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Numerical and experimental investigation of plasma instabilities[1]

KEVIN RONALD, DAVID SPEIRS, KAREN GILLESPIE, MARTIN KING, KATHLEEN MATHESON, SANDRA MCCONVILLE, ROSS BRYSON, ALAN PHELPS, COLIN WHYTE, CRAIG ROBERTSON, SUPA & Department of Physics, University of Strathclyde, Glasgow, ROBERT BINGHAM, STFC Rutherford Appleton Laboratory, Harwell, Oxford, MARK KOEPKE, Department of Physics, West Virginia University, Morgantown, ALAN CAIRNS, IRENA VORGUL, School of Mathematics and Statistics, University of St Andrews, St Andrews, RAOUL TRINES, BARRY KELLETT, STFC Rutherford Appleton Laboratory, Harwell, Oxford — Instabilities in energetic electron populations streaming through plasma is important in geophysical and fusion plasmas (both magnetic and fast ignition inertial confinement schemes). This paper will present progress in an experiment aiming to produce scaled reproductions of cyclotron, streaming and anomalous Doppler instabilities important in natural and applied plasma environments. The experiment originally designed as a scaled reproduction of important aspects of X-mode auroral cyclotron wave emissions has supported the proposal that this is driven by free energy in the descending auroral electron flux. The experiment has also observed emissions from energetic electrons in an R-like mode which may be relevant to equatorial cyclotron emissions. The development of the apparatus to reproduce aspects of fusion relevant instabilities in a more benign environment will be presented as will the results of numerical simulations of streaming and anomalous Doppler instabilities supporting the design of these experiments and the interpretation of the measurements.

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