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Vortex Beams with keV-GeV Energies for Nuclear Applications

Abstract

The light possessing orbital angular momentum (OAM) has successfully been generated and explored in many laboratories. So far, however, energies of the particles with OAM remain below 0.1 keV. We have generated first high energy vortex beam of twisted 580 MeV photons with Compton scattering of topological charge $m=2$ laser light off PETRA 6 GeV electrons. After modifying the laser entrance pipe we plan to expand energies of the twisted photons from 10 MeV to 1.1 GeV for including potentially reach applications ranged from unprecedented quadrupole excitations of nuclei to quarks' manipulation in nucleon. Using diffraction optics, developed at CANDLE laboratory, it's possible to generate twisted beams with $m>2$ topological charge for multipole nuclear excitations to handle specific resonance structures of different nuclei