Researchers explore statistical properties of early type stars derived from LAMOST DR8

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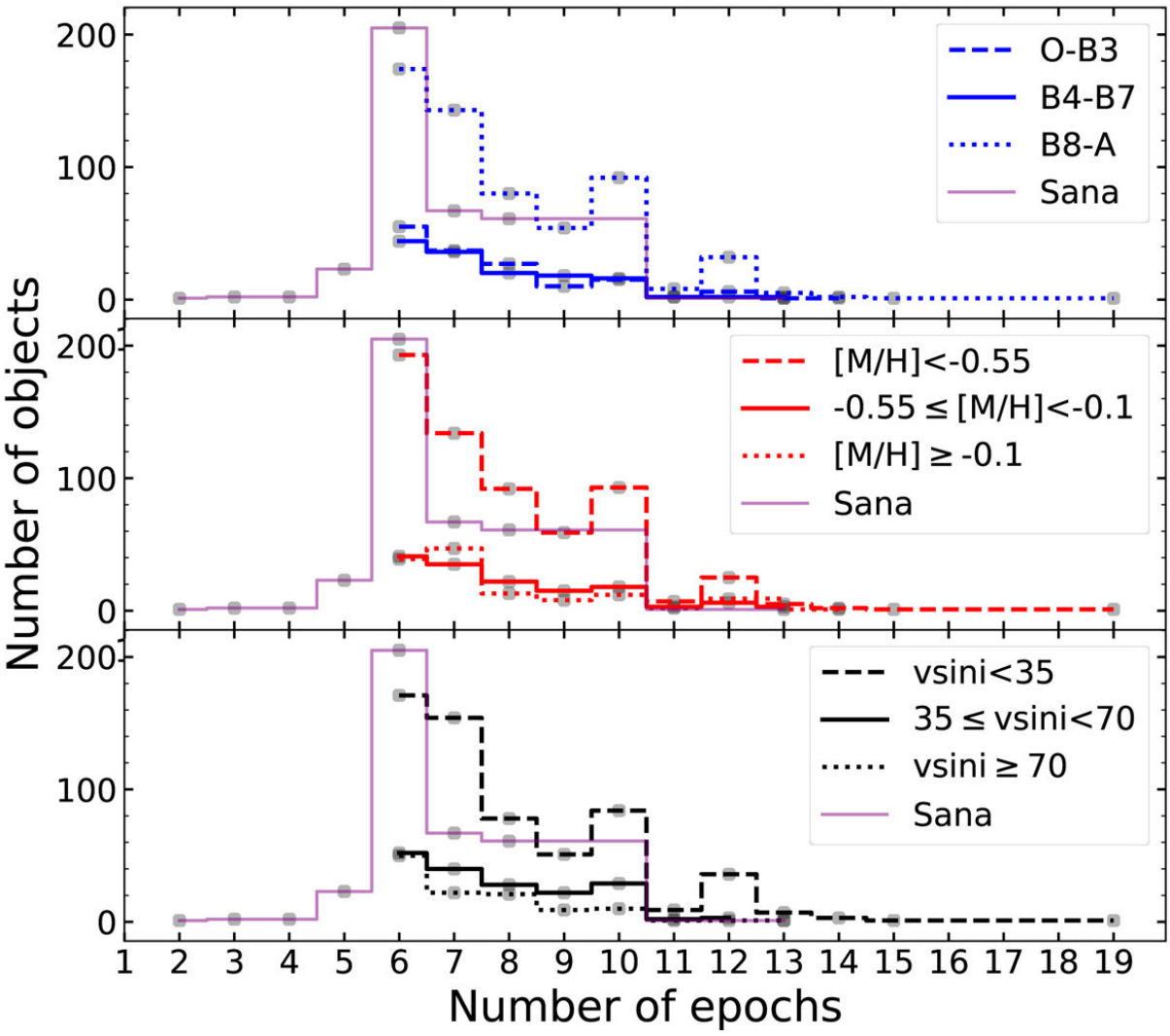

Number distribution for different groups based on T_{eff} (top panel), [M/H] (middle panel), and vsini (bottom panel). The solid purple line represents the observations of samples from Sana et al. (2013) in which about 93% of the

sample are from more than six observations. Credit: *Astronomy & Astrophysics* (2022). DOI: 10.1051/0004-6361/202244300

Researchers led by Ph.D. candidate Guo Yanjun from Yunnan Observatories of the Chinese Academy of Sciences (CAS) have explored the dependency of the intrinsic binary fraction on derived stellar effective temperature, metallicity and projected rotational velocity.

The study was published in *Astronomy & Astrophysics* on Nov. 4. It was based on the intrinsic binary fraction of massive stars from the LAMOST DR8. The researchers utilized the Medium Resolution Spectra (MRS) database to collect optical spectra of 886 early type stars, each with more than six observations.

Early type stars with spectral classification span from O-type to A-type are massive, with high effective temperatures. They contribute to the universe's re-ionization and may enrich metallicity in the galactic environment. Most early type stars are found in binary systems, and they likely evolve to compact binary systems, such as double black holes, double neutron stars, or neutron star and black hole binaries.

Statistical properties of early type massive stars, such as intrinsic binary fraction, distribution of orbital period and mass ratio, are often used as essential inputs for binary population synthesis models and are important tracers to investigate stellar formation. However, previous works were often limited by a small sample of observations or inconsistent data collected from various sources.

In this study, the researchers obtained observations for 886 early type stars from the database, and each target star has more than six spectra. Based on the derived stellar effective temperature, metallicity, and

projected rotational velocity, the researchers divided the sample into sub-groups. Radial velocity measurements of each target star were collected from a prior study led by Guo, and a set of Monte Carlo simulations were applied to the measurements to correct any potential observational biases in the sample.

The researchers found that the intrinsic binary fraction in the sample displayed an increasing trend toward a population with a higher effective temperature. The binary fraction could reach up to ?76% for O- and B-type stars while dropping to 48% for B- and A-type stars. A similar trend was found in the relationship between the intrinsic binary fraction and metallicity, in which the ratio achieved ?72% for metal-rich stars and degraded to 44% for metal-poor stars in the sample.

These results will be further applied to evolutionary models to constrain massive binaries' formation process and provide insights into compact binary formation scenarios.

More information: Yanjun Guo et al, The statistical properties of early-type stars from LAMOST DR8, *Astronomy & Astrophysics* (2022). DOI: 10.1051/0004-6361/202244300

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