

MATERIALS SCIENCE GRADUATE PROGRAM

SEMINAR ON LIQUID CRYSTALS

Fall 2024



**WEDNESDAY,
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AMLCI 101



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Materials Science Graduate Program

An Analytical Derivation of the Angular Dependent Efficiency of a Pancharatnam Phase Device using a Beam Propagation Method

Liquid crystal based Pancharatnam Phase Devices (PPDs) have been shown capable of steering light to over 10 degrees with efficiencies of over 90%, but at angles larger than about 30 degrees the efficiency falls off quickly. It has been realized that this limitation is reminiscent of the angular limitation of Raman-Nath diffraction gratings, and a mathematical expression based on those devices has previously been modified to estimate the efficiency limits of PPDs [1]. However a detailed derivation of this expression for incident circularly polarized light on anisotropic materials has only recently been developed [2]. Following that work, in this talk, the analytical expression for the efficiency limits of PPDs is developed using a beam propagation method. It is shown that what limits the efficiency of PPDs at larger angles is the degree of relative phase variation between the incident and deflected orders. If the incident and deflected orders do not maintain a constant relative phase relationship, the efficiency of energy transfer between them is lowered. The method also provides an intuitive understanding of the optical connection between PPDs and polarization volume holograms.



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