NIR study of the fainter stellar populations in Cygnus OB2

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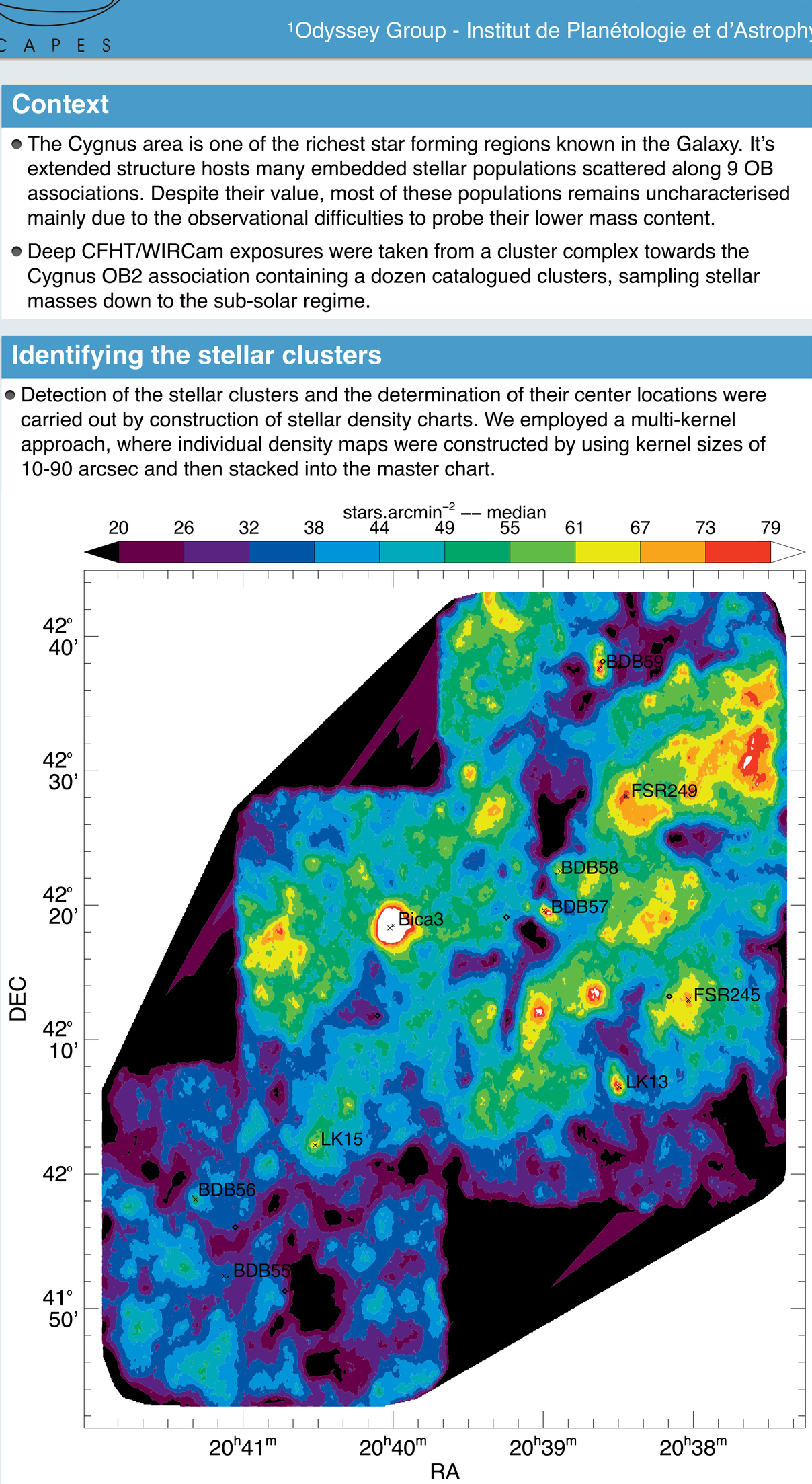
Context

- The Cygnus area is one of the richest star forming regions known in the Galaxy. It's extended structure hosts many embedded stellar populations scattered along 9 OB associations. Despite their value, most of these populations remains uncharacterised mainly due to the observational difficulties to probe their lower mass content.
- Deep CFHT/WIRCam exposures were taken from a cluster complex towards the Cygnus OB2 association containing a dozen catalogued clusters, sampling stellar masses down to the sub-solar regime.

