Effective Linear Response in far-from-equilibrium anyonic beams

Gefen Y.[1], Gu Zhang, Igor Gornyi, and Yuval Gefen
[1] Weizmann Institute, Rehovot, Israel

Linear response theory serves as a fundamental tool in the study of quantum transport, extensively employed to elucidate fundamental mechanisms related to the nature of the particles involved and the underlying symmetries. This framework is, however, limited to equilibrium or near-equilibrium conditions. Here, we develop an effective linear response theory designed to describe charge and thermal quantum transport, where the reference far-from-equilibrium stationary state comprises anyons forming a dilute beam. We apply our theory to study tunnel-coupled anyonic beams in collider geometries, enabling braiding, collisions, and tunneling of anyons at the central collider. Our linear-response transport coefficients directly reflect the fractional charge and statistics of the anyons involved, avoiding the need to measure higher-order current correlations. Moreover, the emergence of finite thermoelectric (Peltier and Seebeck) coefficients signifies the presence of real anyon collisions (as opposed to virtual braiding in the time domain), intimately associated with a broken particle-hole symmetry, specific to anyonic gases.