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Linear Stability Analysis of a Collisionless Distribution Function for the Force-Free Harris Sheet

Fiona Wilson and Thomas Neukirch
School of Mathematics and Statistics, University of St Andrews, United Kingdom (fionaw@mcs.st-and.ac.uk)

A discussion is presented of the first linear stability analysis of the collisionless distribution function recently found by Harrison and Neukirch for the force-free Harris sheet (*Physical Review Letters* 102, 135003, 2009). Macroscopic instabilities are considered, and the perturbations are assumed to be two-dimensional only. The stability analysis is based on the technique of integration over unperturbed orbits. Similarly to the Harris sheet case (*Nuovo Cimento*, 23:115, 1962), this is only possible by using approximations to the exact orbits, which are unknown. Furthermore, the approximations for the Harris sheet case cannot be used for the force-free Harris sheet, and so new techniques have to be developed in order to make analytical progress. In addition to the full problem, the long wavelength limit is considered, and the results of the two cases are compared. The dependence of the stability on various equilibrium parameters is investigated.