Pre-main-sequence population and star formation in the cluster IC1805

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INTRODUCTION

• Most of the stars form in clusters or groups (Lada & Lada 2003).
• They share the same parental heritage but differ in mass and spectral types (SpT).
• Massive stars (>8 $M_\odot$, SpT earlier than B2) influence their vicinity.
Influence of massive star on natal molecular cloud
Radiation Driven Implosion (RDI)

- H II region expands in an inhomogeneous medium
- Compression of pre-existing Dense clumps by ionization / shock front.
- Implosion can lead to the formation of a ‘globule’ surrounded by a dense ionized gas forming a ‘bright rim’. (Bertoldi 1989, Lefloch & Lazareff 1994)

Observational signatures: Asymmetric distribution of YSOs
Example: Bright-rimmed clouds which are located at the periphery of HII regions.

Sugitani et al. (1995)
Collect and Collapse

Observational Signatures: Massive condensations or young stars at the periphery of HII region.
W4 HII Region and Cluster IC 1805
W4 HII region

- Excited by the massive stars of young open cluster IC 1805
- Dozens of massive stars (Massey et al. 1995)
- Consists of many globules and bright-rimmed clouds
- BRC 5 and BRC 7 possess IRAS sources just inside their rims
Age gradients in BRC 7 & BRC 5

Panwar et al. (2014)
**W4 HII Region and Cluster IC 1805**

- Well known high-mass and intermediate-mass population but low-mass stellar population is poorly studied.

- Our aim: to unravel the low-mass stellar population using Spitzer-IRAC/MIPS, 2MASS JHK; V,R observations from CFHT archive.
Why low-mass young stars identification is important?

Census of young low mass stars in star forming regions can be used to

➢ Trace the recent star formation sites

➢ Study the star formation history of the region,

➢ Influence of massive stars on subsequent star formation and evolution of circumstellar disks
Young stellar objects (YSOs)

Class 0
- $T_{\text{bol}} < 70 \text{ K}$, $M_\ast << M_{\text{env}}$
- $< 30,000 \text{ yr}$

Evolved Accreting Protostar
- $T_{\text{bol}} \sim 70-650 \text{ K}$, $M_\ast > M_{\text{env}}$
- $\sim 200,000 \text{ yr}$

Classical T Tauri Star
- $T_{\text{bol}} \sim 650-2880 \text{ K}$, $M_{\text{Disk}} \sim 0.01 M_\odot$
- $\sim 1,000,000 \text{ yr}$

Weak T Tauri Star
- $T_{\text{bol}} > 2880 \text{ K}$, $M_{\text{Disk}} < M_{\text{Jupiter}}$
- $\sim 10,000,000 \text{ yr}$
YSOs Identification

- IR observations using existing ground based and space based facilities
W4 HII Region and Cluster IC 1805
Low-mass stars with circumstellar disks identified using various 2MASS/IRAC/MIPS color-color criteria (Gutermuth et al. 2007)
W4 HII Region and Cluster IC 1805

Cluster radius $\sim 9'$
YSOs Identification

- IR observations using existing ground based and Space based facilities
- X-ray Observations: YSOs are known to emit X-rays at levels that can range many orders of magnitude above main sequence stars (Preibisch et al. 2005; Feigelson et al. 2007). Thus, X-ray observations can efficiently identify YSOs in molecular clouds
- Observations at visible wavelengths
Age/ Mass of the Class I/II sources in the Cluster IC 1805: color-magnitude diagram (CMD)

Distance: 2 Kpc
E(B-V): 0.7 mag
Class III sources in the cluster IC 1805

- X-ray sources from Townsley et al. (2014)
Mass Function of the YSOs

• for stars in the mass range 2.5 - 30 $M_\odot$ :
  $\Gamma = -1.38 \pm 0.19$
  (Ninkov et al. 1995)

• for stars $>10$ $M_\odot$ :
  $\Gamma = -1.3 \pm 0.2$
  (Massey et al. 1995)
Disk evolution of YSOs in the cluster
Disk fraction variation in the cluster
Surface density distribution of the YSOs in the region
Summary

The cluster radius is estimated as 9 arcmin (~5 pc).

We identified and characterised ~380 low-mass young stars using various 2MASS/IRAC/MIPS color-color criteria and x-ray data.

The age and mass of the identified YSO candidates are in the range of 0.1 - 5 Myr and 0.3 - 2.5 Msun, respectively.

Mass function slope of our YSO sample is close to the Salpeter value.

Diskless sources are relatively older compared to the disk bearing sources.

Surface density distribution of the YSO candidates suggests that IC 1805 could have formed in a filamentary cloud.
Collaborators

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