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Nonequilibrium-induced metal-superconductor quantum phase transition in graphene SO TAKEI, YONG BAEK KIM, University of Toronto — We study the effects of dissipation and time-independent nonequilibrium drive on an open superconducting graphite monolayer, or graphene. In particular, we investigate how dissipation and nonequilibrium effects modify the semi-metal-BCS quantum phase transition that occurs at half-filling in equilibrium graphene with attractive interactions. Our system consists of a graphene sheet sandwiched by two semi-infinite three-dimensional Fermi liquid reservoirs, which act both as a particle pump/sink and a source of decoherence. A steady-state charge current is established in the system by equilibrating the two reservoirs at different, but constant, chemical potentials.The nonequilibrium BCS superconductivity in graphene is formulated using the Keldysh path integral formalism, and we obtain generalized gap and number density equations valid for both zero and finite voltages. The behaviour of the gap is discussed as a function of both attractive interaction strength and filling for various graphene-reservoir couplings and voltages.

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