Contribution ID: **62** Type: **Oral Presentation**

A farewell to waves

The wave nature of particles is a notoriously unintuitive feature of quantum theories. However, it is often deemed essential, due to material particles exhibiting diffraction and interference. Troublingly, Lande and Levy-Leblond have shown that de Broglie wavelengths are not relativistically covariant, making any such wave properties physically inconsistent. In this work we explore whether modern experiments vindicate an alternative view: that apparent waviness in diffraction and interference scenarios emerges as a consequence of quantised interactions between particles. Such a view has historically received very little attention, despite being the exact modern explanation of both the Kapitza-Dirac effect and ultrafast electron diffraction. We study a photon orbital angular momentum realisation of the double slit to prove this explanation capable of unifying quantum interference phenomena.

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Session Classification: Theoretical and Computational Physics

Track Classification: Track G - Theoretical and Computational Physics