Coherent effects in atomtronic circuits

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Abstract

Atomtronics is an emerging field seeking to realize atomic circuits exploiting ultra-cold atoms manipulated in micro-magnetic or laser-generated micro-optical circuits. In this talk, I will be focusing on maybe the simplest instance of atomtronic circuit: ultracold-atoms in ring-shaped potentials and pierced by an effective magnetic flux. Several quantum coherent effects occur in such systems that can be of interest in quantum technology[1]. In particular, I will be discussing the source-to-drain out of equilibrium dynamics of the bosonic fluid along the ring (see Fig1). I will show how the system experiences a specific crossover between physical regimes dominated by pronounced interference patterns and others in which the Aharonov-Bohm effect is effectively washed out[2].


FIG. 1. Atomtronic setup consisting of a superfluid condensate in a ring lattice with two attached leads. The dynamics is controlled by Aharonov-Bohm flux $\Phi$ and ring-lead coupling $K$. Particles tunnel between ring sites with rate $J$ and particles interact on-site with strength $U$. 