Abstract

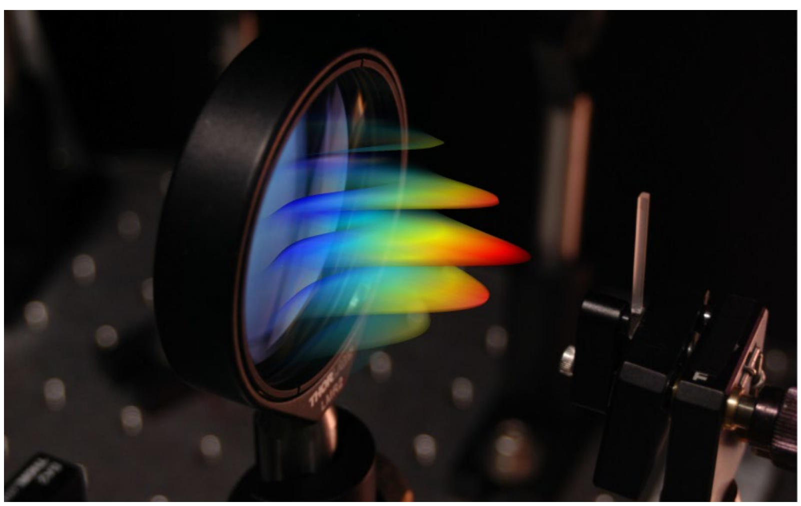
Central to quantum theory, the wavefunction is a complex distribution associated with a quantum system. Despite its fundamental role, it is typically introduced as an abstract element of the theory with no explicit definition. Tomographic methods can reconstruct the wavefunction from a disparate set of measurements. In contrast, I present a method to directly measure the wavefunction so that its real and imaginary components appear straight on our measurement apparatus. In turn, this method functions as a simple operational definition of the wavefunction. At the heart of the method is a joint measurement of position and momentum that is made possible by weak measurement (a concept that I will attempt to demystify). I will describe an experimental example of the method in which we directly measured the transverse spatial wavefunction of a single photon. I will then present new experimental work that extends this concept and explores other ways to measure position and momentum together.

Related Papers:

Nature, 474, 188 (2011). http://arxiv.org/abs/1112.5471

Phys. Rev. Lett. 117, 120401 (2016). https://arxiv.org/abs/1604.07917

Phys. Rev. Lett 119, 050405 (2017). http://arxiv.org/abs/1701.04095



Artistic Impression of the Direct Measurement of the Wavefunction