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**NONLINEAR SURFACE WAVES AND BISTABILITY OF DIELECTRIC PERMITTIVITY
PROFILES SUSTAINED BY AN INTENSE RADIATION IN NONLINEAR LAYERS**

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The initial theoretical studies¹ of an interface between two dielectric materials, one of which has an intensity-dependent refractive index predicted that under appropriate conditions the reflectivity of the interface exhibit optical hysteresis and bistability². The effect occurs at grazing angles of incidence and for weak nonlinearities. Then, the hysteresis jumps from the regime of nonlinear total internal reflection to the vanishing reflection regime appear in the reflection coefficient. There has been considerable evidence that surface waves have a strong influence on the nonlinear reflection², but the current status of both theoretical and experimental investigations of nonlinear surface waves is far from being satisfactory.

It has been shown recently that overdense plasma layers^{3,4}, as well as classically opaque metallic films⁵, can be highly transparent for a (TM) p-polarized radiation even in a linear regime. In fact, 100% transmission can be obtained if dissipation is neglected. Inclusion of dissipation, obviously reduces transparency below 100% but preserves the effect of vanishing reflection. The effect is due to resonant excitation of electromagnetic surface eigenmodes of the layer. Since in the linear regime surface waves cannot be excited by an electromagnetic radiation incident upon a single homogeneous layer, special plasma density profiles or overcoatings of metallic films are required to obtain the effect. A question arises whether it is possible to obtain a similar dielectric permittivity profile sustained by an intense radiation in nonlinear media.

In the present work we present a self-consistent theory of interaction of an intense (TM) p-polarized, as well as unpolarized radiation with nonlinear layers, within the framework of a stationary one-dimensional model and cubic nonlinearity approximation. There are no restrictions regarding the angle of incidence. We will show that:

1. Conditions can be found when a nonlinear layer which is homogeneous and opaque in a linear regime does not reflect an intense obliquely incident TM radiation. For relatively low energy flux densities and negligible dissipation, a self-sustaining profiles of dielectric permittivity which contain discontinuous transitions from negative to positive dielectric permittivity regions are established. Then, the "nonlinear TM surface waves", which are eigenmodes of such

discontinuities, provide perfect coupling between the incident and the transmitted radiation. These nonlinear surface modes do not have linear analog since they are associated with discontinuities which are sustained by the intense radiation itself. However, the permittivity profiles established are similar to those required for total transparency in a linear regime³⁻⁵. We have found the threshold energy flux density for bistability of dielectric permittivity profiles and the corresponding reflection coefficient.

2. The first integral of the complete set of nonlinear Maxwell's equations can be found which provides studies of unpolarized nonlinear surface waves and reflection of unpolarized light. Although the parameters of discontinuities established in dielectric permittivity profiles are similar to those of the TM polarization the conditions for vanishing reflection differ significantly.

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