A multi-wavelength study of circumstellar disk evolution in Cygnus OB2

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Why low mass star formation?

Low mass star formation in massive clusters: Global star formation models

TRAPPIST–South first light image of the Tarantula Nebula¹

Protoplanetary disk evolution²

Brown dwarf formation³

Role of stellar feedback on low mass and sub-stellar realm

IMF in sub-stellar regime⁴

HSC observations of a feedback driven protoglobular cluster 'Cygnus OB2'

- A young massive Galactic proto-globular cluster at 1.6 kpc, age: 3-5 Myrs.
- Rich in OB-stars (∼ 150 O-type stars) implying PMS population affected by extreme UV environment.
- The deepest and the widest optical ($r_2$, $i_2$, $z$ and $Y$-band) observations of any Galactic star forming region.
- ~ 713,529 sources observed in 1.5° diameter region centred at Cygnus OB2 with atleast 2-band detection with $27^m$ ($\leq 0.06$ $M_\odot$ at $Av=6^m$, $d=1.6$ kpc)
- HSC photometry ∼ $3^m$–$5^m$ deeper than existing PanSTARRS and GTC/OSIRIS photometry.

Top: Histogram shows the detection limit in individual HSC filters. Bottom: Histogram shows comparison between HSC ($26.7^m$) and existing GTC/OSIRIS ($23.7^m$) and Pan-STARRS ($21.7^m$) photometry.

We acknowledge the HSC helpdesk and IUCAA cluster computing facility for the HSC data reduction.
Disk population in Cygnus OB2

- \( \sim 4200 \) disk-bearing sources identified in the entire region.

- Approximately, 65% of disk bearing sources have age < 3 Myrs and mass < 0.5 \( M_\odot \).

\[ ([K-3.6]-(Y-K)) \]

Two-color plot overplotted with identified Class I and II YSOs.

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A clustering of disk sources is observed towards the centre of Cygnus OB2.

We perform a deep multi-wavelength study with deep HSC optical, UKIDSS NIR and Spitzer MIR data to identify disk-bearing sources in the feedback affected environment of Cygnus OB2.

Sources reaching down to brown dwarf limit ($\leq 0.07 M_\odot$) have been detected with our Subaru HSC optical data.

We identify $\sim 4200$ disk bearing sources with 65% of them with age $< 3$ Myrs and mass $< 0.5 M_\odot$.

We attempt to segregate cluster members from contaminants using machine learning techniques.

Further, we aim to analyse the variation of circumstellar disk fraction as a function of age and mass.

We also aim to identify sub-stellar sources, star to brown dwarf ratio and obtain the IMF Cygnus OB2.

References