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Excitation spectrum of a tightly confined spin-2 Bose gas MATJAZ PAYRITS, RYAN BARNETT, Imperial Coll — We introduce an effective low-energy action for a spin-2 Bose gas in a tight trap in the presence of a quadratic Zeeman field. We derive the excitation spectrum by expanding the action to second order in deviations from the ground state configuration and subjecting it to a functional integral analysis. This is a generalization of standard Bogoliubov theory as it allows for the study of excitations about fragmented states, occuring ubiquitously in spinor Bose gas systems. It is found that the excitations generally consist of mean-field-like states uniformly integrated over rotations about the direction of the magnetic field (or all of SO(3) in the absence of a magnetic field). This parallels the general observation that states breaking fewer symmetries tend to be lower in energy. Though unstable in the thermodynamic limit, these states are stabilized for finite particle numbers, potentially allowing for a convenient means of studying fragmentation experimentally. For the nematic region of the spin-2 phase diagram, we also show that the quadratic Zeeman dependence of the spectrum smoothly approaches the previously obtained discontinuous mean-field dependence.

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