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Stoner ferromagnetism in a thermal pseudospin-1/2 Bose gas JURAJ RADIC, STEFAN NATU, VICTOR GALITSKI, University of Maryland, College park — We compute the finite-temperature phase diagram of a pseudospin-1/2 Bose gas with contact interactions, using two complementary methods: the random phase approximation and self-consistent Hartree-Fock theory. We show that the spin-dependent interactions, which break the (pseudo) spin-rotational symmetry, generally lead to the appearance of a magnetically ordered phase at temperatures above the superfluid transition. In three dimensions, we predict a normal easy-axis/easy-plane ferromagnet for sufficiently strong repulsive/attractive inter-species interactions respectively. The normal easy-axis ferromagnet is the bosonic analog of Stoner ferromagnetism known in electronic systems. For the case of inter-species attraction, we also discuss the possibility of a bosonic analogue of the Cooper paired phase. This state is shown to significantly lose in energy to the transverse ferromagnet in three dimensions, but is more energetically competitive in lower dimensions. Extending our calculations to a spin-orbit-coupled Bose gas with equal Rashba and Dresselhaus-type couplings (as recently realized in experiment), we investigate the possibility of stripe ordering in the normal phase. Within our approximations however, we do not find an instability towards stripe formation.

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