Contribution ID: **35** Type: **Contributed Talk**

Hidden by a star: The redshift and the offset broad line of the flat-spectrum radio quasar PKS 0903−57

Friday 19 September 2025 09:30 (15 minutes)

PKS 0903−57 is a little-studied γ-ray blazar that has recently attracted considerable interest due to the strong flaring episodes observed since 2020 in high energy (HE; 100 MeV ≤ E ≤ 100 GeV) and very high-energy (VHE; 100 GeV ≤ E ≤ 10 TeV) γ-rays. Its nature and properties have not been well determined until recently by Goldoni et al. (2024), which this talk is based on. The main challenge has been the presence of a nearby star at a distance of 0.67" from the blazar, somewhat hiding it. The work of Goldoni et al. (2024) was carried out as part of the aims of Cherenkov Telescope Array Observatory redshift determination group. We performed spectroscopy of the optical counterpart of the PKS 0903-57 using the Southern African Large Telescope and the Very Large Telescope (VLT), and monitored it photometrically with the Rapid Eye Mount (REM) telescope. Using the VLT observations taken with a narrower slit (0.5" wide) under subarcsecond seeing (˜0.5") conditions, we were able to isolate the signatures of the blazar from those of the star and firmly measured its redshift to be z = 0.2621 ± 0.0006, thanks to the detection of five narrow optical lines. The detection of a symmetric broad Hα line with full width at half maximum (FWHM) of 4020 ± 30 km/s together with a jet-dominated continuum lead us to classify PKS 0903-57 as a flat-spectrum radio quasar. Finally, we detected with high significance a redshift offset (~1500 km/s) between the broad line and the host. This is the first time that such an offset has been unequivocally detected in a VHE blazar, possibly pointing to a very peculiar accretion configuration, a merging system, or a recoiling black hole. We have performed further VLT, REM and Swift observations recently (2025) that we are still analyzing.

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Session Classification: AGN

Track Classification: Active Galactic Nuclei