Braginskii viscosity as a heating mechanism in momentum driven AGN jets

T. Berlok, O. Franke, C. Pfrommer, K. Ehlert, R. Pakmor & R. Weinberger

Leibniz-Institut für Astrophysik Potsdam (AIP)

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Background and previous work

Braginskii viscosity, i.e. anisotropic diffusion of momentum with respect to the direction of the magnetic field, has been theorized to be of importance in the weakly collisional plasma that comprises the intracluster medium. Previous simulations have focused mainly on the ability of Braginskii viscosity to suppress fluid instabilities. It was found that including Braginskii viscosity does not significantly change the bubble survival time (Dong & Stone 2009, Kingsland+ 2019). Braginskii viscosity has also been theorized to provide a heating rate via dissipation of turbulent motions (Kunz+ 2011).

Arepo jet simulation with Braginskii viscosity

On this poster, we show the Braginskii heating rate associated with viscous dissipation of motions generated by an AGN jet bubble as it buoyantly rises in the ICM.

We use the Arepo jet module (Weinberger+ 2017) combined with the Braginskii viscosity implementation in Berlok+ 2020. The simulation setup is similar to Ehlert+ 2021.

Preliminary results

We show density (left), heating (middle) and cooling (right) as a function of time in thin projections on the right.

The viscous heating attains the largest values in the vicinity of the bubble boundary and in its wake. Although the heating rate can be comparable to the cooling rate in small, localised regions, the motions driven by the bubble are not vigorous enough for the Braginskii heating to globally offset cooling.