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Impact of classical forces and decoherence in three-terminal Aharonov-Bohm devices ELIA STRAMBINI, VINCENZO PIAZZA, FABIO BELTRAM, NEST INFM-CNR & Scuola Normale Superiore, I-56126 Pisa, Italy, GIORGIO BIASIOL, Laboratorio Nazionale TASC INFM-CNR, I-34012 Trieste, Italy, LUCIA SORBA, NEST INFM-CNR & Scuola Normale Superiore, I-56126 Pisa, Italy & Laboratorio Nazionale TASC INFM-CNR, I-34012 Trieste, Italy — Multi-terminal Aharonov-Bohm (AB) rings are ideal building blocks for quantum networks (QNs) thanks to their ability to transform input states into controlled coherent superpositions of output states. We report on experiments performed on three-terminal GaAs/AlGaAs AB devices and compare our results with a scattering-matrix model of our device including Lorentz forces and decoherence. Our devices were studied as a function of external magnetic field (B) and gate voltage (V_g) down to a $T=350$ mK. The total output current from two terminals while applying a small bias to the third lead was found to be symmetric with respect to B with clear AB oscillations showing abrupt phase jumps between 0 and π at different values of V_g , reminiscent of the phase-rigidity constraint due to Onsager-Casimir relations. Surprisingly, the individual outputs show an almost linear dependence of the oscillation phase on the external electric field. We emphasize that a simple scattering-matrix approach does not explain the observed behavior and show how to extend this model in order to fully describe the observed phenomena.

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