[WE-P9] Plasma Physics / *Physique des plasmas*

(DPP)

WEDNESDAY, JUNE 16
MERCREDI, 16 JUIN
14h15 - 15h30

[Room/Salle : Strathcona] ***Chair: C. Boucher, INRS***

WE-P9-1 14h15

AKIRA HIROSE, Plasma Physics Laboratory, University of Saskatchewan

Anomalous Electron Thermal Conductivity In Tokamaks.

The electron thermal diffusivity in tokamaks has been known to be anomalously high since the beginning of the tokamak research. As the anomalous ion thermal diffusion is caused by an ion temperature gradient, it is natural to seek instabilities driven by electron temperature gradient (ETG). A toroidicity driven ETG mode has been revisited in tokamak stability analysis based on a fully kinetic, electromagnetic integral equation code recently developed in the Laboratory. The ETG mode is characterized by short wavelengths which can be comparable with the Debye length and charge neutrality often assumed in the analysis of the ETG mode breaks down. For typical tokamak discharge parameters, the maximum growth rate occurs at a wavenumber comparable with the Debye wavenumber. The growth rate is of the order of the electron transit frequency and is proportional to square root of plasma beta factor. The electron thermal diffusivity based on simple mixing length estimate is large enough to be relevant to the experimentally observed values, and it increases with the plasma minor radius [1].

1. A. Hirose, Phys. Rev. Lett. 92, 025001 (2004).

WE-P9-2 14h45

Discrete Alfvén Wave Spectra Due to Hall Current*, **Atsushi Ito** [1], S. Ohsaki [2] and S.M. Mahajan [3] , [1] *University of Saskatchewan*, [2] University of Tokyo and [3] University of Texas — Non-ideal effects on inhomogeneous MHD may resolve singularity in the Alfvén continuous spectrum by inducing higher order derivative in the mode equation. It has been shown analytically [1] that the coupling of the Hall current with the sound wave gives rise to discrete spectra, and dominates the electron-inertia (kinetic) effect [2]. A numerical code has been developed to investigate parameter regimes of the ion skin depth, the sound speed, and the wave numbers which allow the presence of discrete Alfvén spectra and radial mode structure.

1. S. Ohsaki and S.M. Mahajan, Phys. Plasmas **11**, 898 (2004).
2. S.M.~ ahajan, Phys. Fluids **27**, 2238 (1984).

* Work supported by NSERC and CRC

WE-P9-3 15h00

Joint Plasma/Thermal Model for Plasma Ion Implants of Photonic Materials, **Michael P. Bradley**, *University of Saskatchewan* — Ion implantation is a powerful tool for the modification of materials by the introduction of controlled amounts of impurities at controlled depths. It has great promise for the production of new photonic and optoelectronic materials. In plasma ion implantation the ions to be implanted are extracted from a plasma in contact with the target. Obviously the final material characteristics depend upon the ion species used and the depth of the implants. In addition, the final characteristics of an ion-implanted sample depend significantly upon its thermal history because of the importance of thermally-driven diffusion and activation processes. Because high-dose ion implants (such as those which might be used to produce buried luminescent SiC layers) lead to very rapid target heating, the temperature vs. time history of the target is a critical aspect of any ion implantation process, and must be known and controlled to achieve optimal results. Accurate, predictive modelling of plasma conditions and their effect on target temperature is an important component of my research program in Plasma Ion Implantation at the University of Saskatchewan. In this talk I will present the results of a numerical model which incorporates the coupling between plasma ion implant conditions and target heating, and discuss the implications for my photonics materials research program.

WE-P9-4 15h15

Observation Constrained Equilibria, Plasma Instabilities, And Substorm Intensification Phase*, **Peter Dobias** [1], J.A. Wanliss [2], I.O. Voronkov [1] and J.C. Samson [1], [1] *University of Alberta* and [2] Embry Riddle Aeronautical University — Dynamics of a substorm onset is one of the most challenging problems in space plasma physics. A sufficient theory must be able to explain the sub-Alfvenic time scales of the onset, and must also provide plausible explanations for the whole series of observed characteristics connected to substorms. We use the Grad-Shafranov equation to define a 3D plasma equilibrium. The theoretical equilibrium is tied to ground-based CANOPUS observations through the proton aurora equatorward boundary as an experimental constraint for the equilibrium. Then we use an energy-based nonlinear stability analysis to follow the stability of the magnetotail during the late growth phase, including periods just prior to and after the onset of the subtorm intensification phase. Using various potential sources of a perturbation to plasma equilibrium, we demonstrate that timing of the substorm onset coincides with the transition between nonlinearly stable and unstable configurations of the magnetotail. Possible triggering mechanism for the instability could include field line resonances, shear flow or shear flow-ballooning instability, or a strong external impulse.

* This work is being supported by NSERC.

15h30 Session Ends / Fin de la session