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Collective modes of fermionic alkaline earth atoms with SU(N) spin symmetry SAYAN CHOUDHURY, ERICH MUELLER, Cornell Univ, THOMAS KILLIAN, KADEN HAZZARD, Rice University — Alkaline earth atoms have a large spin degeneracy (controllable from $N = 1, \ldots, 10$) and an enhanced interaction symmetry that can enhance quantum fluctuations. Collective modes, excited by quickly changing the trap frequencies in a trapped gas, can be used to investigate properties of the excitations that emerge from these interactions. In particular, the collective mode frequency and damping time reflect properties of the gas's quasiparticles like their lifetime and typical interaction energy. We calculate the frequencies and damping rate of the breathing and quadrupole modes for fermionic alkaline earth atoms confined by a quasi-2D harmonic trap. We find a significant interaction dependent shift in the collective mode frequencies. For an isotropic trap, the breathing mode does not exhibit damping. However, the quadrupole mode, a crossover occurs from the collisionless to the hydrodynamic regime as the interaction strength increases. For the experimentally relevant case of an anisotropic trap, the breathing and quadrupole modes couple and both of these modes exhibits damping. The most important physical consequence of the large N in this system is to give the ability to parametrically tune the ratio of the typical interaction strength to collisional damping.

Sayan Choudhury
Cornell Univ

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