University of Victoria | Graduate Studies

Notice of the Final Oral Examination
for the Degree of Master of Science

of

DAYTON PREISSL

BSc Hons. (University of Victoria, 2019)

"The Hot, Magnetized, Relativistic Vlasov Maxwell System"

Department of Mathematics and Statistics

Friday, December 11, 2020
9:00 A.M.
Conducted Remotely

Supervisory Committee:
Dr. Slim Ibrahim, Department of Mathematics and Satistics, University of Victoria (Supervisor)
Dr. Christophe Cheverry, Institut de recherche mathématique de Rennes, Université de Rennes (Non-Unit Member)

External Examiner:
Dr. Weiran Sun, Department of Mathematics, Simon Fraser University

Chair of Oral Examination:
Dr. Charlotte Loppie, School of Public Health and Social Policy, UVic

Dr. Stephen Evans, Acting Dean, Faculty of Graduate Studies

Abstract

This master thesis is devoted to the kinetic description in phase space of strongly magnetized plasmas. It addresses the problem of stability near equilibria for magnetically confined plasmas modeled by the relativistic Vlasov Maxwell system. A small physically pertinent parameter ϵ, with $0 < \epsilon \ll 1$, related to the inverse of a gyrofrequency, governs the strength of a spatially inhomogeneous applied magnetic field given by the function $x \longmapsto \epsilon^{-1}\mathbf{B}_e(x)$. Local C^1-solutions do exist. But these solutions may blow up in finite time. This phenomenon can only happen at high velocities [14] and, since ϵ^{-1} is large, standard results predict that this may occur at a time T_ϵ shrinking to zero when ϵ goes to 0. It has been proved recently in [7] that, in the case of *neutral*, *cold*, and *dilute* plasmas (like in the Earth's magnetosphere), smooth solutions corresponding to perturbations of equilibria exist on a uniform time interval $[0, T]$, with $0 < T$ independent of ϵ. We investigate here the *hot* situation, which is more suitable for the description of fusion devices. A condition is derived for which perturbed $W^{1,\infty}$-solutions with large initial momentum also exist on a uniform time interval, they remain bounded in the sup norm for well-prepared initial data, and moreover they inherit some kind of stability.