

Extended Airy Beams

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A finite-energy *bending* Airy beam solution to the paraxial equation in free space was first formulated analytically by Siviloglou and Christodoulides and subsequently demonstrated experimentally by Siviloglou, Broky, Dogariu and Christodoulides. This work was motivated by the infinite-energy (nonspreading) *accelerating* Airy solution to the Schrödinger equation introduced by Berry and Balazs in the context of quantum mechanics. An Airy beam is slowly diffracting; it can retain its intensity properties over several diffraction lengths while bending laterally along a parabolic path despite the fact that its centroid is constant. Another feature, which has been demonstrated both analytically and experimentally, is that an Airy beam propagating in free space can perform ballistic dynamics akin to those of projectiles moving under the action of gravity. These exotic properties suggest various physical applications, such as Airy beam-mediated particle cleaning and vacuum electron acceleration. Ultra intense Airy beams have been used to create curved plasma channels. Airy beams have been studied in connection with unbiased photorefractive media. Accelerating spatiotemporal Airy wavepackets can defy effectively both dispersion and diffraction.

Both bending Airy beams and accelerating Airy wavepackets are characterized by self-healing properties; they tend to reform in spite of the severity of imposed perturbations. The robustness of such beams in scattering and turbulent environments has been studied numerically and experimentally in the optical regime.

The specific purpose in this presentation is to examine extended bending Airy beam solutions to the paraxial equation in the presence of parabolic, inverted parabolic, and range-dependent quartic transverse profiles.