Scattering of Light by Rough Surfaces; *per Aspera ad Astra*

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The scattering of electromagnetic waves on rough surfaces is permanently taking place everywhere in our environment. Our knowledge on this extensively studied phenomenon and the associated applications truly extend "from the rough roads to the stars". For instance, the propagation of radio signals along the rough surface of the earth (terrain, sea surface), the reflections of radio waves from the ionosphere or even from celestial bodies all belong to this subject. In the everyday practice of extreme light research, the wave reflection on plasma mirrors is an important tool for pulse cleaning, which naturally belongs to the subject category of scattering by random rough surfaces.

Since, in general, the shapes of the various rough surfaces are very complex, it has long been useful to model them by stochastic fields. In our recent theoretical work, whose few results are to be presented in the talk, we have improved the so-called "micro-facet-model" (which is widely used in computer graphics, to generate the so-called appearance functions). According to this model, the rough surface is an assembly of tiny plane surfaces, whose orientations and slopes are subject to chance. Recently we have derived several new probability density functions of slopes, and some known ones, which have earlier been introduced ad hoc. Besides, we have treated the local interaction of the plane electromagnetic waves with the random facets (scattering) and their propagation in the frame of phenomen-ological Maxwell equations.

We present new results on some relevant distribution of random slopes of the micro-facets, as well as results on the amplitude correlation and the intensity distribution of the scattered radiation. On the basis of the analytic formulae obtained, we can keep track of how the roughness and the material constitution (*e.g.* permittivity) of a surface are related to the characteristics of the scattered laser radiation (e.g. increased divergence). Our analysis may certainly be applied in the diagnostics and qualification of some rough surfaces.