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Presentation Type: Oral
Sorting Category: 02.00 Atomic, Molecular, and Charged Particle Collisions
Sub-Category: 02.03 Electron-Atom Collisions
Category Type: Experimental/Theoretical
Title: Electron scattering in Fourier reciprocal space maps the scattering potential

Abstract Body: Diffraction-like fringe structures appear in the differential cross-section (DCS) of elastic electron–atom scattering [1]. A recent investigation of e–C_{60} scattering [2] revealed that such diffraction can be probed in two ways: (i) through the angular DCS of scattering at a fixed impact energy and (ii) through the energy DCS at a fixed scattering angle, the latter promising applications in ultrafast electron diffraction studies. In the current theory-experiment joint research, we present a novel analysis of diffraction in DCS of atomic targets to establish a connection to the scattering potential. Scattering parameters are calculated using the Dirac–Partial wave formalism [3]. Employing a Fourier transform (FT) method, we process the oscillations (fringes) in DCS to gain insights of its relationship with the overall interaction potential [4]. We show that the effective diffracting length, derived from the transform of angular DCS into reciprocal space, as a function of energy can delineate the scattering potential, a quantity which is a fundamental collision parameter, not merely a mathematical entity, but directly inaccessible to experimental observation. The approach may find applications in large-volume, multiscale modelling.

[1] **B. P. Marinković**, V. Vujcić, G. Sushko, D. Vudragović, D. P. Marinković, S. Dorjević, S. Ivanović, M. Nesvić, D. Jevremović, A. V. Solov'yov, and N. J. Mason, **Nucl. Instr. Meth. Phys. Res. B** 354, 90 *(2015)*.

[2] **R. Aiswarya,** R. Shaik, J. Jose, H. R. Varma, and H. S. Chakraborty, **Phys. Rev. Lett**. 133, 033002 *(2024)*.

[3] **F. Salvat,** A. Jablonski, and C. J. Powell, **Comput. Phys. Commun.** 165, 157 *(2005)***.**

[4] **R. Aiswarya**, J. Jose, N. Simonović, B. P. Marinković, and H. S. Chakraborty, **Phys. Rev. A Lett.** 113, L010801 (2026)

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Newsworthy Research?	Yes, I would like to consider highlighting my abstract in its outreach to journalists.
Media Summary:	While quantum projectiles diffract from sharper edges of matter's structure, this theory-experiment research shows that they can, rather counterintuitively, also diffract from long range Coulombic boundaries of atoms. Thus, effective scattering potentials are extracted by a Fourier analysis of the angular distribution of scattering which may find use in large-volume, multi-scale modeling where adopting the complex ab initio potential is exigent and costly. Fundamentally, the angular spectrum makes the idea of a “potential” a descriptive reconstruction, not merely a mathematical, oncological claim.
Has the work you are presenting been submitted to or published in a peer-reviewed journal?	Yes
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