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Young's double-slit interference with nondegenerate biphotons

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It is well known that Young's double-slit interference (DSI) is one of the most important effects in physics. In the early days of quantum mechanics, DSI was regarded as a single-photon effect and is still the best example to illustrate wave-particle duality, the uncertainty principle and complementarity. In the last two decades, much attention has been devoted to the study on two-photon DSI with a quantum entangled light source and a thermal light source. But in all these works the photons in the interference have the same frequency. When two photons passing through the double-slit have different colors, one may even doubt that the interference is possible at all. If it is possible, how the two different frequencies work to generate the interference patterns? And how is the matter about the which-path information when the two photons can be identified by their color? In this article, we answer these questions by reporting a DSI experiment with two photons of different color, in which a two-axis interference pattern is proposed for describing complete interference information about two-color frequencies, i.e. interference patterns for frequencies ω1, ω2, ω1+ω2, and ω1-ω2. The passage from degenerate photon pair to two-color pair represents a substantial step forward, since the photons can now be identified by their colors and previous quantum interpretation is not appropriate. Our work provides an intuitive picture of in-phase and out-of-phase non-degenerate photon correlations, and a complete and general description about the which-path information of two colored photons in quantum interference.

Biography

Jun Xiong obtained his BS Degree from the Minzu University in P R China (2014). He is currently a PhD student in the Department of Physics at the Beijing Normal University, P R China. His current research is focused on quantum imaging.

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