₄ (1.570 μm) + CH₄ (1.690 μm)
• Total on-source integration time at each position was 5 minutes for the J and Ks filters, and 16 minutes for H-band
• 90% completeness limits: \( J = 20.0, \) \( H = 20.0, \) \( K_s = 18.5 \)
• Mass sensitivity: 90% complete to \( ~1.5 M_{\text{Jup}} \) for 1 Myr age and photospheric temperature of \( ~1100K \) at 124 pc for \( A_V = 0 ; \) falls to \( 2.0, 4.0, \) and \( 8.5, \) and \( 10 M_{\text{Jup}} \) for \( A_V = 5, 10, \) and 20, respectively.

 acknowledgements

A.M. acknowledges the support of the NASA Rocky Mountain Space Grant Consortium.

Substellar-Planetary Mass IMF

Fig. 3.— Plot of substellar to planetary mass IMF, assuming all 948 new candidates to be cloud members. De-reddened J magnitudes were used to estimate absolute J magnitudes for all sources, since this band is least affected by disk emission. 1 Myr COND or DUSTY models were then used to infer masses from absolute J magnitudes. The 57 objects in our survey with \( M > 0.1 M_{\odot} \) are excluded from this plot. Note the dramatic rise in number of sources across the planetary mass boundary. Follow-up spectroscopy is in progress.