W3 MAIN

A TEST CASE FOR CLUSTER FORMATION

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Introduction: Embedded clusters play an important role in the star formation process: it is in these embedded clusters where most, or even all, young stars are born. In such star-forming regions, stars interact via stellar feedback and dynamical interactions with each other and with the surrounding interstellar medium. We use the embedded cluster W3 Main as a test case to derive constraints on the formation of embedded clusters. Deep near-infrared JHK imaging of W3 Main as well as K-band multi-object-spectroscopy of the massive stars using LUCI1 at the LBT provide us with a detailed picture of this complex region.

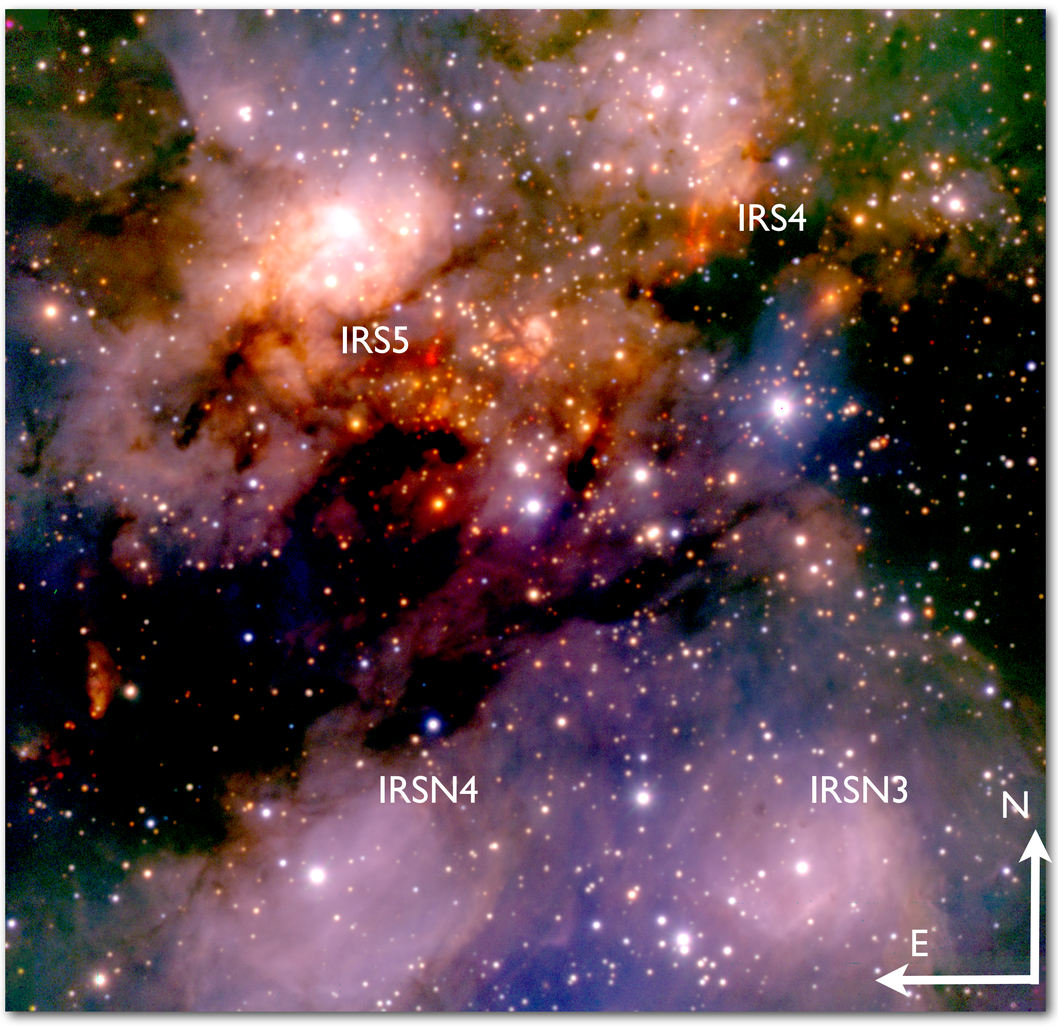
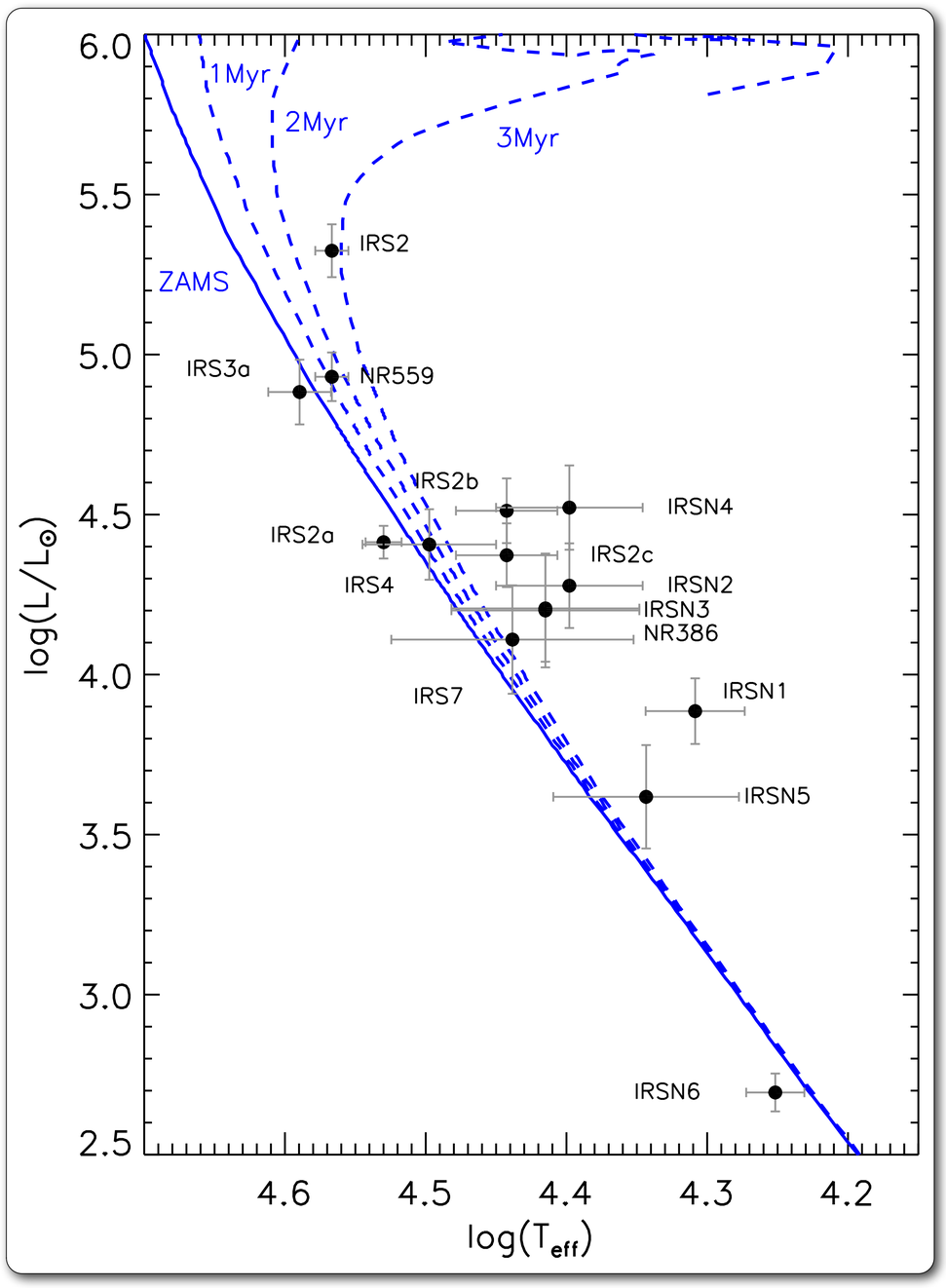


Fig 1: JHKs color composite of the central 2.5 pc (4.5') of W3 Main taken with LUCI1 at the LBT.

