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Quantum rotor theory of spinor condensates in tight traps RYAN BARNETT, HOI-YIN HUI, CHIEN-HUNG LIN, JAY D. SAU, S. DAS SARMA, Joint Quantum Institute and Condensed Matter Theory Center — In this talk, we theoretically construct exact mappings of many-particle bosonic systems onto quantum rotor models. In particular, we analyze the rotor representation of spinor Bose-Einstein condensates. There is an exact mapping of a spin-one condensate of fixed particle number with quadratic Zeeman interaction onto a quantum rotor model. We use the rotor mapping to describe the different dynamical regimes recently observed in ^{23}Na condensates. We also suggest a way to experimentally observe quantum mechanical effects (collapse and revival) in spinor condensates. We classify three distinct physical limits of the rotor model: the Rabi, Josephson, and Fock regimes. The last regime corresponds to a fragmented condensate and is thus not captured by the Bogoliubov theory. The semiclassical limit of the rotor problem is discussed and connections with the quantum wave functions are made through use of the Husimi distribution function. Finally, we describe how to extend the analysis to higher-spin systems and derive a rotor model for the spin-two condensate. This work was supported by the NSF JQI Physics Frontier Center.

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