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Interference between two indistinguishable electrons - observation of two-particle Aharonov-Bohm interference[1]

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The two-particle AB experiment proposed by Yurke et. al. [1] and Samuelsson et. al. [2], was realized recently in a mesoscopic device in the quantum Hall effect regime. It was the first observation of quantum interference oscillations between two independent non-interacting particles. The interference fringes were observed only in the joint probability of electrons arrival at two different drains; hence being the quantum analogue to the Hanbury Brown and Twiss experiment with classical waves [3]. This counter intuitive effect is a direct result of the quantum exchange statistics of identical quantum particles. The experimental details and results will be discussed in the light of the theoretical effort to interpret this observation as a signature of orbital entanglement between the two independent electrons, even tough they never interacted with each other. New difficulties regarding the finite temperature and imperfect visibility were resolved only recently, in a non- trivial way.

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[3] R. Hanbury Brown, R. Q. Twiss, Phil. Mag. 45, 663-682 (1954).

[1]Nature 448, 333-337 (2007)