PROTOPLANETARY DISKS FRACTION IN CYGNUS OB2 FROM THE CYG-OB2 CHANDRA LEGACY SURVEY

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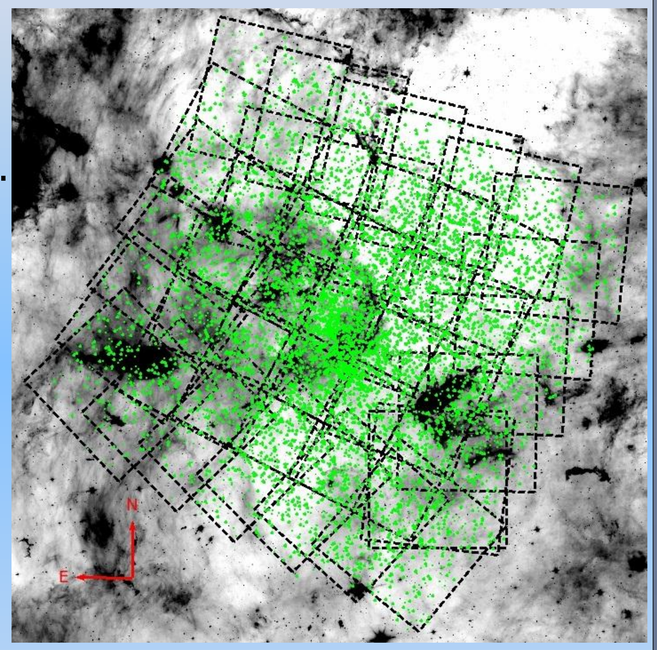
1. ABSTRACT

Because of their energetic radiation and violent winds, massive OB stars should have multiple feedback on the star formation process in their parental cloud: driving its collapse and triggering new episodes of star formation (1); removing the intracluster cloud halting the star formation process; inducing the photoevaporation of nearby circumstellar disks (2) and protostellar envelopes (3). Cygnus OB2 is the best target to study star formation in presence of massive stars. It is the most massive cluster in the Cygnus-X region at about 1450 parsec from the Sun (4), closer to the Sun than any other massive young cluster, and hosting more than 2000 OB stars (5) and a rich pre-Main Sequence population aged between 3-5Myrs (6). In this preliminary study we find evidence that the disk fraction in CygOB2 decreases close to O stars, as expected if the circumstellar disks in low-mass members have been photoevaporated by the radiation from massive stars.

2. The Chandra Cygnus OB2 Legacy Survey

36 overlapping Chandra/ACIS-I observations of a 1 deg^2 area centered on CygOB2. Each pointing is 30Ksec, so in the central 0.5 deg^2 a 120Ksec depth has been reached. The observation is complete at 1 $M_\odot$, with about 9000 sources detected. The survey is completed with:

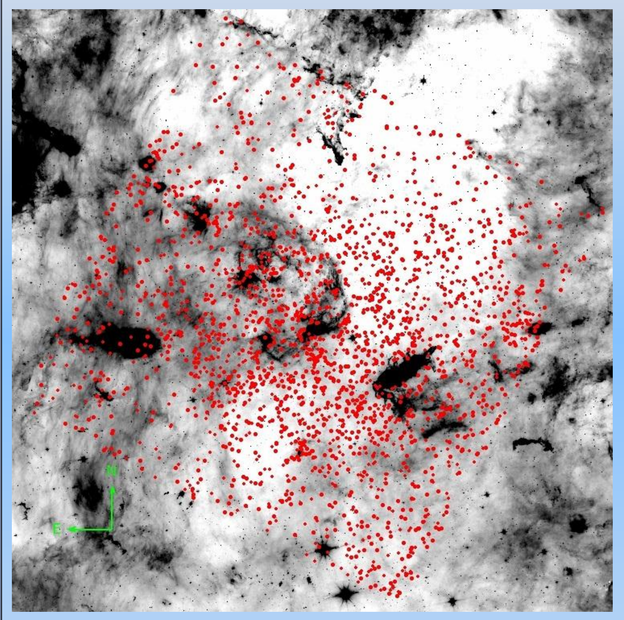
- Optical data in *r'i'z'* band from new OSIRIS observations at the 10.4m GTC (central 40'×40' area).
- Optical data in *r'i'Halpha* from IPHAS survey (7).
- NIR data from UKIDSS/GPS catalog in *JHK* bands.
- NIR data from the The Spitzer Space Telescope Cygnus-X Legacy Survey (8).



