Simple numerical method for studying UV radiation with orbital angular momentum through laser plasma interaction

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Recent advancements in laser physics and nonlinear optics are enhancing our understanding of high-intensity laser pulse interactions with materials. High-order harmonic generation (HOHG) [1], which occurs when a powerful laser pulse interacts with plasma, produces ultraviolet (UV) radiation with unique properties such as orbital angular momentum (OAM) [2].

This article focuses on modeling such a phenomenon. One process involved in HOHG is the relativistic oscillating mirror (ROM) [3], where a laser pulse interacts with the overdense plasma, creating an oscillating mirror that reflects the pulse. The conventional approach uses a computationally demanded solution for the Vlasov-Maxwell equations. However, Einstein's 1905 model [3] of relativistic mirror motion offers a simpler, more computationally efficient alternative, suitable for qualitative studies.

For simulations, we use Laguerre-Gaussian modes for laser, and the target is treated as a relativistically moving mirror with perfect reflection. This paper introduces a lightweight 3D numerical tool for modeling HOHG from overdense plasma and generating harmonics with OAM, including fractional and dynamic OAM.

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