IISER physicists develop nanophotonic method to retrieve encoded structure in light

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A GROUP of physicists from Pune have experimentally demonstrated a novel experimental protocol that will optimize retrieval and transfer of optical information and energy at the scale of a microchip.

Information can be encoded and transmitted using structured light. Across the world, research to develop methods to store and retrieve this information are currently on. Having advanced experimental protocols has become a necessity and one such pathway has been devised by the group led by G V Pavan Kumar from the Indian Institute of Science Education and Research (IISER), Pune.

The team experimentally retrieved spin angular momentum and orbital angular momentum of light through scattering using silver nanowire. In their experimental configuration, silver nanowires facilitate better interaction with light due to their metallic nature.

"Both these angular momenta of light are important degrees of freedom available in a propagating light beam. These can be used to encode optical information and can be harnessed to study and understand interactions between light and matter at a scale smaller than the wavelength of light, wherein nanoscale optical forces and torques play a significant role," said Kumar.

Such pathways, say IISER scientists, can be best suitable in decoding the information, that too at microchip levels.

"This protocol can be used to read and retrieve information at microscales and our work adds a new pathway of retrieval by using light scattering technique," the physicists said.

Scholars Diptabrata Paul and Deepak Sharma, who were part of the study published in the journal Laser & Photonics Reviews, further stated that the new protocol can be harnessed to apply optical forces and torques down to the scale of a large molecule. "Such pathways hold potential in improving light-molecule interactions, optical data reading, at classical and quantum optical regimes," they said. Applications of this protocol include rotation and sorting of micro and nano-objects as required in a chiral biological environment and in nano-scale opto-mechanics at classical and quantum regimes.

One can potentially apply optical forces and torques on tiny objects including quantum objects such as molecules, quantum dots and nanoparticles. This has implications in photonic manipulation of matter at micro and nanoscale, said IISER scientists.