Yonggi Kim[5] (김용기), Joh-Na Yoon[5] (윤요라), and IMSNG team
[1]*SNU Astronomy Research Center, Seoul National University, Seoul, Republic of Korea*
[2]*Astronomy Program, Department of Physics & Astronomy, Seoul National University, Seoul, Republic of Korea*
[3]*National Youth Space Center, Goheung, Jeollanam-do, Republic of Korea*
[4]*Korea Astronomy and Space Science Institute, Daejeon, Republic of Korea*
[5]*Chungbuk National University Observatory, Chungbuk National University, Cheongju, Republic of Korea*

The progenitor of Type Ia supernovae is largely expected as a close binary system of a carbon/oxygen white dwarf (WD) primary and its secondary non-degenerate (single degenerate; SD) or degenerate companion (double degenerate; DD). Here we present a high-cadence monitoring observation of SN 2021hpr in a spiral galaxy, NGC 3147. SN 2021hpr shows typical characteristics as a normal type Ia supernova from its photometric ($\Delta m_{15}(B)=1.01\pm0.03$, dust free $M_{B,max}=-19.45\pm0.02$) and spectroscopic data. To investigate its progenitor system, we fit the early part of *BVRI*-band light curve simultaneously with a combined version of ejecta-companion and simple power-law model. As a result, we found a significant feature of an early excess possibly from a $7.63\pm0.52R_{\odot}$-sized companion at the optimal viewing angle while the fit is not successful at the common viewing angle. No possible red sources brighter than F555W=-7.01 AB mag is detected at the SN location in Hubble Space Telescope (HST) pre-explosion images, excluding massive stars with initial mass of $>16M_{\odot}$ as companions. We suggest the progenitor system of SN 2021hpr can be a fairly large companion such as a main sequence, a low mass subgiant, and a helium giant star. In addition, a possibility of the ejecta-Disk Originated Matter (DOM) interaction for the DD scenario considering linearly-rising early flux still remains.

고에너지/이론천문학

[구 HA-01] Preexsiting Suprathermal Electrons and Preacceleration at Quasi-Perpendicular Shocks in Merging Galaxy Clusters

Ji-Hoon Ha[1], Dongsu Ryu[1], Hyesung Kang[2] and Sunjung Kim[1]
[1]*Department of Physics, School of Natural Sciences UNIST, Ulsan 44919, Korea*
[2]*Department of Earth Sciences, Pusan National University, Busan 46241, Korea*

Merger shocks with $M_s<\sim3-4$ have been detected in galaxy clusters through radio observations of synchrotron radiations emitted from cosmic-ray (CR) electrons. The CR electrons are believed to be produced by the so-called diffusive shock acceleration (DSA) at the merger shocks. To describe the acceleration of electrons, the injection into DSA has to be understood. Recent studies have showed that electrons could be energized through stochastic shock drift acceleration (SSDA), a mechanism mediated by multi-scale plasma waves at shock transition zone. However, such preacceleration process seems to be effective only at the supercritical shocks with $M_s>\sim2.3$, implying that further studies should be done to explain radio relics with weaker shocks. In this talk, we present the results obtained by fully kinetic 2D particle-in-cell (PIC) simulations, which include pre-existing suprathermal electrons possibly ejected from active galactic nuclei (AGNs) or produced by previous episodes of turbulence/shocks. The simulations indicate that the pre-existing electrons enhance the upstream plasma waves in shocks with $M_s<\sim2.3$. However, the wavelength of such waves is not long enough to scatter off suprathermal electrons and energize them to the injection momentum for DSA. Hence, we conclude that preexciting suprathermal electrons alone would not solve the problem of electron acceleration at radio relic shocks.

[구 HA-02] Features in broadband SEDs of young pulsar wind nebulae: existence of two different electron populations

Chanho Kim, Hongjun An
Department of Astronomy and Space Science, Chungbuk National University, Cheongju-si 28644, Republic of Korea

Pulsar Wind Nebula(PWN)는 radio부터 TeV band까지 넓은 파장에 걸쳐 복사를 하며 이 복사는 Spectral Energy Distribution(SED)으로 측정된다. 관측된 SED는 두 개의 주요한 bump를 보이는데 low-energy emission bump는 synchrotron radiation에 의해 만들어지고 high-energy emission bump는 inverse Compton scattering에 의해 만들어진다. 대부분 PWN들의 SED는 단일 전자 분포로 설명이 가능하지만 최근 연구 결과에 의하면 Crab nebula, G21.5-0.9 같은 일부 young pulsar wind nebula의 X-ray SED에서 단차나 기울기의 변화 등 단일 전자 분포로 설명하기 어려운 부분이 관측되기도