OBSERVATIONS OF BLUE MASSIVE STARS WITH ELT-HARMONI

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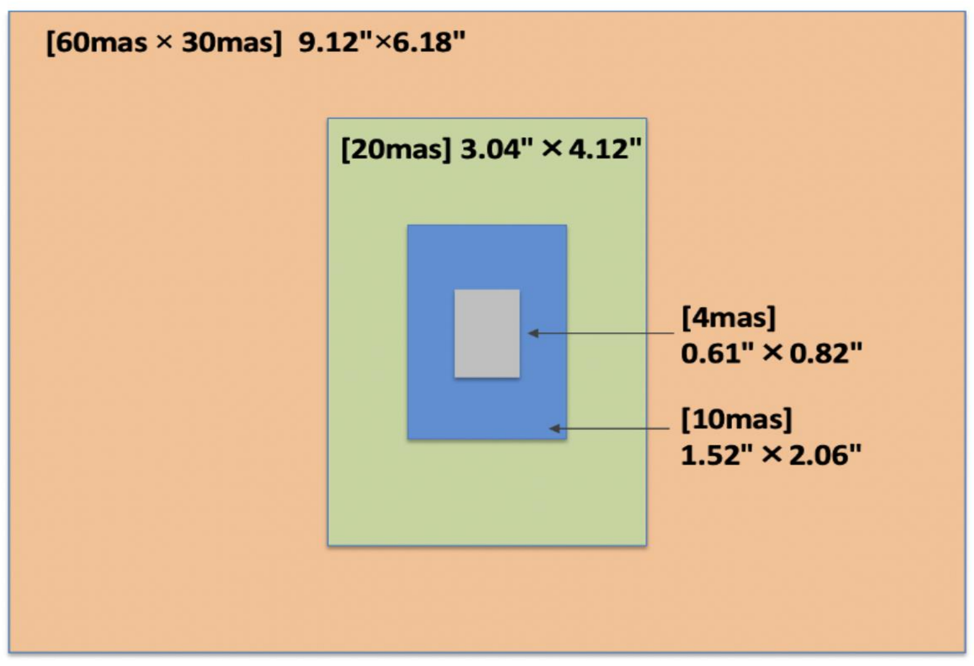
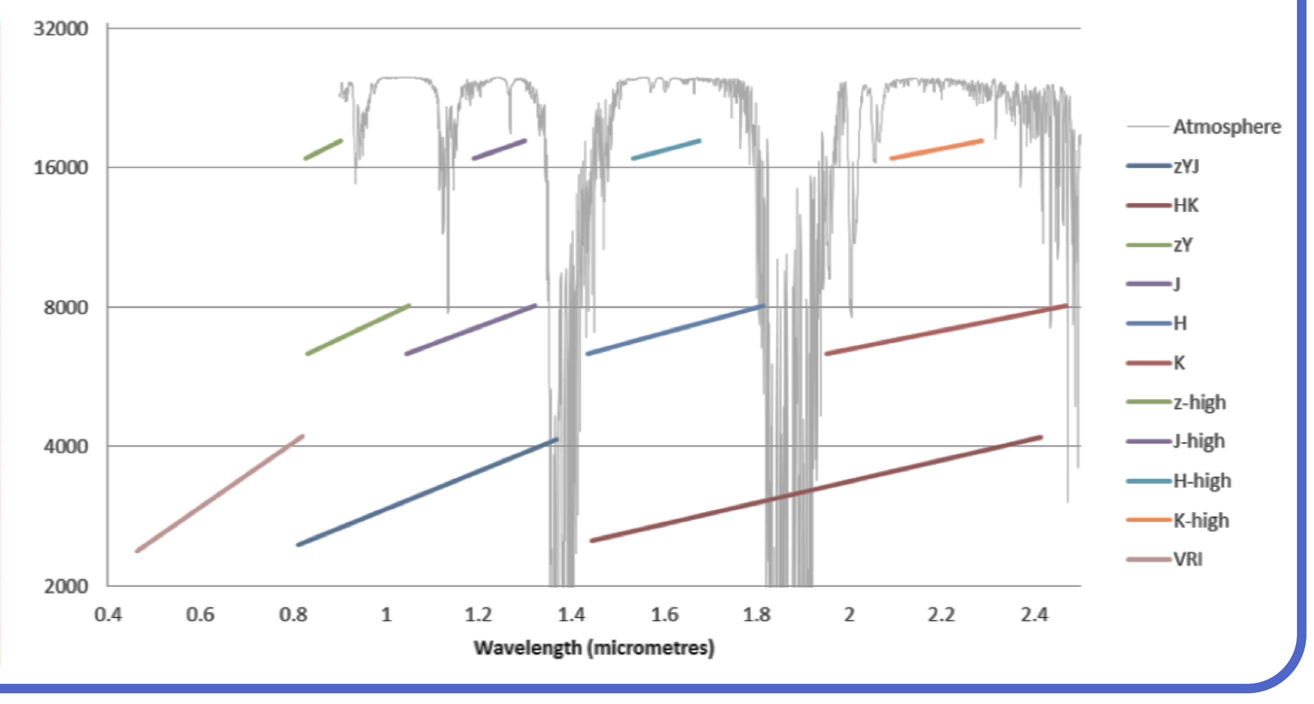
HARMONI at the ELT: Performance

