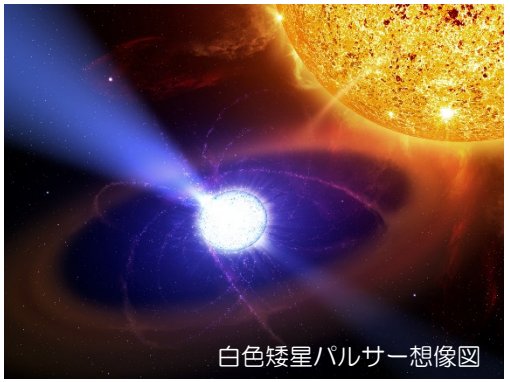
理学部物理学科・宇宙物理セミナー

Saitama University
埼玉大学

開催日時・場所(Date&Place)

2018年2月16日(金) 17:30 ～ 18:30
理学部１号館４階・物理会議室


白色矮星パルサー想像図

講演者 (Speaker)

釜江常好 (東京大学・名誉教授)

講演題目(Title)

Evidence for GeV Cosmic Rays from White Dwarfs in the Local Cosmic Ray Spectra and in the Gamma-ray Emissivity of the Inner Galaxy

概要 (abstract)

Recent observations found that electrons are accelerated to 10 GeV and emit synchrotron hard X-rays in two magnetic white dwarfs (WDs), also known as cataclysmic variables (CVs). In nova outbursts of WDs, multi-GeV gamma-rays were detected inferring that protons are accelerated to 100 GeV or higher. In recent optical surveys, the WD density is found to be higher near the Sun than in the Galactic disk by a factor 2.5. The cosmic rays (CR) produced by local CVs and novae will accumulate in the local bubble for 10^6 – 10^7 yrs. On these findings, we search for CRs from historic CVs and novae in the observed CR spectra. We model the CR spectra at the heliopause as sums of Galactic and local components based on observational data as much as possible. The initial Galactic CR electron and proton spectra are deduced from the gamma-ray emissivity, the local electron spectrum from the hard X-ray spectra at the CVs, and the local proton spectrum inferred by gamma-ray spectrum at novae. These spectral shapes are then expressed in a simple set of polynomial functions of CR energy and regressively fitted until the high-energy (>100 GeV) CR spectra near Earth and the Voyager-1 spectra at the heliopause are reproduced. We then extend the modeling to nuclear CR spectra and find that one spectral shape fits all local nuclear CRs and the apparent hardening of the nuclear CR spectra is caused by the roll-down of local nuclear spectra around 100 – 200 GeV. All local CR spectra populate in a limited energy band below 100 – 200 GeV and enhance gamma-ray emissivity below 10 GeV. Such an enhancement is observed in the inner Galaxy, suggesting the CR fluxes from CVs and novae are substantially higher there.

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