Spitzer [8.0] image of CygOB2 with ACIS-I pointings (black) and the detected X-ray sources (green)

3. Selection of disk-bearing members

- Stars with infrared excesses selected from their position in various infrared color-color diagrams.
- Criteria to remove the extragalactic contaminants also applied.
- A total of 2190 candidate stars with disks selected.



Spatial distribution of the candidate stars with disks (red dots)

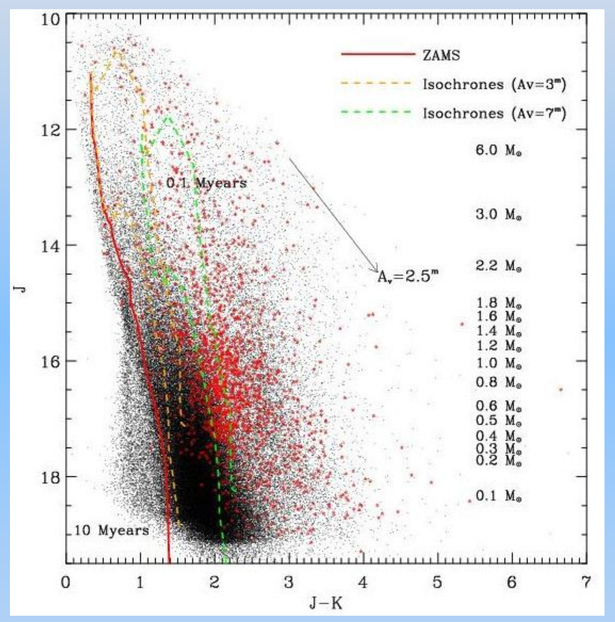
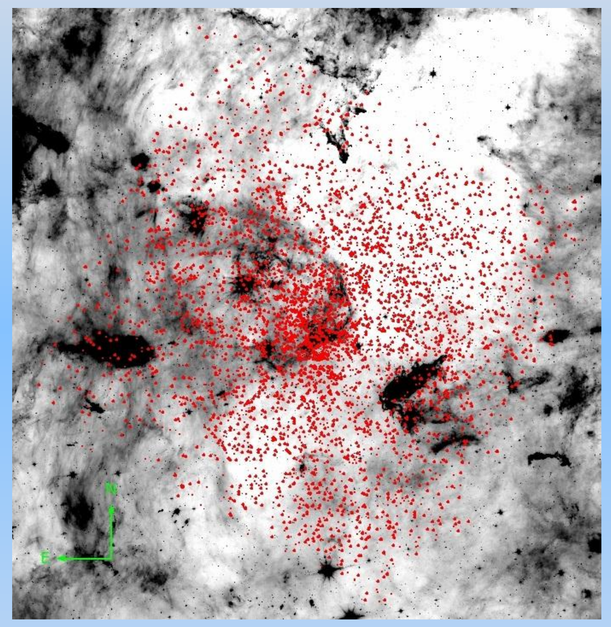


Diagram of all the NIR sources and the candidate stars with disks (red); masses from the 3Myrs isochrone (Av=7)

4. Selection of disk-less members

- X-ray sources with one stellar counterpart (optical and/or infrared).
- Stellar counterparts with colors typical of a cluster member (no contaminant objects).
- A total of 4626 candidate stars without a disk selected.



