emissions from clusters of galaxies by performing cosmological hydrodynamic simulations. The estimated gamma-ray flux is below the Fermi-LAT upper limit. In addition, the possible neutrino emission due to the decay of charged pions in galaxy clusters would be about <~ 1% of the atmospheric neutrino intensity in the energy range of <~ 100 GeV. In this talk, we will discuss the implication of our results.

[구 HT-03] SED modelling of broadband emission in the pulsar wind nebula 3C 58

Seungjong Kim (Kim S.), Hongjun An (An H.)
Department of Astronomy and Space Science, Chungbuk National University, Cheongju-si 28644, Republic of Korea

We investigate broadband emission properties of the pulsar wind nebula (PWN) 3C 58 using a spectral energy distribution (SED) model. We attempt to match simultaneously the broadband SED and spatial variations and emission about 3C 58 in X-ray band. We further the model to explain a possible far-IR feature of which a hint is recently suggested in 3C 58: a small bump at ~10^11 GHz in the PLANCK and Herschel band. While external dust emission may easily explain the observed bump, it may be internal emission of PWNe implying an another additional population of particles. Although significance for the bump in 3C 58 is not higher than other PWNe, here we explore possible origins of the IR bump using the emission model and find that a population of electrons with GeV energies can explain the bump. If it is produced in the PWN, it may provide new insights into particle acceleration and flows in PWNe.

[구 HT-04] Electron Firehose Instabilities in High-β Intracluster Medium

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

The firehose instability is driven by a pressure anisotropy in a magnetized plasma when the temperature along the magnetic field is higher than the perpendicular temperature. Such condition occurs commonly in astrophysical and space environments, for instance, when there are beams aligned with the background magnetic field. Recently, it was argued that, in weak quasi-perpendicular shocks in the high-β intracluster medium (ICM), shock-reflected electrons propagating upstream cause the temperature anisotropy. This electron temperature anisotropy can trigger the electron firehose instability (EFI), which excites oblique waves in the shock foot. Scattering of electrons by these waves enables multiple cycles of shock drift acceleration (SDA) in the preshock region, leading to the electron injection to diffusive shock acceleration (DSA). In the study, the kinetic properties of the EFI are examined by the linear stability analysis based on the kinetic Vlasov-Maxwell theory and then further investigated by 2D Particle-in-Cell (PIC) simulations, especially focusing on those in high-β (β~100) plasmas. We then discuss the basic properties of the firehose instability, and the implication of our work on electron acceleration in ICM shock.

[구 HT-05] Machine-assisted Semi-Simulation Model (MSSM): Predicting Galactic Baryonic Properties from Their Dark Matter Using A Machine Trained on Hydrodynamic Simulations

Yongseok Jo, Ji-hoon Kim
Center for Theoretical Physics, Department of Physics and Astronomy, Seoul National University

We present a pipeline to estimate baryonic properties of a galaxy inside a dark matter (DM) halo in DM-only simulations using a machine trained on high-resolution hydrodynamic simulations. As an example, we use the IllustrisTNG hydrodynamic simulation of a $(75\,h^{-1}\mathrm{Mpc})^3$ volume to train our machine to predict e.g., stellar mass and star formation rate in a galaxy-sized halo based purely on its DM content. An extremely randomized tree (ERT) algorithm is used together with multiple novel improvements we introduce here such as a refined error function in machine training and two-stage learning. Aided by these improvements, our model demonstrates a significantly increased accuracy in predicting baryonic properties compared to prior attempts --- in other words, the machine better mimics IllustrisTNG's galaxy-halo correlation. By applying our machine to the MultiDark-Planck DM-only simulation of a large $(1\,h^{-1}\mathrm{Gpc})^3$ volume, we then validate the pipeline that rapidly generates a galaxy catalogue from a DM halo catalogue using the correlations the machine found in IllustrisTNG. We also compare our galaxy catalogue with the ones produced by popular semi-analytic models (SAMs). Our so-called machine-assisted semi-simulation model (MSSM) is shown to be largely compatible with SAMs, and may become a promising method to transplant the

baryon physics of galaxy-scale hydrodynamic calculations onto a larger-volume DM-only run. We discuss the benefits that machine-based approaches like this entail, as well as suggestions to raise the scientific potential of such approaches.

