New hyperluminous quasar discovered

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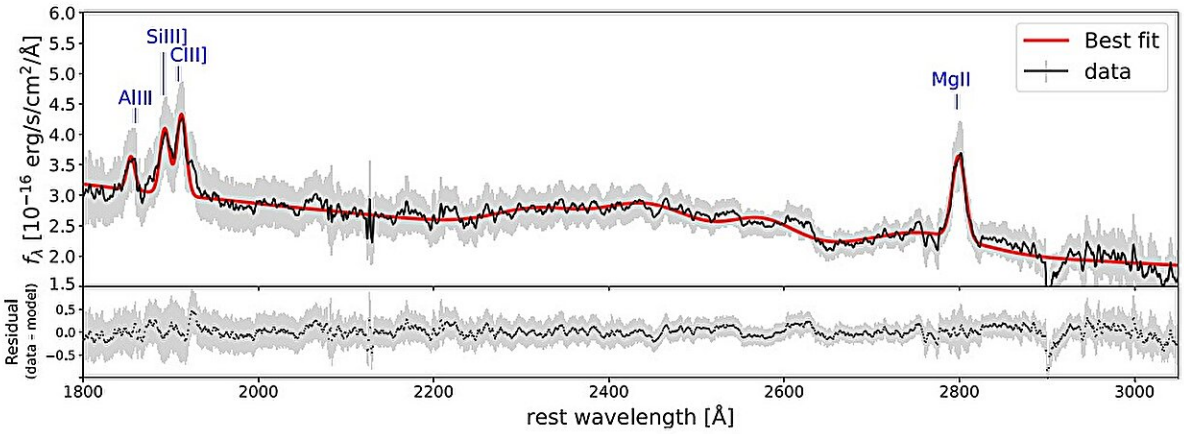

The optical spectrum of eFEDSJ0828−0139 taken by the KOOLS-IFU. Credit: Toba et al, 2024

An international team of astronomers reports the discovery of a new hyperluminous quasar. The newfound quasar, which received the designation eFEDSJ0828–0139, has a high star-formation rate and its black hole is accreting mass at a super-Eddington rate. The discovery was detailed in a research paper published August 16 on the preprint server *arXiv*.

Quasars, or quasi-stellar objects (QSOs), are active galactic nuclei (AGN) of very high luminosity powered by supermassive black holes (SMBHs), emitting electromagnetic radiation observable in radio, infrared, visible, ultraviolet and X-ray wavelengths. They are among the brightest and most distant objects in the known universe, and serve as fundamental tools for numerous studies in astrophysics as well as cosmology.

Now, a group of astronomers led by Yoshiki Toba of the National Astronomical Observatory of Japan (NAOJ) has detected a new quasar with a bolometric luminosity of more than 290 quattuordecillion erg/s. The quasar was first identified by the eROSITA instrument onboard the Spektr-RG spacecraft and its nature was confirmed by Toba's team with the Seimei Telescope and the James Clerk Maxwell Telescope (JCMT).

"We performed the optical spectroscopic observations with KOOLS-IFU on the Seimei Telescope (...) To measure the precise infrared luminosity (LIR), we obtain submillimeter data taken by SCUBA-2 on JCMT and conduct the spectral energy distribution analysis with X-ray to submillimeter data," the researchers explained.

According to the paper, the newfound hyperluminous quasar eFEDSJ0828–0139 has a spectroscopic redshift of 1.62. The mass of the SMBH in this quasar was found to be approximately 620 million solar masses.

The study found that eFEDSJ0828–0139 has a very high infrared luminosity—at a level of 68 trillion solar luminosities and its Eddington ratio is 3.6. This confirms that eFEDSJ0828–0139 is a hyperluminous quasar with a very high black hole mass accretion rate.

The results indicate that eFEDSJ0828–0139 also has an extremely high star-formation rate (SFR). The astronomers calculated that the SFR of

this quasar is at least 1,000 solar masses per year.

Summing up the findings, the authors of the paper noted that eFEDSJ0828−0139 is likely in a particular phase in which SMBH and its host galaxy are actively growing in the framework of galaxy-SMBH co-evolution.

"We may be witnessing the growing phase of both SMBH and its host galaxy in the course of the galaxy–SMBH coevolution, as expected by the numerical simulation," the researchers concluded.

The astronomers added that their discovery proves that many more hyperluminous quasars could be detected with the eROSITA all-sky survey and follow-up observations using next-generation multi-object spectrographs, such as the Subaru Prime Focus Spectrograph (PFS).

More information: Yoshiki Toba et al, Discovery of a hyperluminous quasar at z = 1.62 with Eddington ratio > 3 in the eFEDS field confirmed by KOOLS-IFU on Seimei Telescope, *arXiv* (2024). DOI: 10.48550/arxiv.2408.08498