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Title: The fluid approach: Basic instabilities in magnetized plasma

Abstract.

High temperature laboratory plasmas and, even more, rarefied space plasmas are characterized by a typical collisional time scale much longer than the plasma dynamics time scale. As a consequence, these plasmas can be considered in first approximation as collisionless and the dynamics as Hamiltonian. Indeed, the diffusive length scale is many orders of magnitude smaller than any dynamical or kinetic length scale, as for example, in the solar wind where the mean free path is of the order of the dimension of the system (i.e. one astronomical unity). Nevertheless, on the very long length scales (or low frequencies) a hydrodynamic approach for the modeling of such plasmas has been successfully used in laboratory plasmas and even in the solar wind case where, for example, Alfvèn waves have been observed.

Here we start with an introduction on the possibility to describe the plasma dynamics as a magnetized fluid when collisions arise on a time scale much longer than the dynamical time scale. We then focus on two fundamental instabilities in magnetized plasmas: the Kelvin-Helmholtz instability and the Rayleigh-Taylor instability. Transition to the kinetic regime is discussed. Finally, applications to space plasmas problems are given.