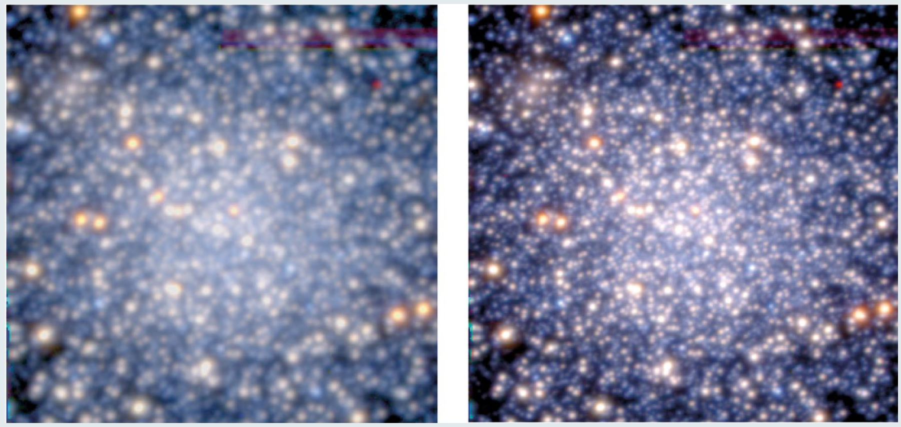
INSTRUMENTATION

# Vision of a MUSE

Approximately a year ago, the integral field spectrograph MUSE on the fourth unit telescope of ESO's Very Large Telescope was equipped with its Adaptive Optics Facility. Adaptive optics (AO) techniques compensate for the blurring effect of the Earth's atmosphere, resulting in sharper and higher-contrast images. Sebastian Kamann and colleagues (*Mon. Not. R. Astron. Soc.* **480**, 1689–1695; 2018) have used MUSE to observe an extragalactic open star cluster, NGC 419, in the Small Magellanic Cloud, to determine the rotational properties of the cluster's stars (pictured with, right, and without, left, AO compensation).



Credit: Oxford Univ. Press

NGC 419 is an intermediate-age (<2 Gyr) massive cluster that exhibits a somewhat common phenomenon termed the extended main-sequence turn-off (extended MSTO), which manifests itself as a spread in the Hertzsprung–Russell diagram at the point where main sequence stars join the giant branch. In a single star cluster where stars are (supposedly) the same age, stars of the same mass should follow the same evolutionary track. A spread or extension would be an indication that some other mechanism was affecting the effective temperature of the stars, with currently favoured explanations including there being a range of stellar ages (up to 100 Myr) in the cluster or a range of stellar rotation rates.

During instrument commissioning, Kamann et al. used MUSE's GALACSI AO module to halve the width of the instrument's point spread function, significantly increasing the number of resolved stars in the observations of NGC 419, more than doubling the number of extracted spectra (from 2,254 to 5,015), and improving the signal-to-noise ratio (S/N). Making a S/N cut left 3,321 stars with good quality spectra, from which two sub-samples were taken to represent the red and the blue sides of the MSTO. Template spectra were then fitted to the observational data to obtain effective stellar temperatures ($T_{\text{eff}}$) and rotational velocities ($V$) for the two populations, resulting in $T_{\text{eff}} = 7{,}690 \pm 20$ K and $V\sin i = 87 \pm 16$ km s$^{-1}$ for the blue component and $T_{\text{eff}} = 7{,}420 \pm 20$ K and $V\sin i = 130 \pm 22$ km s$^{-1}$ for the red component, where $i$ is the inclination to the line of sight. Given the relative difference in rotational velocities between these two groups of stars (which should be robust to systematic effects), Kamann et al. tentatively conclude that stars on the red side of the main sequence rotate faster than stars on the blue side on average, reasonably explaining the extended MSTO. ❐

Paul Woods

Published online: 3 September 2018
https://doi.org/10.1038/s41550-018-0572-3