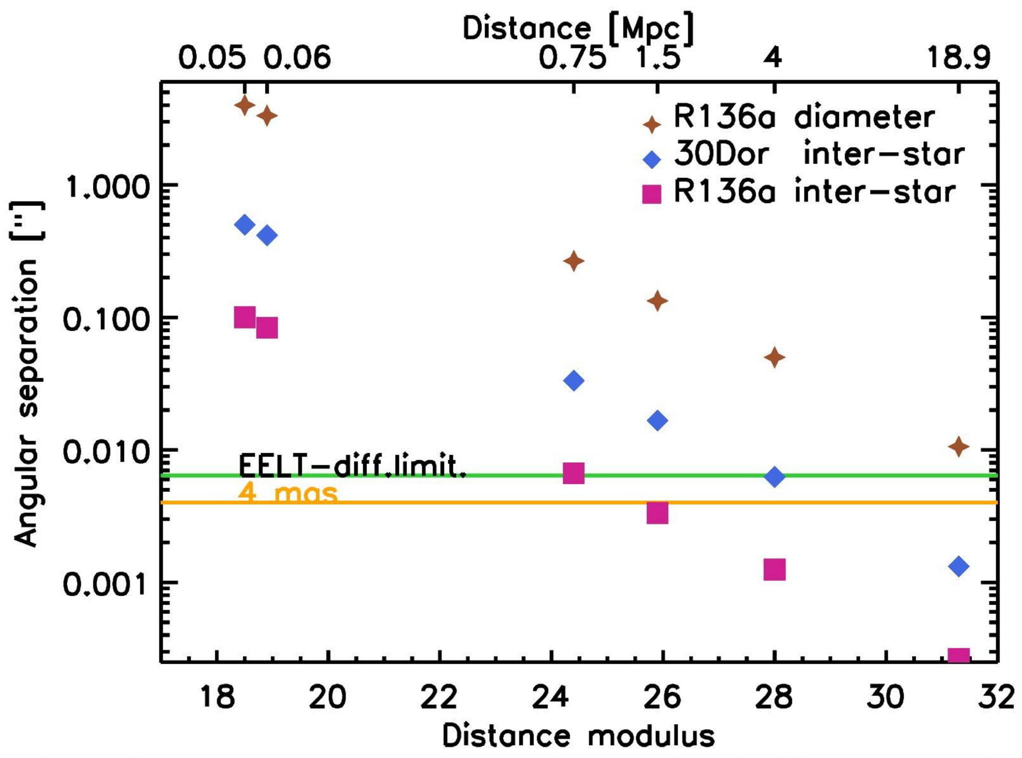
With 39m diameter and assisted by powerful adaptive optics systems, the **European Extremely Large Telescope (ELT)** will offer revolutionizing sensitivity and spatial resolution at optical and near infrared (NIR) wavelengths. First light is expected at late-2028.

HARMONI is an integral field unit (IFU) spectrograph planned for the first generation of ELT instruments. HARMONI's design will ensure fully profiting from ELT's maximum spatial resolution while delivering spectra for each spaxel. This will be achieved thanks to a collection of plate scales (and fields of view, **left** figure), and low-, mid- and high- spectral resolution gratings (**right**).



