# Relativistic Bohmian Trajectories of Photons *Via* Weak Measurements

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Bohmian mechanics is a nonlocal hidden-variable interpretation of quantum theory in which particles follow deterministic trajectories. Historically, it has not been widely accepted due to its apparent conflict with relativity. In this talk, I will discuss recent results that ground the relativistic trajectories of photons in weak measurements of their energy and momentum [1]. The resulting deterministic velocity field is explicitly Lorentz-covariant, constructed from the time and space components of the Klein-Gordon conserved current vector. I demonstrate the unusual features of the trajectories in a Mach-Zehnder interferometer (see Fig. 1) and in a two-photon Hong-Ou-Mandel-type interaction. Finally, I show that there exists a general relativistic interpretation of the photon trajectories in terms of an exotic spacetime geometry.

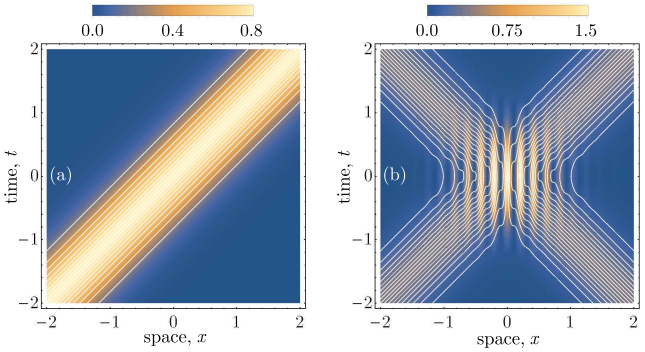

Figure 1: Bohmian trajectories of photons in (a) a Gaussian pulse, and (b) in a superposition of left- and right moving pulses

## References

[1] J Foo, E Asmodelle, A P Lund and T C Ralph, Nat. Commun. **13**, 4002 (2022)