Plan Overview

A Data Management Plan created using DMPTool

DMP ID: https://doi.org/10.48321/D1KQ0G

Title: Atomic Multi-Photon Ionization Using Vortex Laser Photons

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Grant: FRG24

Template: Data Management Plan - AUS Funded Research

Project abstract:

In this project, I wish to formulate the theory of strong field MPI and ATI of a single one-electron atom irradiated by an intense beam of vortex photons. I plan to follow the steps of some work I did more than two decades ago for the same processes, albeit using linearly- and circularly polarized plane-wave laser beams. The method is based on semiclassical treatment in which the electron is treated quantum-mechanically and the radiation fields of the vortex beam are modeled classically by Laguerre-Gaussian and/or Bessel functions. The angular momentum of the vortex photons may get transferred to the emitted electrons, producing vortex electrons. My approach will employ a wavefunction time-evolved using a series introduced by M. Frasca, which is similar to the Dyson series, albeit with the roles of the non-interacting atomic Hamiltonian and the interaction reversed. The results will be transition probabilities for the multi-photon ionization and energy spectra of the emitted electrons. More specifically, the study will try to answer the following questions: (1) Can MPI and ATI, employing vortex photons, be done fully analytically? (2) Does one get emitted electron energy spectra with peaks like in MPI and ATI with plane-wave linearly and circularly polarized photons? (3) Will the emitted electrons carry angular momentum (i.e., will they be vortex electrons)?

Start date: 06-01-2024

End date: 05-31-2025

Last modified: 01-22-2024

Atomic Multi-Photon Ionization Using Vortex Laser Photons

Output from numerical calculations will be data files (.dat)

On my network drive.

No access concerns.

Dat will be shared by email, if need be.

fig1.dat, ...

No need for permanent retention.

Planned Research Outputs

Data paper - "Atomic Multi-Photon Ionization Using Vortex Laser Photons"

Analytic work (equations) will be derived for the ionization rates of atomic electrons. Data produced from the equations will be presented graphically.

Planned research output details

Title	Type	Anticipated release date	Initial access level	Intended repository(ies)	Anticipated file size	License	Metadata standard(s)	May contain sensitive data?	May contain PII?
Atomic Multi-Photon Ionization Using Vortex Laser ...	Data paper	Unspecified	Open	None specified		None specified	None specified	No	No