Identifying the stellar clusters

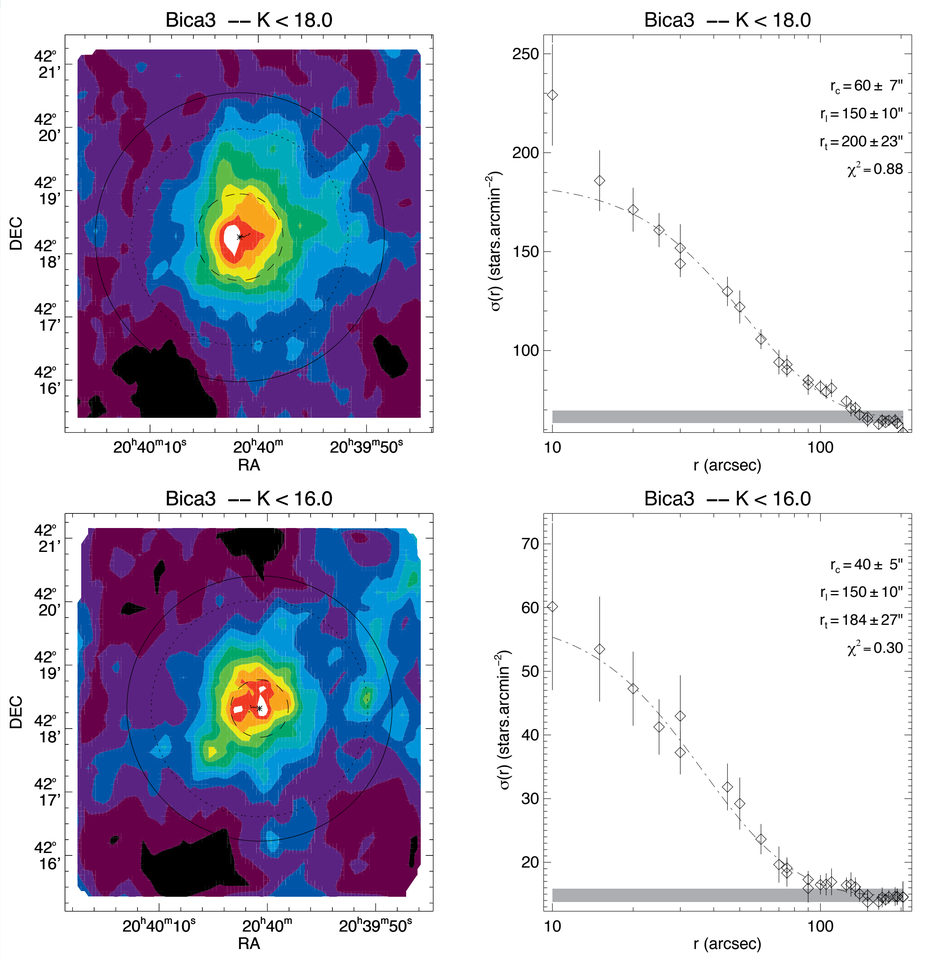
- Detection of the stellar clusters and the determination of their center locations were carried out by construction of stellar density charts. We employed a multi-kernel approach, where individual density maps were constructed by using kernel sizes of 10-90 arcsec and then stacked into the master chart.



STELLAR DENSITY MAP OF THE OBSERVED DATA SHOWING THE KNOWN STELLAR CLUSTERS. SEVERAL OTHER DENSITY ENHANCEMENTS CAN BE IDENTIFIED, AND MAY BE POSSIBLY RELATED TO UNKNOWN

