Cosmic Magnetic Field

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The Faraday rotation measure (RM) of extragalactic radio sources is one of tools that can explore the magnetic field in the cosmic web. We have investigated the statistical properties of the RM using the data of simulations for the large-scale structure formation of the universe. Various modelings for the cosmic magnetic field including the redshift dependence, and the intrinsic RM of radio sources have been considered. We here present the structure functions (SFs) of simulated RMs for small angular separations, and compare the SFs with observations, specifically those from the NRAO VLA Sky Survey (NVSS) and LOFAR Two-Metre Sky Survey (LoTSS). We then discuss the implications of our work.

[박 GC-03] Radiative Transfer in Highly Thick Media through Rayleigh and Raman Scattering with Atomic Hydrogen

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Hydrogen is the most abundant element in the universe, which is, in the cosmological context, attributed to its simplest structure consisting of a proton and an electron. Hydrogen interacts with an electromagnetic wave in astrophysical environments. Rayleigh scattering refers to elastic scattering, where the frequencies of the incident and scattered photons are the same. Rayleigh and resonance scattering is a critical role study Lyman Alpha objects in the early universe. The scattering causes the frequency and spatial diffusion of Lyα. In the case of Raman scattering, the energies of the incident and scattered photons are different. The photons near Lyβ convert to the optical photons near Hα through Raman scattering. The photon scattered by atomic hydrogen can carry both of the properties of the H I region and the emission region. I adopt a Monte Carlo approach to investigate the formation of the various spectral line features through Rayleigh and Raman scattering in highly thick media of atomic hydrogen. In this thesis, I present my works on radiative transfer involving the scattering processes between far UV photon and atomic hydrogen. I introduce scattering processes with atomic hydrogen and the spectral, spatial, and polarized information originating from the scattering.

[구 GC-04] Testing delayed AGN feedback using star formation rate measurements by SED fitting with JCMT/SCUBA-2 data

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The impact of AGN on star formation is one of the main questions in AGN-galaxy coevolution studies. However, direct evidence of AGN feedback is still rare. One of the main obstacles is that various star formation rate (SFR) indicators are contaminated by AGN contribution. We present IR-based SFR measurements of a sample of 52 local ($z<0.3$) AGNs, which were selected based on kinematical properties of ionized gas outflows, using SED analysis with JCMT/SCUBA-2 data. First, we will compare IR-based SFR with other SFR indicators to check the reliability of the SFR indicators. Second, we will discuss the contribution of Mid-IR emission from hot dust of AGN torus by comparing SED fitting results with and without including AGN dust component. Finally, we will report the correlation between specific SFR (sSFR) and AGN activity (e.g., outflow strength or Eddington ratio) as evidence of no instantaneous feedback and discuss the implications of these results

[구 GC-05] Preparing for low-surface-brightness science with the Rubin Observatory: characterisation of LSB tidal features from mock images

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Minor mergers leave behind long lived, but extremely faint and extended tidal features including tails, streams, loops and plumes. These act as a fossil record for the host galaxy's past interactions, allowing us to infer recent accretion histories and place constraints on the properties and nature of a galaxy's dark matter halo. However, shallow imaging or small homogeneous samples of past surveys have resulted in weak observational constraints on the role of galaxy mergers and interactions in galaxy assembly. The Rubin Observatory, which is optimised to deliver fast, wide field-of-view imaging, will enable deep and unbiased observations over the 18,000 square degrees of the Legacy Survey of Space and Time (LSST), resulting in samples of potentially of millions of objects undergoing tidal interactions.

Using realistic mock images produced with state-of-the-art cosmological simulations we perform a comprehensive theoretical investigation of the extended diffuse light around galaxies and galaxy groups down to low stellar mass densities. We consider the nature, frequency and visibility of tidal features and debris across a range of environments and stellar masses as well as their reliability as an indicator of galaxy accretion histories. We consider how observational biases such as projection effects, the point-spread-function and survey depth may effect the proper characterisation and measurement of tidal features, finding that LSST will be capable of recovering much of the flux found in the outskirts of L* galaxies at redshifts beyond local volume. In our simulated sample, tidal features are ubiquitous In L* galaxies and remain common even at significantly lower masses (M*>10^10 Msun). The fraction of stellar mass found in tidal features increases towards higher masses, rising to 5-10% for the most massive objects in our sample (M* ~10^11.5 Msun). Such objects frequently exhibit many distinct tidal features often with complex morphologies, becoming increasingly numerous with increased depth. The interpretation and characterisation of such features can vary significantly with orientation and imaging depth. Our findings demonstrate the importance of accounting for the biases that arise from projection effects and surface-brightness limits and suggest that, even after the LSST is complete, much of the discovery space in low surface-brightness Universe will remain to be explored.

[구 GC-06] Probing neutral gas clouds and associated galaxies in the early universe

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Neutral (HI) gas clouds associated with galaxies are responsible for fuelling the star-formation in the universe. In literature, the extremely strong damped Lyman-alpha absorbers (or ESDLAs) have been known to be sensitive to the effects of HI-H2 transition and star-formation in galaxies. Yet, ESDLAs are rare to probe due to the smaller cross section they subtend on the sky (similar to galaxies).

In my talk, I will focus primarily on my study of the nature of ESDLAs that are observed as absorption signature along the line-of-sight (LOS) of a quasar (QSO). I will further look at the HI-H2 transition and interesting results relevant to diffuse molecular gas and the multi-phase medium (gas in different ionization states) that are associated with ESDLAs.

Furthermore, I will also discuss how the ESDLA environments differ from the high star-forming and molecular environments detected in blind optical and radio surveys consecutively.

[구 GC-07] Tracing the first galaxies with the James Webb Space Telescope

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I will start with presenting new results on the stellar populations of galaxies at a redshift of z=9-11, when the universe was only a few hundred million years old. By combining Hubble Space Telescope observations with Spitzer imaging data, I will show how challenging it is currently to measure basic physical properties of these objects such as star-formation rates, stellar masses and stellar ages. In particular, the current measurements greatly depend on the assumptions (priors) for the spectral energy distribution modeling. Finally, I will discuss how the James Webb Space Telescope (JWST) will revolutionize this field next year and allow us to probe and characterize the first generation of galaxies in much greater detail. Specifically, I will present an overview of the JWST Advanced Deep Extragalactic Survey (JADES), a joint program of the JWST/NIRCam and NIRSpec Guaranteed Time Observations (GTO) teams involving 950 hours of observation.

[구 GC-08] Large Scale Distribution of Globular Clusters in the Coma Cluster

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Coma cluster (Abell 1656) is one of the most massive local galaxy clusters such as Virgo, Fornax, and Perseus, which holds a large collection of globular clusters. Globular cluster systems (GCSs) in a galaxy cluster tell us a history of hierarchical cluster assembly and intracluster GCs (ICGCs) are known to trace the gravitational potential of the galaxy cluster.