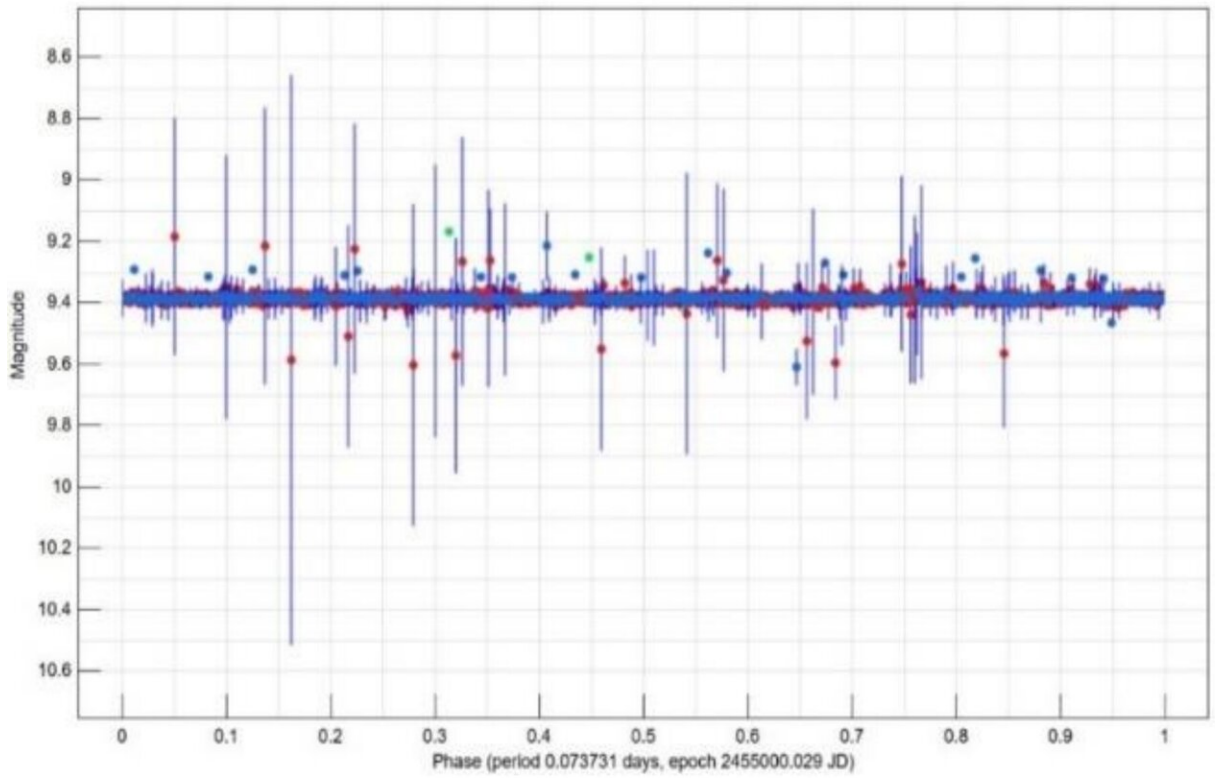
Study reveals nature of single-line spectroscopic binary star KIC 10417986

November 25 2022, by Li Yuan



Light curve of KIC 10417986 generated from SWASP. Credit: *Journal of Physics: Conference Series* (2021). DOI: 10.1088/1742-6596/1719/1/012017

Binary systems are ideal for accurately identifying basic physical parameters, such as mass, radius and luminosity, of stars. Pulsating variable stars are especially significant, as they offer means for detecting

stellar internal structure.

Studies of binary systems with δScuti star can lead to the accurate derivation of basic physical stellar parameters, and provide additional constraints for examinations of asteroseismology of pulsating components.

Recently, researchers led by Dr. Feng Guojie from the Xinjiang Astronomical Observatory (XAO) of the Chinese Academy of Sciences and their collaborators conducted time-domain spectroscopic observation of KIC 10417986 with the Nanshan 1.2-m Optical Telescope and Xinglong 2.16-m Telescope.

They obtained orbital parameters and stellar parameters of the binary system for the first time. They also extracted and preliminarily identified the pulsating frequencies and their modes by analyzing light curves from Kepler.

The study was published in *Research in Astronomy and Astrophysics*.

The researchers showed that KIC 10417986 is a single-line spectroscopic binary star, and derived its orbital parameters. "The orbital period is about 0.84495 days, which is different from the possible orbital period of 0.0737 days obtained from the Kepler light curves. The reliable orbital period provides strong assurance for identifying the pulsation frequencies correctly," said Dr. Feng.

Using synthetic spectra fitting technique, they determined primary atmospheric parameters, such as the effective temperature, surface gravity, metallicity and rotation velocity. From the single-lined nature and mass function of the star, the derived orbital inclination was 26 ± 6°, and the mass of the secondary was about 0.52 $M_\odot$, suggesting that it should be a late-K to early-M type star.

In addition, fourteen frequencies were extracted from Kepler light curves. Among them, six independent frequencies in the high-frequency region were identified as the p-mode pulsations of δ Scuti star, and one independent frequency in the low-frequency region. The latter is probably the rotational frequency due to the starspots, which indicates magnetic activity and surface differential rotation of the primary component.

More information: Guo-Jie Feng et al, KIC 10417986: Spectroscopic Confirmation of the Nature of the Binary System with a δ Scuti Component, *Research in Astronomy and Astrophysics* (2022). DOI: 10.1088/1674-4527/ac8b5c

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