

KMI Colloquium

Sagittarius A* as an Origin of the Galactic Cosmic Rays?



Yutaka FUJITA
(Osaka University)

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Abstract: The origin of cosmic rays (CRs) has been discussed for a long time. We explore the possibility that Sagittarius A* (Sgr A*), which is the low-luminosity active galactic nucleus of the Milky Way Galaxy, significantly contributes to the observed TeV-PeV cosmic rays (CRs) as a Galactic PeV particle accelerator ("Pevatron"). We have investigated Sgr A* as a Pevatron and studied neutrino and gamma-ray emissions from escaping CRs. Moreover, we show that a large number of TeV-PeV CRs may have been injected from Sgr A*, and that those CRs may have filled in the Galactic halo and some of them may have entered the Galactic disk. Based on a diffusion-halo model, we solve diffusion equations for the CRs and compare the results with the CR spectrum and the anisotropy observed on the Earth as well as the diffuse gamma-ray emission from the Central Molecular Zone (CMZ) surrounding Sgr A*. We find that the CR spectrum, the anisotropy and the recent gamma-ray observations with the High Energy Stereoscopic System (HESS) can be explained simultaneously if (1) Sgr A* was more active in the past, (2) the CR spectrum at the source (Sgr A*) is relatively hard, (3) the diffusion coefficient for the Galactic disk is small, and (4) the energy dependence of the diffusion coefficient is different between the CMZ and the halo.