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Transfer of Orbital and Spin angular momentum from non-paraxial optical vortex to atomic BEC ANAL BHOWMIK, Department of Physics, Indian Institute of Technology Kharagpur, Kharagpur-721302, India, PRADIP KUMAR MONDAL, Department of Applied Science, Haldia Institute of Technology, Haldia-721657, India, SONJOY MAJUMDER, Department of Physics, Indian Institute of Technology Kharagpur, Kharagpur-721302, India, BIMALENDU DEB, Department of Materials Science, Indian Association for the Cultivation of Science, Jadavpur, Kolkata 700032, India — Allen and co-workers first brought up the realization that optical vortex can carry well defined orbital angular momentum (OAM) associated with its spatial mode. Spin angular momentum (SAM) of the light, associated with the polarization, interacts with the internal electronic motion of the atom. The exchange of orbital angular momentum (OAM) between optical vortex and the center-of-mass (CM) motion of an atom or molecule is well known in paraxial approximation. We show that, how the total angular momentum (TAM) of non-paraxial optical vortex is shared with atom, in terms of OAM and SAM. Both the angular momenta are now possible to be transferred to the internal electronic and external CM motion of atom. Here we have studied how the Rabi frequencies of the excitations of two-photon Raman transitions with respect to focusing angles. Also, we investigate the properties of the vortex superposed state for a Bose-Einstein condensate condensate by a single non-paraxial vortex beam. The density distribution of the vortex-antivortex superposed state has a petal structure which is determined by the quantum circulations and proportion of the vortex and antivortex.

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