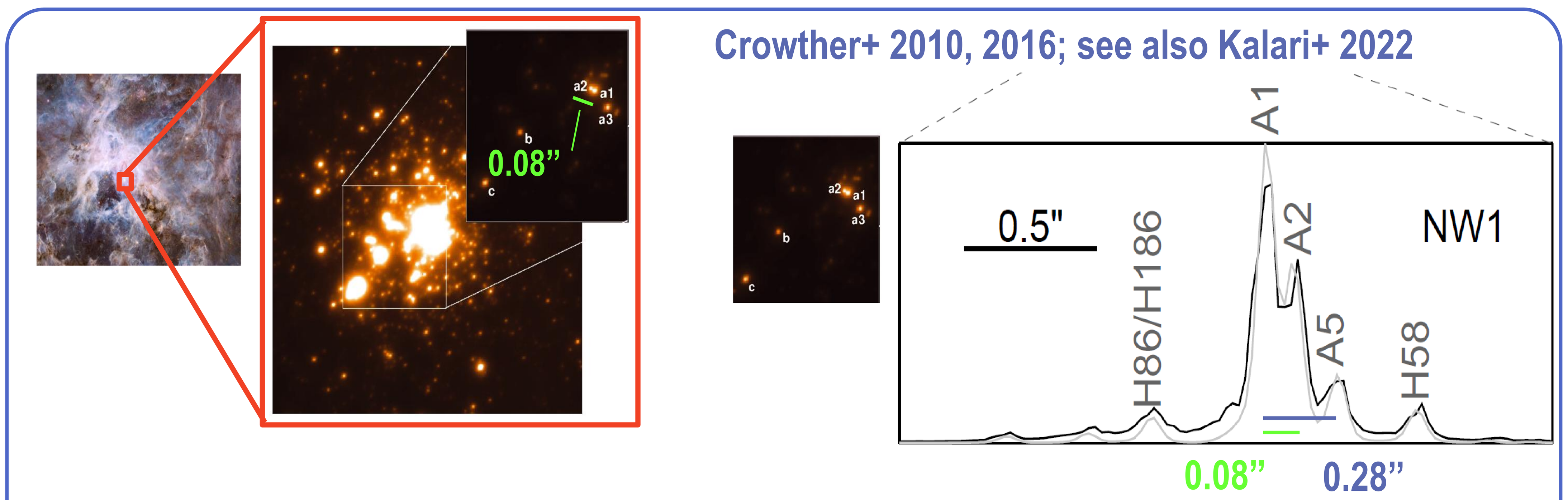


Breaking down R136a and analogs in the Local Group



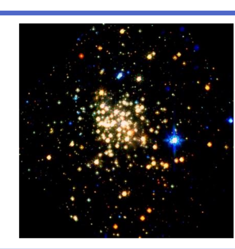
Garcia+ 2021, adapted

The 4 miliarcsecond (mas) scale fully samples the Airy disk at 1μm. HARMONI will break down R136a-like clusters as far as the outer Local Group, enabling studying the impact of environment (star-formation rate, metallicity) on the upper-end of the initial mass function, thus setting observational constraints to the theories of massive star formation.



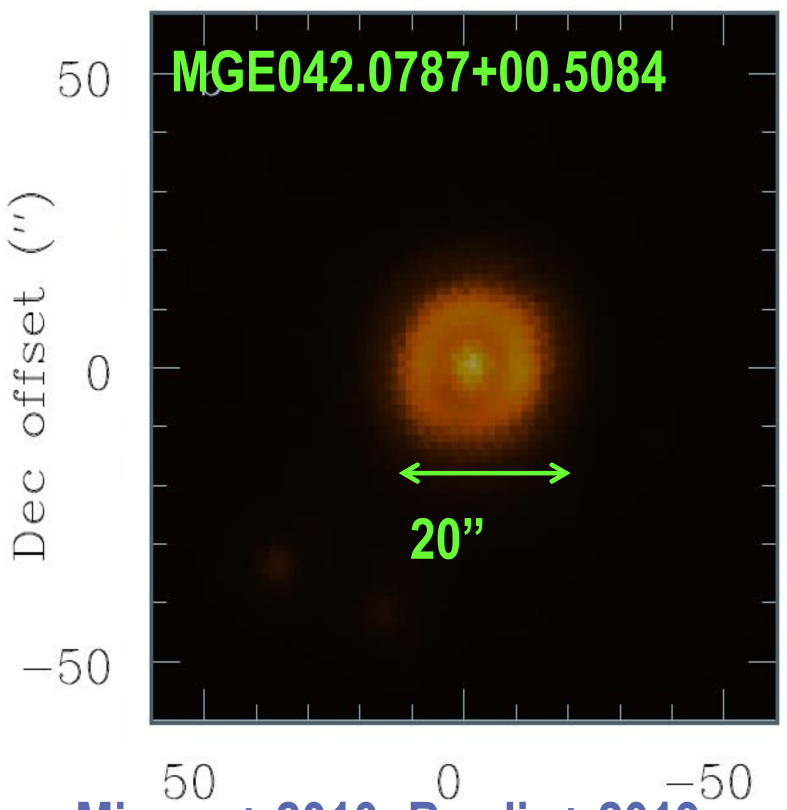
HARMONI will amply **resolve the core of R136a**, thus deciphering if the ≥150 $M_\odot$ stars A1 and A2 are truly single and whether there is an underlying cluster.

