Backward radiation from a horseshoe type cyclotron instability
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Glasgow, UK — Recent observations of Auroral Kilometric Radiation produced by a beam-driven cyclotron instability suggest that it is generated at a small angle to perpendicular in the backward direction with respect to the beam. New data also suggest backward propagation of cyclotron radiation from some stars with dipole magnetic field. Our experiment at the University of Strathclyde investigating cyclotron maser emission similar to AKR also showed that the fastest growing wave is propagating backward, with this result confirmed by simulations and analytic calculations of the growth rate. We propose here a possible explanation of this phenomenon. The instability is driven by a population inversion of the electron distribution in the perpendicular direction and for different directions of propagation slightly away from perpendicular the cyclotron resonance curve passes through the region of maximum gradient for different frequencies. Near cyclotron resonance the real part of the dispersion relation is strongly frequency dependent. We show that this leads to the conclusion that the peak growth would be expected for a small backward angle, in line with the results of observation and simulation.