Core plasma ion cyclotron emission driven by fusion-born ions

Ion cyclotron emission (ICE) signals whose spectral peaks match the fundamental cyclotron frequencies of hydrogen and tritium in the plasma core, near the magnetic axis, are observed in ASDEX Upgrade deuterium plasmas. In these cases the only source of energetic (1 MeV) hydrogen and tritium ions is D–D fusion reactions between neutral beam injected deuterium ions and bulk deuterium ions. Hydrogen-matched core ICE is observed in a wide variety of ASDEX Upgrade plasmas, while tritium-matched core ICE is (so far) only observed in so-called H-mode density limit plasmas. In all cases ICE signals are detected directly using B-dot probes, which provide information on the emission frequency, the amplitude, and, in principle, the parallel wavenumber values. These observations support the idea of using an ICE-based diagnostic to monitor the presence of fusion-born alpha particles in tritium-burning fusion plasmas on devices such as JET, ITER, CFETR, or DEMO.

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