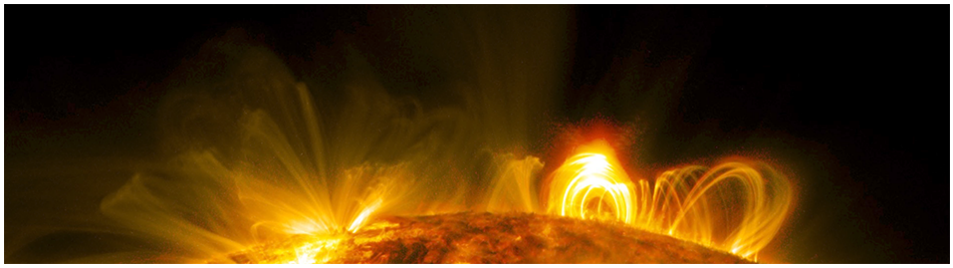

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Magnetic reconnection as a key phenomenon in clusters of galaxies

Wednesday, 17 November 2021 09:00 (15 minutes)

The Intra-Cluster Medium (ICM), i.e., the ideal classical plasmas associated with individual cluster of galaxies (CLGs), is the most dominant known form of cosmic baryons. Within the ICM, the member galaxies move at transonic velocities, and their motion was long believed to be unaffected by the ICM. However, through a series of X-ray observations (from Makishima et al. 2001 to the latest one, Gu, Makishima, Matsumoto et al. 2020), we have revealed that the galaxies strongly interact with the ICM, and transfer a fraction of their kinetic energies to the ICM on cosmological time scales. Our grand scenario (Gu+20) can explain; (1) the vitally needed heating source for the ICM to stop its radiative cooling; (2) the stable balance between the heating and cooling ; (3) the turbulence velocity of ~160 km/s measured with Hitomi; and (4) the uniform metal distributions in the ICM out to the CLG periphery. At the same time, it provides natural explanations to; (5) the radial distributions of the three components (galaxies < Dark Matter < ICM) in nearby CLGs ; and (6) the observed cosmological infall of galaxies towards the CLG centers (Gu+13,+16). We further expect that the scenario ultimately explains; (7) the particle acceleration in the intra-cluster space, and (8) the long sought origin of the environmental effects working on galaxies. Since the galaxy motion through the ICM is transonic and super Alfvenic, we do not expect the creation of either strong shocks or slow shocks. Instead, magnetic reconnection is considered to play a key role when the kinetic energies of galaxies are transferred to the ICM, and the galaxies are dragged and decelerated by the ICM as a back reaction.

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