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Sign reversal of the boson-boson interaction potential in planar Bose-Fermi mixtures under a synthetic magnetic field

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We study the mutually coupled, strongly interacting bosonic and non-interacting fermionic, species of unequal masses in the regime where the retardation effects are an important part of the physics. A cloud of neutral atoms experiences a synthetic magnetic field because of a vector potential that imposes a phase shift on the constituents. The magnetic field causes the oscillations of the magnitude and sign of the effective interaction between bosons from repulsive to attractive in contrast to the static case. We show that the dynamics for the gaseous Bose-Fermi mixtures when reaching the quantum-Hall regime becomes highly nontrivial.