Laguerre Gaussian beam tunability and beam propagation study

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Abstract

Two dimensional (2D) nanomaterials like Molybdenum disulfide (MoS_2) have been drawing a lot of interest due to their excellent nonlinear optical response. In this seminar a thermal lens formation in MoS_2 nanoflakes dispersion using mode mismatched pump probe configuration is presented. Observation of the pump and probe beam intensity patterns gave visual insights on time evolution of photothermal lens formation. Effect of MoS_2 nanoflakes concentration on thermo-optic properties of dispersions were studied using thermal lens spectroscopy technique. Further, a thermo-optic refraction-based technique to measure thermal lens size is proposed. Thermal lens size is observed to inflate with pump power which is exploited to demonstrate 'normally on' all optical switch.

In addition, thermo- optic refraction in MoS_2 nanofluid paved way for temporally switchable optical mode conversion. The MoS_2 nanofluid is used as a medium where the thermal microlens is created by a focused laser beam (pump). The convective thermal plume generated above the focal point of the pump beam within the nanofluid acts as an astigmatic thermal lens. It is discovered that mode conversion of the Laguerre-Gaussian (LG) to the Hermite-Gaussian (HG) beam (vice versa) takes place upon passing through the thermal lens. The topological charge of the LG beam can be easily determined using the proposed mode converter. The mode transformation is explained theoretically as the Fourier components of the LG beam undergoing different optical paths while propagating through the convective plume.

Further, combining the LG beam generation with thermal lensing phenomenon resulted in the demonstration of novel Thermo-optic refraction interferometer (TORI). Application of TORI in milk samples, and analysis of output interferograms clearly indicated the phase deterioration, which is potential for milk monitoring.