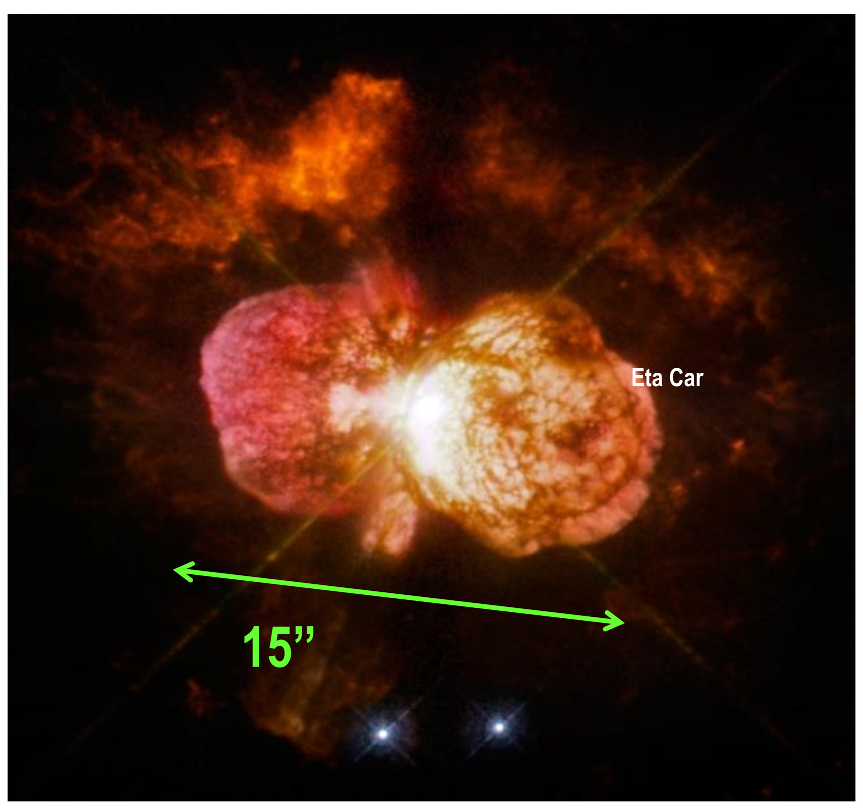
HARMONI will also break down the core of the Milky Way massive clusters (the Arches central part subtends 10"x10", e.g. Figer+ 2002).



Circumstellar structures

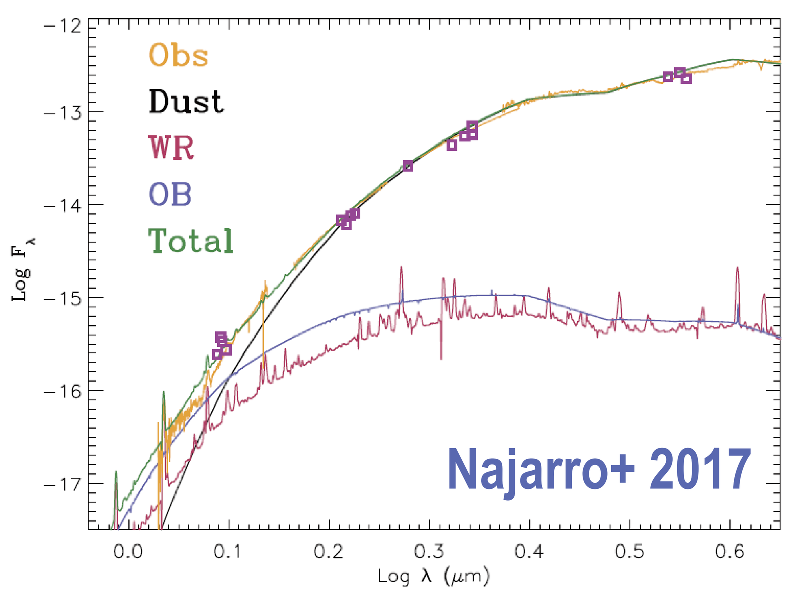
Luminous Blue Variables (LBVs) experience strong occasional episodes of mass ejection with unknown driving mechanism.
LBVs have been recently proposed to be the result of binary interaction or stellar mergers (e.g. Smith & Trombleson, 2015). HARMONI will resolve structures around LBVs and also provide high spectral resolution spectroscopy of the central stars, hence helping **determine the origin of these structures in eruptions or non-conservative binary mass transfer / stellar mergers.**

