Notre Dame Science
Department of Physics

MHD SIMULATIONS OF RAM PRESSURE STRIPPING

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Ram pressure stripping can remove significant amounts of gas from galaxies in clusters, and thus has a large impact on the evolution of cluster galaxies. Recent observations have shown that key properties of ram-pressure stripped tails of galaxies, such as their width and structure, are in conflict with predictions by simulations. To increase the realism of existing simulations, we simulated for the first time a disk galaxy exposed face-on to a uniformly magnetized wind including radiative cooling and self-gravity of the gas. We find that magnetic fields have a strong effect on the morphology of the gas in the tail of the galaxy. While in the purely hydrodynamical case the tail is very clumpy, the MHD case shows very filamentary structures in the tail. The filaments can be strongly supported by magnetic pressure and, wherever this is the case, the magnetic fields vectors tend to be aligned with the filaments. Interestingly, we observe the formation of two dominant magnetized density tails behind the galaxy resembling the double tail observed in ESO 137-001. In our simulations the double tails result from the folding of the ambient magnetic field around the galaxy. The detectability of such structures depends on the time since the beginning of the stripping process, the length scale of the magnetic field fluctuations in the ICM, the orientation of the galaxy with respect to the line-of-sight, and the relative emissivities of the tail and ambient ICM. Despite the fact that the magnetic fields strongly affect the tail morphology, magnetic draping does not suppress the rate of gas stripping, and the magnetic fields may in fact enhance it. Gravitational and shear instabilities tangle the magnetic field. In combination with the buildup of the magnetic pressure in front of the galaxy, this undoes the protective effect of this layer and allows the gas to leak out of the galaxy.

Astrophysics Seminar

All interested persons are cordially invited to attend.