[포IM-11] Study of Weak Astrophysical Shock Waves using a PIC Code

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Shock waves are ubiquitous in astrophysical environments. In particular, shocks formed by merger of subclumps, infall of matter and internal flow motion in intracluster media (ICMs) and cluster outskirts are relatively weak with Mach number M $\lesssim$ a few. At such weak shocks, it has been believed that the diffusive shock acceleration (DSA) of cosmic rays is rather inefficient. Yet, the presence of nonthermal phenomena, such as radio halos and relics, suggests that contrary to the expectation, DSA as well as magnetic field amplification should operate at weak shocks in cluster environments. We recently initiated a study of weak, collisionless, astrophysical shocks using a PIC(Particle-in-Cell) code. The PIC code describes the motion of electron and ion particles under the electromagnetic field which is represented in grid zones. Here, we present a preliminary work of one-dimensional simulations. We show how shocks are set up as the turbulent electromagnetic field is developed in the shock transition layer, and discuss the implication on DSA and magnetic field amplification.

[포IM-12] Simultaneous 22GHz Water and 44GHz Methanol Maser Survey of Low-mass Protostars

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We have carried out a multi-epoch, simultaneous 22GHz H_2O and 44GHz class I CH_3OH maser survey of 109 low-mass protostars. H_2O maser emission was detected in 23 sources, while CH_3OH maser emission in 12 sources. Eight of the CH_3OH detected sources are new detections. For comparison, only four low-mass protostars have been previously found to emit the maser emisison. We investigate difference between the properties of the two masers, such as relative velocity with respect to molecular gas and variability. We also compare the isotropic luminosities of both masers with the bolometric luminosity of the central star.