Abstract Submitted
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Particle-in-cell simulations of an alpha channeling scenario: electron current drive arising from lower hybrid drift instability of fusion-born ions[1] JAMES COOK, SANDRA CHAPMAN, Warwick University, RICHARD DENDY[2], Culham Centre for Fusion Energy — Particle-in-cell (PIC) simulations of fusion-born protons in deuterium plasmas demonstrate a key alpha channeling phenomenon for tokamak fusion plasmas. We focus on obliquely propagating modes at the plasma edge, excited by centrally born fusion products on banana orbits, known to be responsible for observations of ion cyclotron emission in JET and TFTR. A fully self-consistent electromagnetic 1D3V PIC code evolves a ring-beam distribution of 3MeV protons in a 10keV thermal deuterium-electron plasma with realistic mass ratio. A collective instability occurs, giving rise to electromagnetic field activity in the lower hybrid range of frequencies. Waves spontaneously excited by this lower hybrid drift instability undergo Landau damping on resonant electrons, drawing out an asymmetric tail in the distribution of electron parallel velocities, which constitutes a net current. These simulations demonstrate a key building block of some alpha channeling scenarios: the direct collisionless coupling of fusion product energy into a form which can help sustain the equilibrium of the tokamak.

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