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Matter-wave amplification in a seeded ^{23}Na spinor Bose-Einstein condensate JONATHAN WRUBEL, HYEWON PECHKIS, Joint Quantum Institute, NIST and the University of Maryland, PAUL GRIFFIN, University of Strathclyde, RYAN BARNETT, EITE TIESINGA, PAUL LETT, Joint Quantum Institute, NIST and the University of Maryland — In an $F = 1$ spinor condensate, spin-changing interactions of atoms in the $|m_{F_A}, m_{F_B}\rangle = |0, 0\rangle$ state can only produce the $|0, 0\rangle$ (unchanged) or $|1, -1\rangle$ states. Because of the ideally perfect correlation in the production of $m_F = -1$ and $m_F = +1$ atoms, the magnetization $m = n_{m_F=+1} - n_{m_F=-1}$ is a squeezed quadrature of the system. Here we use a microwave-dressed ^{23}Na Bose-Einstein condensate to create a nonlinear matter-wave amplifier which can produce spin-squeezed states. We then use microwaves to transfer a fraction of the $m_F = 0$ condensate into a coherent seed of $m_F = +1$ atoms. After some evolution time, we show that $n_{m_F=+1}$ can be used as a large amplitude measurement of only a few atoms initially in the $m_F = -1$ state. This kind of measurement may be important in achieving high phase sensitivity in Heisenberg-limited matter-wave interferometers.

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