특별세션
AI시대 천문인의 미래를 위한 소통

[초 CAW-01] Data Science and Deep Learning in Natural Sciences

Meeyoung Cha[1,2]

[1]*Chief Investigator, Institute for Basic Science (IBS), Daejeon, Korea*
[2]*Associate Professor, School of Computing, Korea Advanced Institute of Science and Technology (KAIST), Daejeon, Korea*

We are producing and consuming more data than ever before. Massive data allow us to better understand the world around us, yet they bring a new set of challenges due to their inherent noise and sheer enormity in size. Without smart algorithms and infrastructures, big data problems will remain intractable, and the same is true in natural science research. The mission of data science as a research field is to develop and apply computational methods in support of and in the replacement of costly practices in handling data. In this talk, I will introduce how data science and deep learning has been used for solving various problems in natural sciences. In particular, I will present a case study of analyzing high-resolution satellite images to infer socioeconomic scales of developing countries.

[초 CAW-02] Women's Leadership in the International Astronomical Union

Hyesung Kang[1,2]
[1]*Chair, National Organizing Committee, IAUGA2021*
[2]*Department of Earth Sciences, Pusan National University, Busan 46241, Korea*

Recently, women astronomers have played increasingly important roles in the International Astronomical Union (IAU). Although only 18% are women across the entire membership of the IAU, currently one half of the IAU Executive Committee members are female. In fact, the previous, current, and next presidents of the IAU and many of the Division presidents are women. I will review a variety of efforts that the IAU has carried out to pursue equality and diversity in Astronomy. Also I will share my personal experience and thoughts on meritocracy as a guiding principle that governs academic integrity and scholarly power system in scientific communities in Korea.

[구 CAW-03] Introduction to KAS code of ethics(천문학회 윤리강령제정)

Hyerim Noh(노혜림)
[KASI]

천문학회에서는 천문학의 발전을 위해 학회원들이 지켜야할 책무를 준수하고 서로를 신뢰하고 존중하여 자유로운 연구환경을 마련하는데 노력하는 것을 목적으로 연구윤리, 성희롱, 각종 차별 등 도덕윤리를 포함한 새로운 윤리강령을 제정할 계획으로 있으며 현재 윤리 TF 팀이 구성되어 일하고 있다. 전반적 윤리강령이 필요하게 된 배경, 취지, 그리고 필요성에 대해 간략하게 설명하고 참가자들의 의견을 청취하려 한다.

특별세션
차세대태양코로나그래프

[구 NGSC-01] Development of a diagnostic coronagraph on the ISS: BITSE overview and progress report

Yeon-Han Kim[1], Seonghwan Choi[1], Su-Chan Bong[1], Kyungsuk Cho[1,2], Young-Deuk Park[1], Jeffrey Newmark[3], Nat. Gopalswamy[3], Seiji Yashiro[3], Nelson Reginald[3]
[1]*Korea Astronomy and Space Science Institute, Korea*
[2]*University of Science and Technology, Korea*
[3]*NASA Goddard Space Flight Center, USA*

The Korea Astronomy and Space Science Institute (KASI) has been collaborating with the NASA's Goddard Space Flight Center, to install a coronagraph on the International Space Station (ISS). The coronagraph will utilize spectral information to simultaneously measure electron density, temperature, and velocity. As a first step, we developed a new coronagraph and launched it on a stratospheric balloon in 2019 (BITSE) from Fort Sumner, New Mexico in USA. As the next step, the coronagraph will be be further developed, installed and operate on the ISS (CODEX) in 2022 to address a number of important questions (e.g., source and acceleration of solar wind, and coronal heating) in the physics of the solar corona and the heliosphere. Recently, BITSE has been launched at Fort Sumner, New Mexico. In this presentation, we