Structural parameters

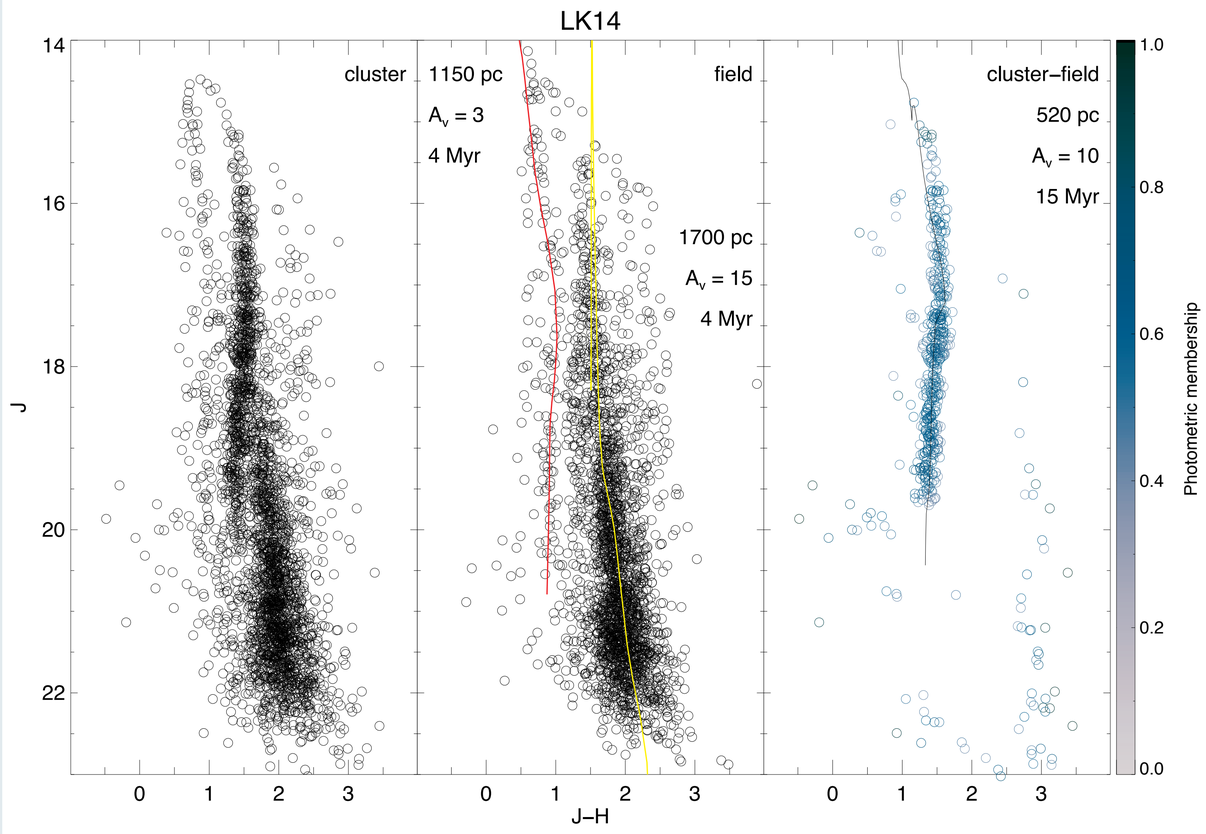
- Structural parameters were derived by a king-profile fitting over the magnitude limited radial density profile of the clusters. Different magnitude cuts were used to compare the properties of the general population and the brighter population.



KING-PROFILE FITTING OVER RADIAL DENSITY PROFILE OF BICA3 CLUSTER AT DIFFERENT MAGNITUDE CUTS. THE CONSIDERABLE REDUCTION IN THE CLUSTER'S CORE RADIUS SIGNALS THAT THE BRIGHTER STARS ARE MORE DENSELY PACKED THAN THE FAINTER ONES.

