Researchers find stratified structure in broad-line region for changing-look active galactic nuclei

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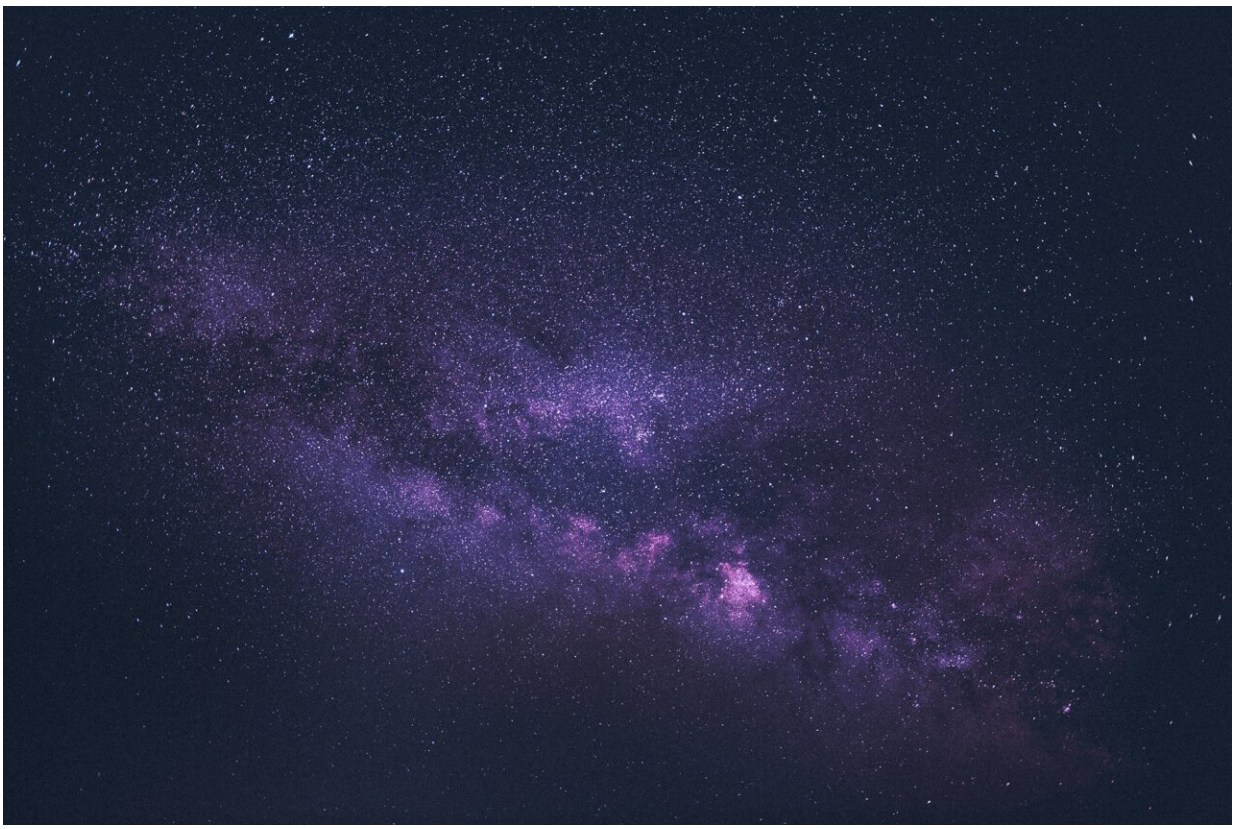

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It is generally believed that double-peaked broad emission lines originate from an elliptical disk. Appearance or disappearance of the broad

Balmer emission lines correspond to type 1 and type 2 active galactic nuclei (AGNs), respectively. Hence, the name changing-look AGN.

The physical origin of the changes of spectral type is still debated by researchers. Reverberation mapping (RM) observations can shed light on this issue.

In a study published online in the *Astrophysical Journal*, FENG Haicheng, Prof. LIU Hongtao, and their collaborators from Yunnan Observatories of the Chinese Academy of Sciences investigated the double-peaked broad emission line and changing-look AGN NGC 2617.

From October 2019 to May 2020, the researchers performed spectroscopic RM observations of NGC 2617 with the 2.4 m optical telescope located at Lijiang Observatory of Yunnan Observatories. Their intensive and homogeneous RM monitoring campaign was run during a high-activity state of NGC 2617. The sampling is ~ 2 days.

For the first time, they detected the velocity-resolved reverberation signature of the object. Both Hα and Hβ showed an asymmetrical profile with a peak in the velocity-resolved time lags. For each of both lines, the lag of the line core was longer than those of the relevant wings, and the peak of the velocity-resolved lags was slightly blueshifted. These characteristics are not consistent with the theoretical prediction of the inflow, outflow or Keplerian disk model.

Besides, the researchers obtained the time lags of Hα, Hβ, Hγ, and He I, which indicates a stratified structure in the broad-line region (BLR) of NGC 2617. This is the first time that the lags of Hα and He I were obtained. A mass of about 20 million solar masses was obtained for the central supermassive black hole in NGC 2617.

Interestingly, the double-peaked broad emission line Hβ disappeared in

the RM observations reported here, but it appeared in the spectra observed in 2016 by the others. It was likely that the structure of BLR had changed. The observational results imply the complexity of the BLR of NGC 2617. The observational data show that the accretion rate changes are likely the origin of the changing-look behavior of NGC 2617.

These findings on changing-look AGNs with double-peaked broad emission lines enable people to better understand the central physical structures and the changing-look mechanisms of these sources.

More information: Hai-Cheng Feng et al. Velocity-resolved Reverberation Mapping of Changing-look AGN NGC 2617, *The Astrophysical Journal* (2021). DOI: 10.3847/1538-4357/abefe0

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