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Spin to Orbital Angular Momentum Conversion Through Second Harmonic Generation in Underdense Plasmas[1] ALEX WILHELM, RANDY LEMONS, DAVID SCHMIDT, CHARLES DURFEE, Colorado Sch of Mines —
Second harmonic generation (SHG) is forbidden in an isotropic medium, so non-centrosymmetric optical crystals are used for efficient frequency conversion. However, SHG light can also be generated in an isotropic underdense plasma by driving a nonlinear polarization where the symmetry is broken by a gradient in the plasma density or laser intensity. In this presentation, we demonstrate that in this SHG process spin angular momentum of a circularly polarized photon is converted to orbital angular momentum (OAM) of the output circularly polarized photon. This principle can be extended to generating second harmonic OAM beams of arbitrary vortex phase by mixing the spin and OAM states of the fundamental. To our knowledge this is the first demonstrated case of conversion of optical spin to a beam with OAM in an isotropic medium.

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