Colour-magnitude diagrams

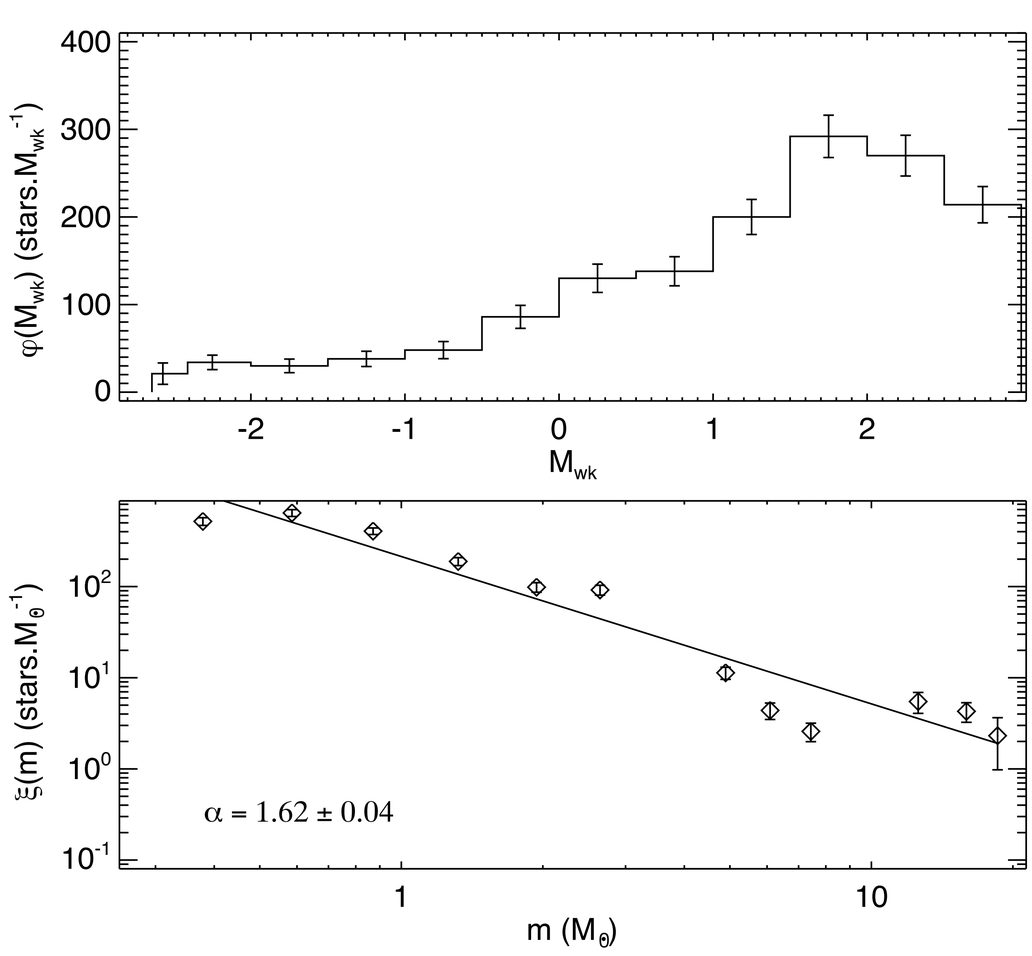
- Determination of age, distance and reddening of the clusters were done by isochrone fitting (PARSEC model) in the colour-magnitude diagrams. A photometry based decontamination method (Maia et al. 2010) were employed to mitigate the field-contamination.



COLOUR-MAGNITUDE DIAGRAMS OF THE LK14 CLUSTER (LEFT), ITS SURROUNDING FIELD (MIDDLE) AND THE DECONTAMINATED ONE (RIGHT). MULTIPLE YOUNG FIELD POPULATIONS (RED AND YELLOW ISOCHRONES) ARE MIXED WITH THE CLUSTER POPULATION (BLACK ISOCHRONE).

Mass distribution

- Mass distribution of the clusters were derived by using the mass-luminosity function of the fitted isochrone to convert its luminosity function into a mass distribution. A mass function of the form $\xi(m) = m^{-\alpha}$ were fitted to the general trend of the distribution.
- The total cluster mass were also derived by integrating the mass distribution down to the hydrogen burning limit.



MASS DISTRIBUTION OF THE BICA3 CLUSTER (BOTTOM) DERIVED FROM ITS LUMINOSITY FUNCTION (TOP). A MASS FUNCTION FIT WERE ALSO PERFORMED YIELDING THE GENERAL SLOPE OF THE MASS DISTRIBUTION.

Results

- We have found hints of mass segregation in 6 (out of 12) known clusters in the region, presenting masses from 200-2000 solar masses and ages up to 2.5 Myr. All these targets present general mass function slopes greater than 1.5.
- We have found 3 young clusters (ages: 1-15 Myr) presenting high extinction (A_v: 9-15) at distances between 500-600pc. These may be related to a foreground molecular cloud (Cygnus Rift), that also harbours star formation.
- We have found 5 very young clusters (ages: 0.5-2.5 Myr) presenting high extinction (A_v: 9-15) at distances between 1.0-1.7kpc. These clusters appear to belong to the Cygnus OB2 association, but are slightly closer than expected.
- We have found 4 very young clusters (ages ~ 1 Myr) presenting only moderate extinction but located at distances beyond 4 kpc. These clusters do not belong to the Cygnus OB2 association and might be related to other structures along the spiral arm.

Acknowledgements

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