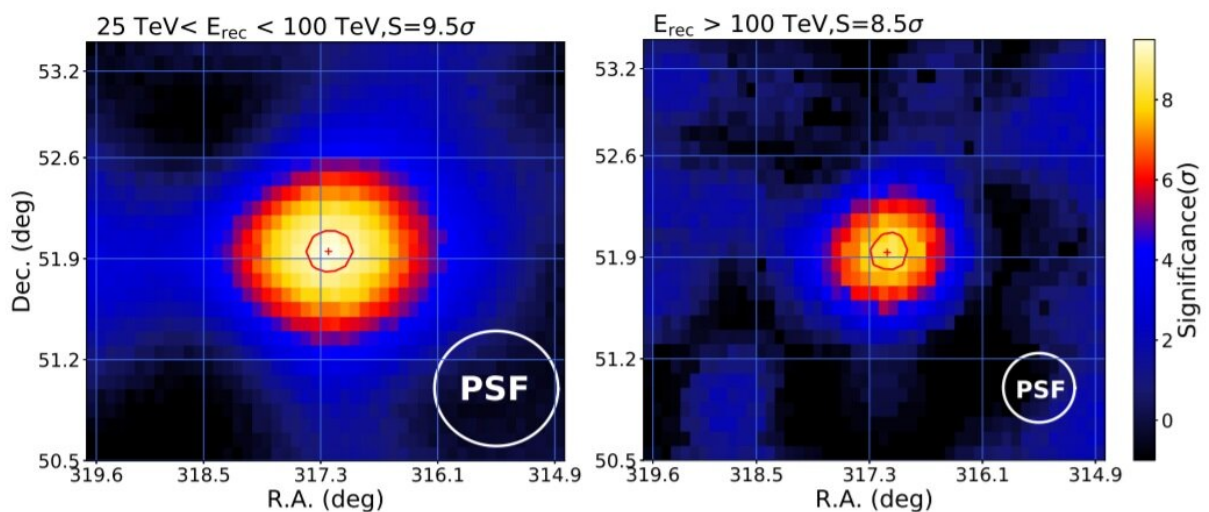


# New ultra-high energy gamma-ray source detected

June 28 2021, by Tomasz Nowakowski



Left: significance map around LHAASO J2108+5157 as observed by KM2A for reconstructed energies from 25 TeV to 100 TeV. Right: significance map for energies above 100 TeV. The red cross denotes the best-fit position. The white circle at bottom-right corner shows the size of PSF (containing 68% of the events). Credit: Cao et al., 2021.

Using the Large High Altitude Air Shower Observatory (LHAASO), astronomers have performed a search for new high-energy gamma-ray sources. As a result, they have identified a new ultra-high energy gamma-

ray source, which received designation LHAASO J2108+5157. The finding is reported in a paper published June 18 on the arXiv pre-print repository.

Sources emitting [gamma radiation](#) with photon energies between 100 GeV and 100 TeV are called very-[high energy](#) (VHE) gamma-ray sources, while those with [photon energies](#) above 0.1 PeV are known as ultra-high energy (UHE) [gamma-ray sources](#). The nature of these sources is still not well understood; therefore, astronomers are constantly searching for new objects of this type to characterize them, which could shed more light on their properties in general.

A team of astronomers led by Zhen Cao of Chinese Academy of Sciences (CAS) has recently conducted such search lasting nearly one year, using the data from LHAASO—a new complex EAS array designed for cosmic-ray and gamma-ray studies, located in the Sichuan province of China. The [observational campaign](#) yielded promising results.

"In this paper, we report in Section 2 the discovery of a new UHE gamma-ray source LHAASO J2108+5157 based on the LHAASO-KM2A observation. It is the first source revealed in the UHE band without a VHE counterpart reported by other detectors," the researchers wrote.

According to the study, LHAASO J2108+5157 is a point-like source with an extension less than 0.39 degrees. However, the astronomers noted that a slightly extended morphology cannot be ruled out due to the limited statistics and uncertainty. The [power-law](#) spectral index of LHAASO J2108+5157 was found to be  $-2.83$ .

No X-ray counterparts were found within 0.26 degrees from the center of LHAASO J2108+5157 and it turns out that the closest X-ray source is

the eclipsing binary RX J2107.3+5202 with the separation of about 0.3 degrees.

The observations found that LHAASO J2108+5157 is associated with a molecular cloud known as [MML2017]4607. The cloud is located some 10,700 light years away from the Earth, has an average angular radius of approximately 0.236 degrees, and its mass is estimated to be 8,469 solar masses.

Trying to explain the detected UHE [gamma-ray](#) emission from LHAASO J2108+5157, the authors of the paper offer few explanations. They noted that UHE emission could be produced by protons accelerated up to PeV colliding with the ambient dense gas. Due to the coincidence between LHAASO J2108+5157 and the molecular cloud [MML2017]4607, they assume that the hadronic origin is the most plausible scenario.

"The observed gamma-rays are attributed to the decay of  $\pi^0$  mesons produced in inelastic collisions between accelerated protons and target gas in the [MML2017]4607. For the energy distribution of the parent particles, we assume an exponential cut-off power-law form," the astronomers explained.

**More information:** Discovery of the Ultra-high energy gamma-ray source LHAASO J2108+5157, arXiv:2106.09865 [astro-ph.HE] [arxiv.org/abs/2106.09865](https://arxiv.org/abs/2106.09865)

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