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[1]. 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 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. The case of longitudinal modes[1] 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.

[1]D. K. Kalluri, *Electromagnetics of Time-Varying Complex Media: Frequency and Polarization Transformer*, CRC Press, April 2010