Spontaneous spin squeezing in a two-component Rb BEC

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The observation of spontaneous spin squeezing in a standard Ramsey sequence applied to a two-component Bose–Einstein condensate (BEC) of 87Rb atoms is presented. The atoms are trapped in the elongated magnetic trap of an atom chip, and the squeezing is generated by state-dependent collisional interactions, despite the near-identical scattering lengths of the spin states. In this proof-of-principle experiment, we observe a metrological spin squeezing that reaches 1.3±0.4 dB for 5000 atoms, with a contrast of 90±1%. This method may be applied to realize spin-squeezed BEC sources for atom interferometry without the need for cavities, state-dependent potentials or Feshbach resonances. An attractive approach would be to use the naturally occurring spatial separation as a nonlinear beam splitter for a matter wave interferometer by releasing the BEC into free fall or into an on-chip waveguide.

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