

Distinguished Lecture Series
EECS COLLOQUIUM
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**Frequency and Polarization Transformer:
A Switched Magnetoplasma Medium in a Cavity**



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When the medium surrounding a standing source wave in a cavity changes in time, interesting transformations happen: changes occur not only in amplitude and polarization of the wave, but also in its frequency. Such transformations are presented in detail in this talk.

This theoretical and simulation (using FDTD) research is performed in a one-dimensional cavity that consists of two rectangular perfect electric conductor (PEC) plates, separated by a small distance. Initially an elliptically polarized standing wave is present in the cavity and the medium is free space. The medium in the cavity is then converted to a lossy magnetoplasma with an arbitrary space and time profile. Essentially this amounts to altering the medium in the cavity from a simple to a complex, dynamic (time-varying), dispersive (frequency dependent), anisotropic (direction dependent) and inhomogeneous (location dependent) medium. The case of longitudinal modes (the static magnetic field in the direction of the cavity dimension) is considered.

It is shown that the elliptically polarized source wave transforms into three circularly polarized waves, as a consequence of the medium change. It is further shown that each of the transformed waves has a unique frequency, amplitude and phase (with respect to the source wave).

The case of switching-off of the static magnetic field, when the source wave is a whistler wave, can lead to a wiggler magnetic field. By an appropriate choice of the parameters, millimeter-wavelength wigglers can be achieved. The case of switching-off the plasma can lead to an increase of frequency by orders of magnitude. Plasma parameters for converting a 10 GHz input signal to a 500 GHz output signal of significant amplitude will be discussed.

Wednesday
Oct. 22nd
4:00 - 5:00 pm

306 Soda Hall
Hewlett-Packard
Auditorium

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