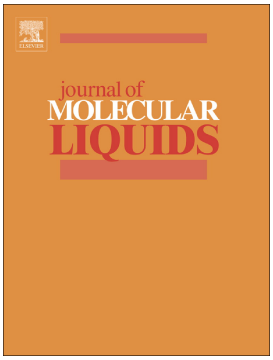

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Liquid-crystal Phase-only Devices

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I. Introduction

Phase-only devices (POD) are devices where materials or optical systems interact with light beams modifying just their phase, i.e., without affecting other beam characteristics such as wavelength or intensity. Phase modifications in PODs can be roughly classified in two categories, those that modify the phase of the same point of the light beam with time –temporal delays–, and those that modify different points of the wavefront –spatial delays. The outcome of the first class usually leads to *modulators*, *tunable filters* or *interferometers*, whereas the second class leads to *beam steerers* and *beam shaping devices* (Fig. 1). Please note that this classification is neither limited nor exclusive.

Liquid crystals are materials particularly suited for phase manipulation. They feature an unusually high optical birefringence that can be easily modified by moderate external fields. The development of LC-based PODs has undergone a significant growth in the last decade, as the interest of many research laboratories has evolved from display to non-display applications of LCs [1]. At present, LC display applications are a topic mostly confined to R&D units of large consumer electronic companies. Most scientific or academic laboratories have drifted to a number of fields where LC optical anisotropy can be exploited for different applications. The economic impact of these applications, obviously being not that of LCDs, is certainly not negligible, and is steadily growing with time. Among others, it is worth mentioning applications in guided and wireless optical communications, light confinement, photonic integrated circuits, tunable filters and lenses, lens arrays, plenoptic and 3D cameras, optical switching, beam steering, spatial light modulators, computer-generated holography and many others.

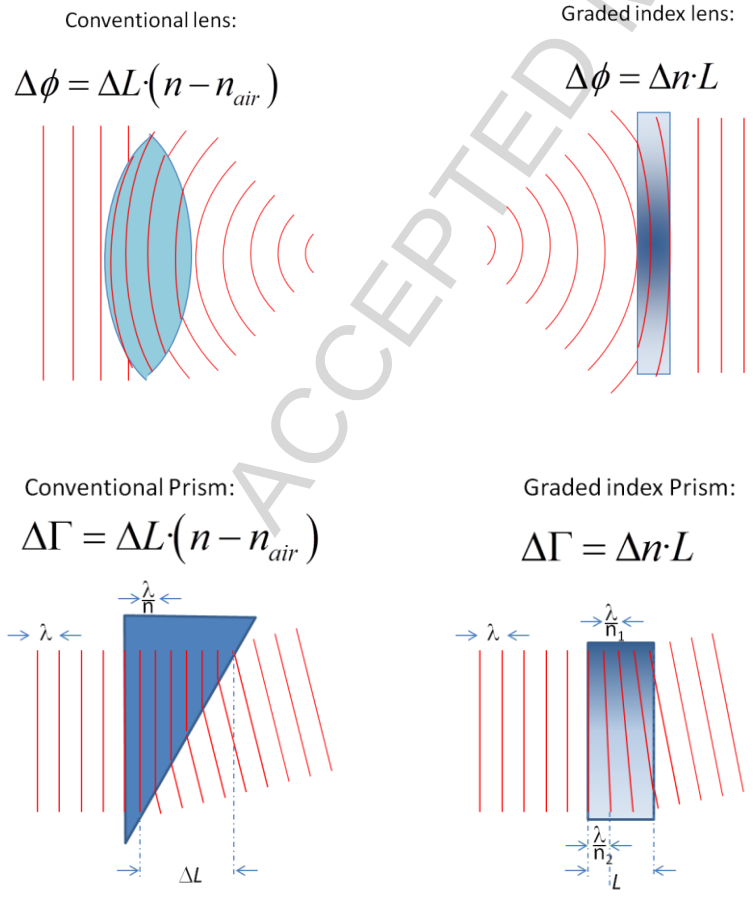

Fig. 1. The principle behind the graded index lens and prism