Way-like galaxies by modeling the probability of successful travel of organic compounds between stars harboring potentially habitable planets. To this end, we apply the modified habitability recipe of Gobat & Hong (2016) to a model galaxy from the MUGS suite of zoom-in cosmological simulations. We find that, unlike habitability, which only occupies narrow dynamic range over the entire galaxy, the panspermia probability can vary be orders of magnitude between the inner (R, b = 1~4 kpc) and outer disk. However, only a small fraction of star particles have very large values of panspermia probability and, consequently, the fraction of star particles where the panspermia process is more effective than prebiotic evolution is much lower than from naïve expectations based on the ratio between panspermia probability and natural habitability.

The lunar surface progressively darkens and reddens as a result of sputtering from solar wind particles and bombardment of micrometeoroids. The extent of exposure to these space weathering agents is frequently calculated as the location in a diagram of reflectance at 750 nm

항성 및 항성계

[구 SA-01] Long-term simultaneous monitoring observations of SiO and H2O masers toward Mira variable WX Serpentis

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We carried out simultaneous monitoring observations of five maser lines, H_2O (22 GHz), SiO v =1, 2, J =1-0 (43.1, 42.8 GHz), and SiO v =1, J =2-1, J =3-2 (86.2, 129.3 GHz), toward the Mira variable star WX Serpentis with the 21-m antennas of the Korean VLBI Network (KVN) in 2009-2021 (~ 12 years). Most spectra of the H_2O maser are well separated into two parts of two blue- and one redshifted features within ± 10 km s-1 of the stellar velocity. All detected SiO masers are generally concentrated within ± 5 km s-1 of the stellar velocity, and sometimes appear split into two components. Overall, the profiles of SiO and H_2O masers detected in WX Serpentis illustrate typical characteristics of the Mira variable. In addition, flux variations of both SiO and H_2O masers are well correlated with the optical light curve of the central star, showing a phase lag of ~ 0.1 for SiO masers and ~ 0.2 for H_2O maser. This phenomenon is considered to be the direct effect of propagating shock waves generated by the stellar pulsation, because SiO and H_2O masers are sequentially distributed at different positions with respect to the central star. In addition, we analyzed long-term trends and characteristics of maser velocities, maser ratio, and the velocity extents (the full width at zero power; FWZP). We also investigated a spectral energy distribution (SED) ranging from 1.2 to 240 μm obtained using several infrared data: *2MASS, WISE, IRAS, ISO, COBE DIBRE, RAFGL*, and *AKARI* (*IRC* and *FIS*). From the *IRAS LRS* and *ISO SWS* spectra of this star, we identified 9.7 and 12 μm silicate emission features consistent with the SE6 spectrum model, corresponding to the typical AGB phase.

[구 SA-02] Twelve-year simultaneous monitoring of the SiO and H_2O masers toward AGB stars: RT Vir, RR Aql, IRC-10151

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We present the results of long-term simultaneous monitoring observations (~ 12 years) of H_2O (22 GHz) maser and several vibrationally excited lines of SiO J = 1-0, 2-1, 3-2 masers (43, 86, 129 GHz) carried out with the 21-m antennas of the Korean VLBI Network (KVN) toward a sample of three AGB stars (RT Vir, RR Aql, IRC-10151) that are believed to be semiregular variable star, Mira variable star, and OH/IR star, respectively, according to a sequential evolutionary phase of AGB star. A total 10 transitions were observed, of which we detected H^2O, SiO v = 1 and 2, J = 1-0, SiO v = 1, J = 2-1 and J = 3-2 maser lines in all three target objects, depending on the observational epochs. In this study, we scrutinize the evolutionary traits of each target object based on the maser line profiles, flux/velocity variations, and phase lags with the optical light curves. The IRAS two color diagram and the infrared spectral energy distributions (SEDs) in the wavelength range from 1.2 to 240 μm of three observed sources were also analyzed.

[구 SA-03] M to mid-L type members of

nearby young moving groups from Gaia EDR3

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In this study, we aim to identify low-mass members of nearby, young stellar moving groups (NYMGs) from Gaia EDR3. The spatio-kinematic membership probabilities of the NYMGs were calculated utilizing the Bayesian membership probability calculation tool developed in our previous study. The youth of these spatio-kinematic members were assessed using positions on color-magnitude diagrams. We identified ~2200 new low-mass NYMG candidate members, that can be confirmed by follow-up spectroscopic observations. We performed pilot spectroscopic observation with WiFeS at Siding Spring Observatory observing 79 candidates, and about 80 per cent of them were confirmed as members.

[구 SA-04] A kinematic study of young stars in Monoceros OB1 and R1 associations

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The Gaia mission opens a new window to study the kinematics and dynamics of young stellar systems in detail. The kinematic properties of young stars provide vital constraints on the formation process of their host systems. Here, we present a kinematic study of the two associations Monoceros OB1 (Mon OB1) and R1 (Mon R1). Member candidates are first selected from the published list of member candidates, a compilation of OB star catalogues, and the classification of young stellar objects with the AllWISE data. According to the conventional wisdom, we selected a total of 728 members with similar proper motions at almost the same distance. Mon OB1 and Mon R1 have high levels of substructures that are also kinematically distinct. We identify six stellar groups in these associations, of which five show a pattern of expansion. In addition, the signature of rotation is found in two stellar groups of Mon OB1. Star formation history is inferred from a color-magnitude diagram. As a result, star formation in Mon OB1 has been sustained for several million years, while Mon R1 formed at almost the same epoch as the recent star formation in Mon OB1. Some old members in the outskirt of Mon OB1 have outward motions, which rules out the previously proposed outside-in star formation scenario. Star-forming regions including Mon OB1 and Mon R1 are found along a large arc-like gas structure. Hence, the formation of these two associations may originate from the hierarchical star formation along filaments in a turbulent molecular cloud.

[구 SA-05] Metallicity-dependent mixing length in evolution models of red supergiant stars in IC 1613

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There is increasing evidence that the convective mixing length (α) in stellar evolution models depends on metallicity of stars. In order to confirm a more precise metallicity-dependent mixing length trend, we investigate the effective temperature and metallicity of 14 red supergiant stars (RSGs) in the irregular dwarf galaxy IC 1613 using the near-infrared spectra observed with the MMIRS on the MMT telescope. From the synthetic spectral fitting to the observed spectra, we find that the mean metallicity is about [Fe/H]=0.69 with a weak bimodal distribution. We also find that the effective temperature of RSGs in IC 1613 is higher by about 250 K than that of the SMC on average. We compare the RSG position with stellar evolutionary tracks on the HR diagram, finding that models with α = 2.2-2.4 H_p can best reproduce the effective temperatures of the RSGs in IC 1613. It is evident that the mixing length values for IC 1613 is lower than that of the Milky Way. This result supports our previous study on a metallicity-dependent mixing length: mixing length decreases with decreasing metallicity of host galaxies. However, this dependency becomes relatively weak for RSGs having a metallicity equal to or less than the SMC metallicity.

[구 SA-06] Observational Feature of Ejecta-Companion Interaction of A Type Ia SN 2021hpr Via The Very Early Light Curve

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