Magnetorotational instability in galaxy clusters: further motivation for measuring the rotation of the ICM with ATHENA

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Clusters of galaxies are embedded in halos of weakly magnetized plasma at the system's virial temperature. Though mainly pressure supported, such intracluster medium (ICM) might rotate significantly. Currently available measures of X-rays emission lines, even combined with measures of X-ray isophote flattening, leave ample room for rotational motions. If the ICM rotates significantly, its stability properties are substantially modified and, in particular, also the magnetorotational instability (MRI) can play an important role. We present simple models of rotating cool-core clusters and we demonstrate that the MRI can be the dominant instability over significant portions of the clusters, with possible implications for the dynamics of the cool cores. The direct measures of the ICM rotation that will be obtained with ATHENA will allow to gauge the importance of the MRI for the evolution of galaxy clusters.

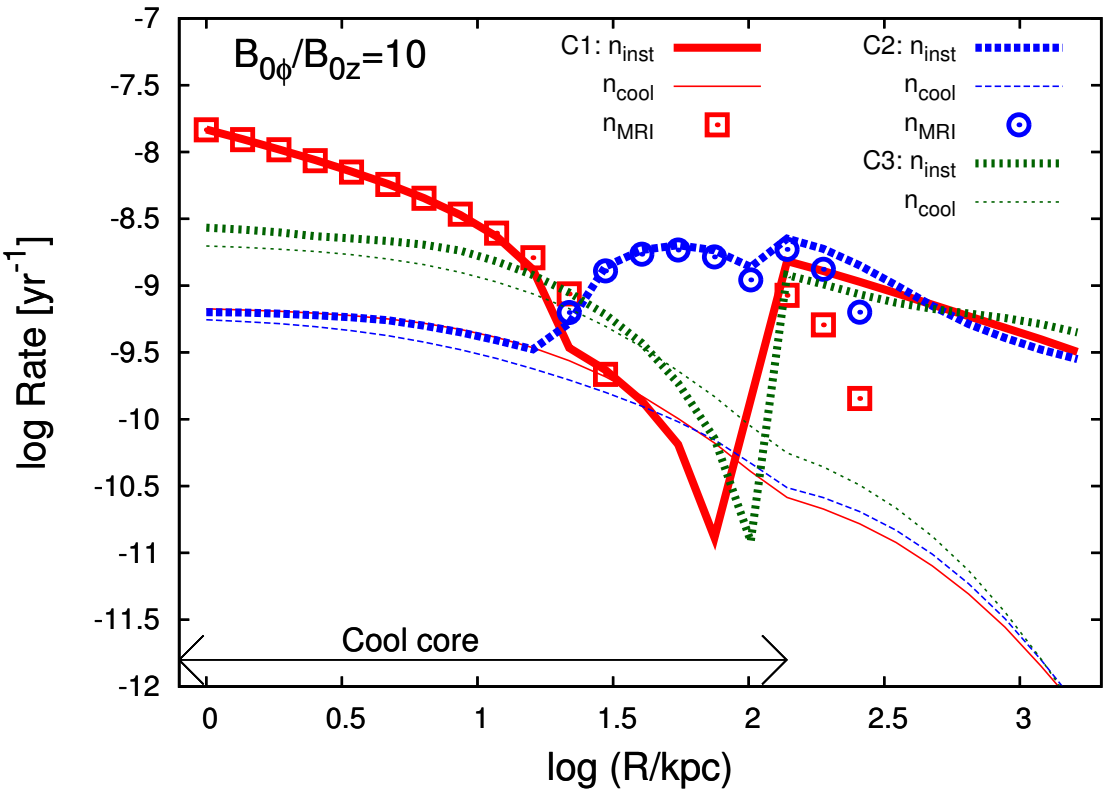

Figure 1: Maximum instability growth rate $n_{\rm inst}$, cooling rate $n_{\rm cool}$, and MRI growth rate $n_{\rm MRI}$ as functions of cylindrical radius in the equatorial plane of three representative rotating cool-core cluster models (C1, C2 and C3). Here $B_{0\phi}$ and B_{0z} are, respectively, the azimuthal and vertical components of the ICM magnetic field (from Nipoti C., Posti L., Ettori S., Bianconi M., 2015, Journal of Plasma Physics, Volume 81, Issue 05, 495810508, arXiv:1506.01387).