BENEMÉRITA UNIVERSIDAD AUTÓNOMA DE PUEBLA

INSTITUTO DE FÍSICA
"LUIS RIVERA TERRAZAS"

SEMINARIO
"DR. JESUS REYES CORONA"

"Josephson Plasma Waves and Nonlinear Phenomena in Layered Superconductors"

Dr. V. A. Yampol'skii
A.Ya. Usikov Institute for Radiophysics and Electronics,
Ukrainian Academy of Sciences.

We analyze theoretically the linear and nonlinear properties of the terahertz electromagnetic waves in layered superconductors. The specific features of these waves are related to a strong anisotropy of the current capability in the Josephson plasma which is formed in such superconductors. Namely, the current density along and across the layers differ not only in the absolute values but in the nature of the currents. The currents along the layers are similar to currents in usual superconductors whereas the currents across layers have the Josephson nature. We also study the effect of a weak non-linearity on the propagation of Josephson plasma waves in layered superconductors. The non-linearity is originated from the Josephson relation between the current density across superconducting layers and the gauge-invariant phase difference of the order parameter. We show that strong non-linear effects can be observed for electromagnetic waves with frequencies slightly above or slightly below the plasma frequency. We study the very unusual for plasma media stop-light phenomenon caused by both the nonlinearity and wave dissipation, the non-linear plasma resonance accompanied by the hysteretic dependence of the wave amplitude on the frequency, the propagation of a non-linear THz beam localized in the direction across the superconducting layers, the nonlinear wave-guide modes in slabs of layered superconductors, and the strong hysteresis dependence of the transmittivity and reflectivity of a superconducting slab on the amplitude of the incident wave.

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