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Parametric Decay Instabilities during Electron Cyclotron Resonance Heating of Fusion Plasmas SOEREN KJER HANSEN, Max Planck Institute of Plasma Physics and Technical University of Denmark, STEFAN KRAGH NIELSEN, Technical University of Denmark, JOERG STOBER, MATTHIAS WILLENSDORFER, Max Planck Institute of Plasma Physics, JESPER RASMUSSEN, MIRKO SALEWSKI, MORTEN STEJNER, Technical University of Denmark, HARTMUT ZOHM, Max Planck Institute of Plasma Physics, ASDEX UPGRADE TEAM — Three-wave interactions are ubiquitous in media with quadratic nonlinearities, including plasmas, fluids, and optical crystals. While their applications, e.g., generation of entangled photons, underlie many recent advances in quantum optics and metrology, they also play a crucial role in the onset of turbulence in plasmas and fluids. We consider parametric decay instabilities (PDIs), in which a monochromatic pump wave decays to two daughter waves when its amplitude exceeds a nonlinear threshold, during electron cyclotron resonance heating (ECRH) of plasmas. Such PDIs are of importance in fusion and ionospheric modification (IM) experiments. We demonstrate that these PDIs can generate strong microwave bursts near half the pump frequency when magnetic islands are present in fusion plasmas at the ASDEX Upgrade tokamak. These bursts have recently damaged essential plasma diagnostics such as electron cyclotron emission radiometers. Our results validate present theories of PDIs during ECRH of fusion plasmas and illustrate the necessity of accounting for PDIs in current and future fusion devices with significant ECRH power. They may even form a basis for testing IM PDI theories in a controlled laboratory setting.

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