Spatial distribution of the candidate members without a disk (red dots)

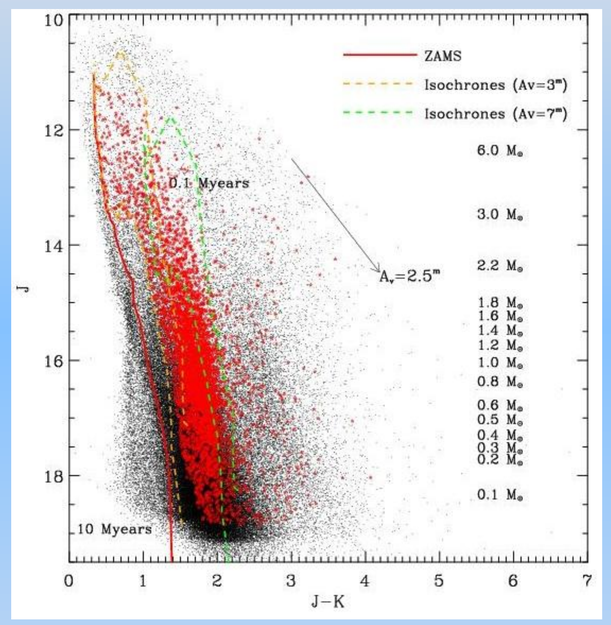
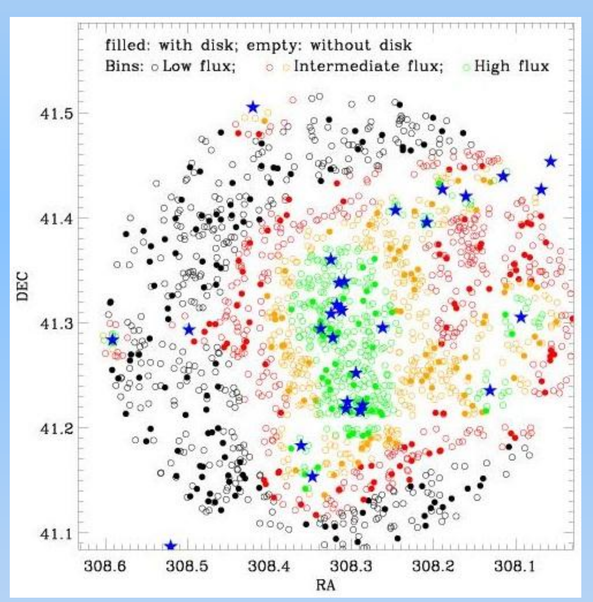


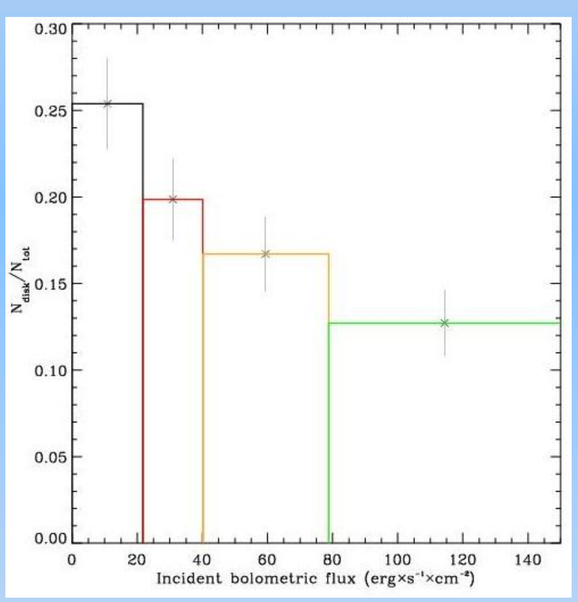
Diagram of all the NIR sources and the candidate members without a disk (red); masses from the 3Myrs isochrone (Av=7)

4. Spatial variation of disk frequency

- Calculated the bolometric flux incident on each cluster member (with J<17) emitted by the O stars associated with CygOB2.
- Divided the incident flux values in 4 bins and calculated the disk fraction for each bin of incident flux.
- Projected distances used.
- We found:
  - disk fraction decreases with increasing the incident flux from O stars
  - this is compatible with photoevaporation of the disks induced by the O stars
  - No evidence of age difference between stars falling in the four bins



Spatial distribution of the cluster members used to study the disk fraction, with a color code corresponding to the four flux bins. O stars: blue symbols



Histogram of the disk fraction as a function of the incident flux emitted by O stars

REFERENCES:

(1) Hester & Desch 2005; (2) Störzer & Hollenbach 1999; (3) Hester et al. 1996; (4) Hanson et al. 2003; (5) Knoedleseder et al. 2000; (6) Wright et al. 2009; (7) Drew et al., 2005; (8) Kraemer et al. 2010.