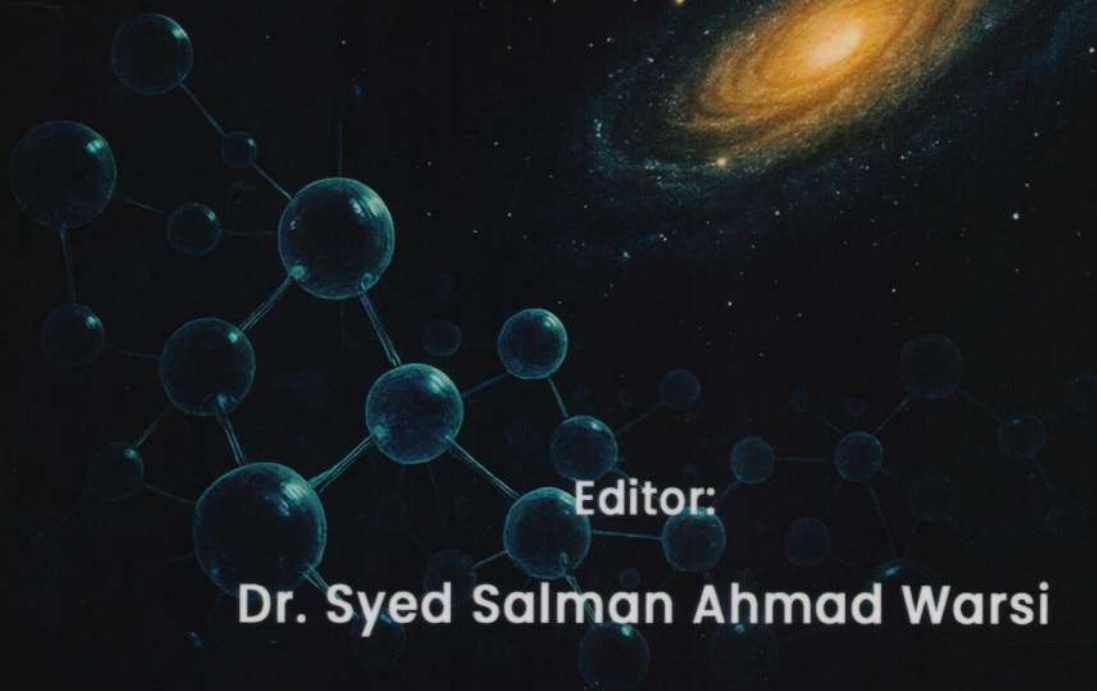


ADVANCES IN CONTEMPORARY PHYSICS

HIGH-ENERGY, COSMOLOGY,
AND SOFT MATTER



Editor:

Dr. Syed Salman Ahmad Warsi

Advances In Contemporary Physics

High-Energy, Cosmology, and Soft Matter

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TEMPERATURE-DEPENDENT OPTICAL PROPERTIES OF PURE AND ANTHRAQUINONE-DOPED NEMATIC LIQUID CRYSTAL E-24

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This chapter presents a comparative analysis of the optical properties of a pure nematic liquid crystal mixture (E-24) and its anthraquinone dye-doped counterpart. The temperature-dependent behavior of the ordinary and extraordinary refractive indices n_o and n_e has been systematically investigated for both samples. The results reveal that the dye-doped sample exhibits comparatively lower refractive indices than the pure nematic mixture. Furthermore, the thermal variation of the optical order parameter has been examined, indicating a higher degree of orientational order in the doped sample. Possible mechanisms responsible for this enhancement are discussed in detail. In addition, variations in birefringence and optical transmittance with temperature have been explored, providing deeper insights into the influence of dye doping on the optical anisotropy of the system.

INTRODUCTION:

Liquid crystals (LCs) are pivotal materials in modern technology due to their unique electro-optical properties [2, 3]. However, a single LC compound often cannot meet all the functional requirements of advanced devices. Consequently, there is growing interest in developing LC mixtures and their doped counterparts [1, 4]. Doped systems, especially those incorporating dyes, polymers, composites, and nanoparticles, have shown promising applications in information display and processing technologies [5, 6].

Among various dopants, dyes are particularly significant due to their anisotropic molecular geometry, which closely resembles that of LC molecules [2, 7]. When introduced into an LC medium, dye molecules tend to align along the LC director axis, enhancing the overall orientational order [7, 8]. The degree of ordering of these dye molecules plays a crucial role; longer dye molecules, due to reduced thermal agitation, often show higher order than the host LC molecules [9]. Interestingly, while the long axis of a dye molecule absorbs minimal light, the orthogonal axis exhibits stronger absorption, influencing the optical properties of the composite [10].

Furthermore, LCs exhibit nonlinear optical responses and are highly sensitive to environmental stimuli, making them suitable for dynamic optical applications [3, 6, 11]. The birefringence