non-equilibrium ionization cooling behind SNR shock, and discuss the implications of our result.

[구 IM-02] Near-infrared Extinction due to Cool Supernova Dust in Cassiopeia A

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We present the results of extinction measurements toward the main ejecta shell of the Cassiopeia A supernova (SN) remnant using the flux ratios between the two near-infrared (NIR) [Fe II] lines at 1.26 and 1.64 μm. We find a clear correlation between the NIR extinction (E(J-H)) and the radial velocity of ejecta knots, showing that redshifted knots are systematically more obscured than blueshifted ones. This internal “self-extinction” strongly indicates that a large amount of SN dust resides inside and around the main ejecta shell. At one location in the southern part of the shell, we measure E(J-H) by the SN dust of 0.23±0.05 mag. By analyzing the spectral energy distribution of thermal dust emission at that location, we show that there are warm (~100K) and cool (~40K) SN dust components and that the latter is responsible for the observed E(J-H). We investigate the possible grain species and size of each component and find that the warm SN dust needs to be silicate grains such as $MgSiO_3$, Mg_2SiO_4, , and SiO_2, whereas the cool dust could be either small (≲0.01 μm) Fe or large (≳0.1 μm) Si grains. We suggest that the warm and cool dust components in Cassiopeia A represent grain species produced in diffuse SN ejecta and in dense ejecta clumps, respectively.

[구 IM-03] Multi-band imaging of the H2O and SiO masers around the late-type stars using KVN

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We present the results of simultaneous observations of the H2O and SiO masers emitted from the circumstellar envelopes (CSEs) of the late-type stars. These observations have been carried out at the four frequency bands (K, Q, W and D bands) using KVN to apply the source frequency phase referencing (SFPR) analysis to the maser lines. We obtain the relative positions between the H2O and the SiO maser spots by using the SFPR method, which are very important to study the physical links between the inner and the outer parts of the CSEs of the late-type stars. The relative positions between the SiO maser spots of the different transitions are also obtained very accurately, which are very crucial to investigate the pumping mechanism of the SiO maser lines. From our results, the capability of the simultaneous multi-band observation of KVN is proved to be powerful to study the complicated physical environments of the CSEs and the stellar evolution of the late-type stars.

[구 IM-04] Evolution of the central molecular zone in interacting barred galaxies

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The central molecular zone (CMZ) is a region of rich molecular gas located in the inner few hundred parsecs in barred spiral galaxies. We study the size and morphology evolution of the CMZ of Milky Way-like galaxies both in isolation and in interaction by using N-body/hydrodynamic simulations. Specifically, we examine the gas flows and star formation activities in the central region of the galaxies. We focus in particular on the effects of galaxy interactions, including flybys and minor mergers, on the evolution of the CMZ.

[구 IM-05] Inner disk properties of a Class I young stellar object revealed by IGRINS

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