

Parametrically Induced Transparency for dummies

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Abstract

Electromagnetically Induced Transparency (EIT) is a well known phenomenon in quantum electrodynamics, whereby with the help of a high power coupling laser a narrow window of transparency can be created within an absorption line of a three level quantum system. Classical analogons have been formulated including examples of induced transparency in plasmas. These are examples of non-linear three wave interactions. Application to actual plasma configurations is hampered by the inherent inhomogeneities of these systems and the requirement to provide overlap between the coupling wave beam and the plasma wave over the entire opaque region. Parametrically Induced Transparency PIT is proposed to lift this problem by limiting the nonlinear three wave interaction to a small region of overlap, where the nonlinear interaction between the drive wave and the signal wave, which is trapped in the interior of the plasma, generates a transport wave which can propagate to the vacuum and be diagnosed. In this lecture the basic physics behind these nonlinear wave phenomena is explained in simple physical terms. In addition a pilot experiment on PIT that is being prepared for the TEXTOR tokamak is described. The unique combination of the FOM ECRH system, with its powerful 140 GHz system and highly focused wave beam, and the Danish CTS diagnostic, with its microwave optics designed for overlap with the gyrotron beam, enable this experiment with only “minor” modifications to the existing hardware.