Age spread: The age of the most massive O star IRS2, and the nature of the HII regions (Tieftrunk et al, 1997) suggest that star formation in W3 Main started at least 2-3 Myrs ago (Bik et al, 2012), and due to dynamical interactions with dense molecular cores in the surroundings and possible internal triggering, star formation is continuing until the present day. Currently the youngest population is located in the center and may be the latest dense concentration of molecular gas in the contracting cloud, forming the youngest sub cluster around IRS5. The young age of the central region is confirmed by a higher disk fraction compared to the outskirts (Bik et al, submitted).

Fig 2: Herzsprung Russell diagram of the massive stars in W3 Main. Over plotted in blue the isochrones from Brott et al, 2011 for non-rotating stars (Bik et al, 2012).



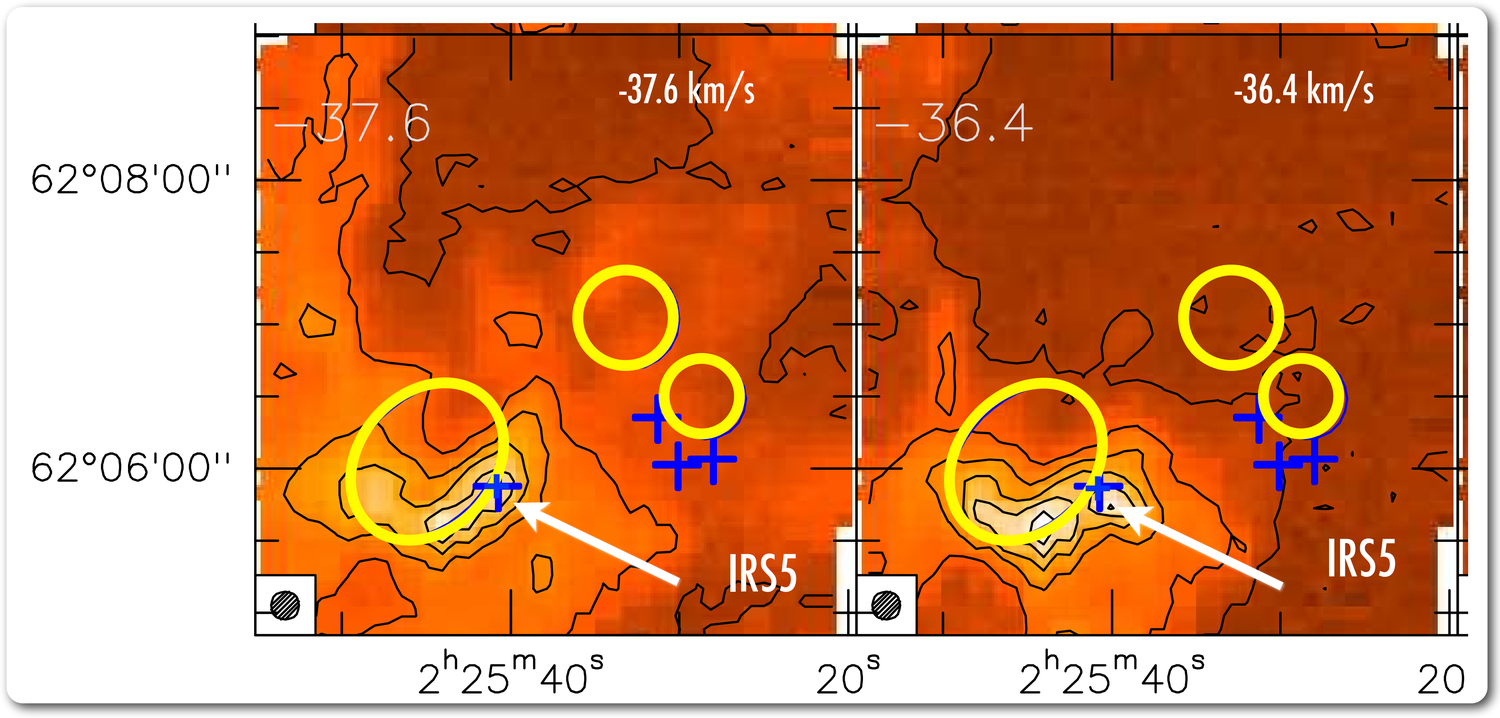
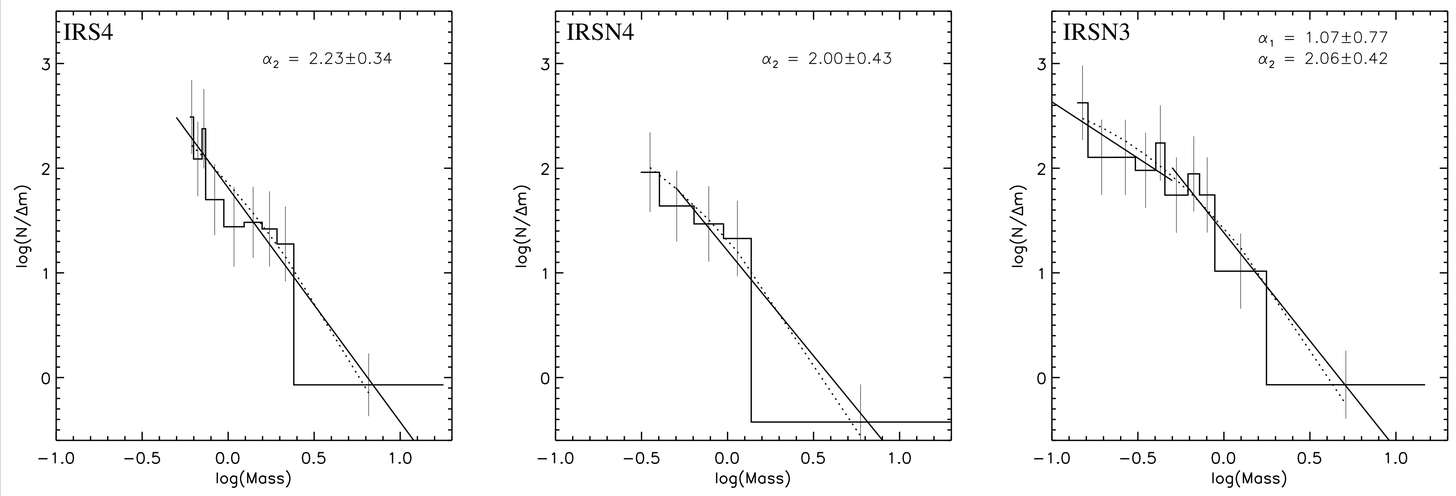


Fig 3: ^{13}CO(2-1) channel maps of the central region of W3 Main (Wang et al, 2012). The yellow ellipses show the most important HII regions and the blue crosses the position of mm cores.

Mass functions were constructed from the completeness corrected JHK photometry catalogue of three subregions in W3 Main. The high-mass slopes are consistent with Salpeter. In the region around IRS3 we detect the most massive brown dwarfs and identify the break in the mass function at 0.5 Msun, consistent with a Kroupa IMF.

Fig 4: Mass functions of three subregions in W3 Main (Bik et al, submitted).



References:
Bik et al, 2012, ApJ,744, 87
Wang et al, 2012, ApJ, 754,87
Bik et al, submitted