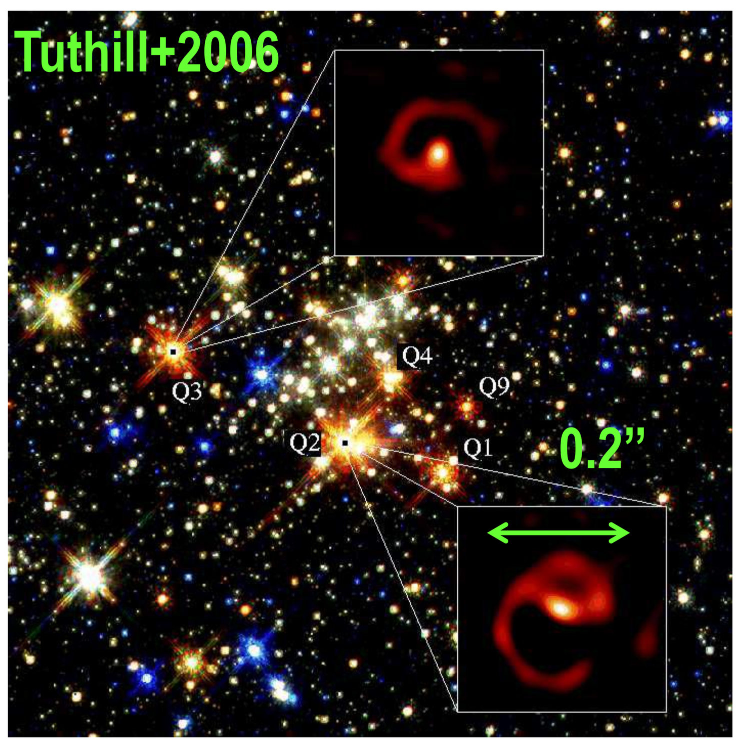


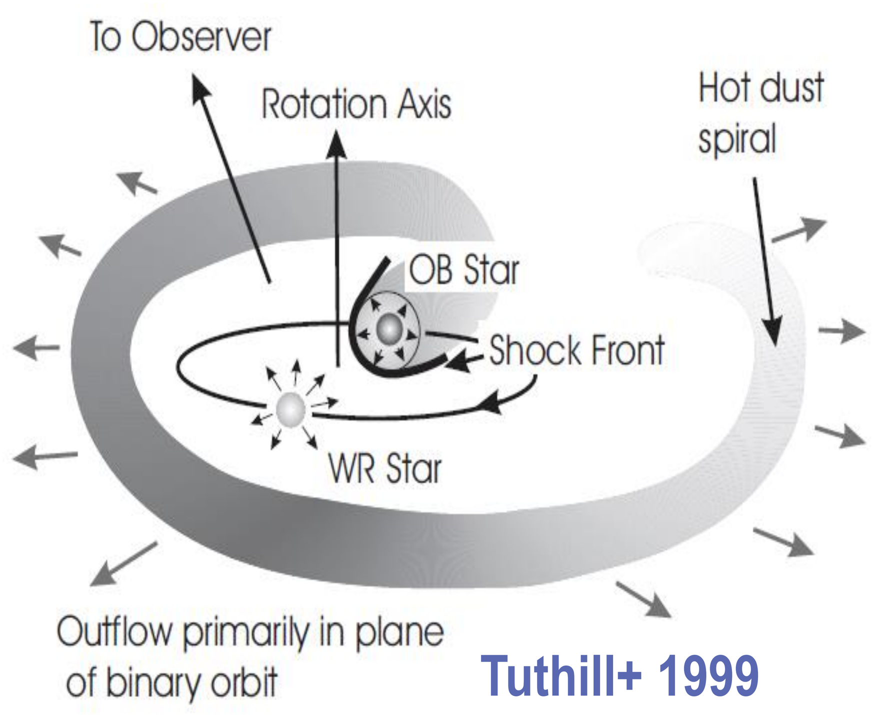


Mizuno+ 2010; Bordiu+ 2019

Speckle interferometry revealed the Quintuplet "stars" as pinwheel structures (Tuthill+ 2006), with O-stars orbiting Wolf-Rayets (Najarro+ 2017), and sites of dust production. HARMONI will disentangle the dust and stellar components, making possible **to broadly characterize the physical properties of the central binary system.**







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