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Rotation measure analysis of shocks and sloshing fronts in a cluster merger simulation

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One of the methods for studying large scale magnetic field structure of the intracluster medium (ICM) is through rotation measure (RM) analysis. By measuring how the linear polarization of background light sources change through the ICM, we may infer the properties of the medium, such as its magnetic field orientations and the electron density distributions. Recent RM observations of the Fornax cluster revealed Mpc-scale depolarization features, which may be linked to merger shocks or sloshing motions. To investigate this, we analyze the RM maps from a cluster merger scenario in the FLASH simulation. Our results show RM enhancements at the shock fronts, while sloshing motions reduce RM magnitude near the cluster center, likely due to turbulence-induced depolarization. Using polarized radiative transfer (PRT) calculations, we find that the uniform background light is more depolarized at the cluster center, with this effect becoming more pronounced as the background intensity decreases.

Primary authors: LIOU, Jia-Rou (Dep. of Physics, National Tsing Hua University, Hsinchu, Taiwan); Dr ON, Alvina (Physics Division, National Center for Theoretical Sciences, Taipei, Taiwan); Prof. YANG, Karen (Institute of Astronomy, National Tsing Hua University, Hsinchu, Taiwan)

Presenter: LIOU, Jia-Rou (Dep. of Physics, National Tsing Hua University, Hsinchu, Taiwan)

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