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Spin Squeezing in Bose-Einstein Condensates: Limits Imposed by Decoherence

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Abstract:

Spin squeezed states are quantum correlated states that could be used to enhance the accuracy of atomic clocks beyond the present value. Due to atomic interactions, such entangled states can be dynamically created in a bimodal condensate as demonstrated recently in experiment [1], [2]. In this talk I will analyze the ultimate limits of this method to create spin squeezing including the presence of decoherence due to atom losses [3]. The effect of a non zero condensed fraction at finite temperature, giving a finite coherence time in the system [4], will also be discussed.

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- [2] C. Gross, T. Zibold, E. Nicklas, J. Esteve, M. Oberthaler, Nature 464, 1165 (2010).
- [3] Yun Li, Y. Castin, A. Sinatra, Phys. Rev. Lett. 100, 210401 (2008).
- [4] A. Sinatra, Y. Castin, E. Witkowska, Phys. Rev. A, 80, 033614 (2009).