Interference Processes in Plasmon Excitations by External Charged Particles for Incoming and Outgoing Trajectories

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Synopsis We study the energy loss of charged particle passing through a solid surface. We employ methods for developing characteristics of spectra energy in order to obtain information on most important phenomena involved. We analize the different production of plasmons for incoming and outgoing trajectories of the particle.

We analize in detail the processes of interaction of charged particles with solid interfaces for incoming and outgoing trajectories, in terms of the dielectric formalism and the semi classical approach, provided by the so-called surface reflexion model which was developed previously by us and other authors [1-3]. This model is valid when the surface is smooth even though it always present a certain level of roughness at an atomic scale that may hinder its treatment [4].
Turning to the problem established by the non-invariant translation of the dielectric function that characterizes the solid, we treat the external particle as a classical particle following a given trajectory. It is well known that the particle excites collective oscillations, or plasmons, in the bulk and on the surface [1]. In this process the particle suffers an energy loss that depends on its initial energy (or velocity) and the characteristics of the material.
Figure 1 illustrates the scheme of the system. We show in detail how different trajectories contribute to the stopping power or, equivalently, to the excitation of bulk and surface plasmons. We obtain the same surface plasmons contribution for both paths, incoming and outgoing at perpendicular trajectory.
On the contrary, the contribution of bulk plasmon shows an oscillatory term for incoming trajectories: that may be attributed to interference effects between direct and reflected plasmons result that we will analyze in detail.

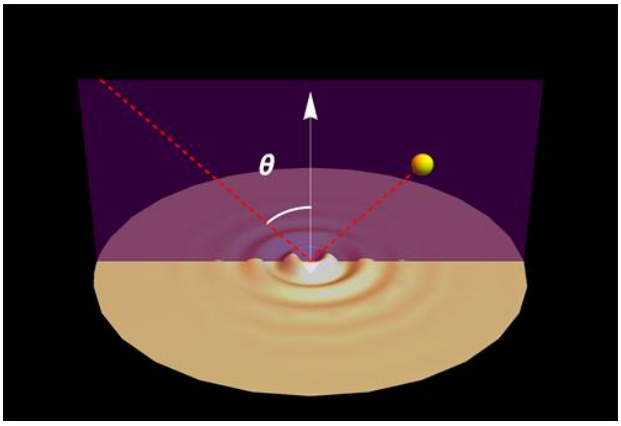

Figure 1. External Charged Particles for Incoming and Outgoing Trajectories near a planar surface

References

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