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Effect of atomic diffusion on spin noise spectroscopy with a tightly focused beam VITO GIOVANNI LUCIVERO, NATHANIEL DAVID MCDONOUGH, NEZIH DURAL, MICHAEL ROMALIS, Princeton University, ROMALIS GROUP TEAM — Atomic diffusion can limit the sensitivity of atomic sensors and optical magnetometers. Here we introduce an analytical model for explaining the atomic diffusion component of the spin time-correlation function under different conditions of beam focusing and buffer gas pressure. For a tightly focused probe beam we find that the decay of the diffusion correlation function follows a power law rather than exponential, as it does in the collimated case. Counterintuitively, this results in a narrowing of the spin-noise linewidth and significant increase in the noise peak amplitude. We are currently performing experimental measurements of the atomic diffusion effects in the spin noise spectra as a function of probe beams focus size down to 2 μm and as a function of the buffer gas pressure. We will present detailed comparison of theory and experiment and discuss implications of the atomic diffusion on sub-shot noise measurements in atomic sensors.

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