ASP Seminar
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Fraunhofer IOF, Carl-Zeiss-Saal, Albert-Einstein-Str. 7

High efficiency blazed gratings in resonance domain

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Blazed gratings are key elements for several applications and optical setups. They can be used, for example, as simple light redirectors or as dispersion elements in spectrometer. For some special applications, like astronomical ones, large area gratings with really high diffraction efficiency are increasingly required. Blazed gratings with a continuous profile as well as traditional multi-level gratings with equidistant level elements show tremendous efficiency losses in the resonance domain (small period-wavelength ratio). In this regime, a thorough optimization of a multilevel structure is mandatory in order to achieve high efficiencies, especially for non Littrow-incidence angles. In this talk, we show that with a fused silica three-level grating is possible to achieve efficiency higher than 90%, if illuminated from substrate, close to normal incidence. A physical interpretation of such large efficiencies, based on a proper three-beam interference mechanism will be provided. The results of the development of adequate multistep fabrication, in order to overcome the alignment/sizing errors typical of standard multilevel technology, will be presented and discussed. In the final part of the talk, a new kind of blazed grating, resulting of combination of three level grating with additional subwavelength structure, will be provided as solution to achieve high efficiency for gratings illuminated from air.

Theses:
• There is no simple fabricable three level grating working highly efficient from air
• The relaxed alignment technology enables the fabrication of new kind of gratings
• The perfect blazed effect is possible: it is the theoretical limit for the achievable efficiency
• The development of new technologies is required, especially for high aspect ratio ridges and for overhanging structures.