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Improving Sensitivity and Bandwidth of an Atomic Magnetometer using Quantum Non-Demolition Measurement VISHAL SHAH, GEORGIOS VASILAKIS, MICHAEL ROMALIS, Princeton University — The fundamental sensitivity of an atomic magnetometer is limited by spin projection noise. In the case of uniform spin relaxation, it is well understood that it is not possible to improve the sensitivity using spin squeezing induced by quantum non-demolition (QND) measurement for measurement time scales longer than spin relaxation time [1, 2]. It is however possible to increase the bandwidth of the magnetometer using QND measurement. Here we experimentally demonstrate, in excellent agreement with the theory, an improvement in the bandwidth of our scalar alkali vapor atomic magnetometer using continuous QND measurement. We also investigate the possibility of improving sensitivity of our magnetometer in the special case in which the spin relaxation is time dependent. The case of time dependent spin relaxation naturally arises in high polarization regime in an alkali-alkali spin-exchange relaxation dominated atomic sample. [1] S. F. Huelga, Phys. Rev. Lett. 79, 3865 – 3868, 1997. [2] M. Auzinsh, Phys. Rev. Lett. 93, 173002, 2004.

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