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Proposed Single Baseline Atom Interferometry Gravitational Wave Measurements PETER L. BENDER, JILA/Univ. of Colorado — A recent paper [P. W. Graham et al., arXiv:1206.0818v1 [gr-qc] 5 Jun 2012] proposed GW measurements using an atom interferometer at each end of a single baseline. The suggested approach makes use of extremely narrow linewidth single photon transitions, such as the 698 nm clock transition in Sr-87. A case discussed has a L = 500 km baseline length between spacecraft, N = 300 large momentum transfer beamsplitters, and a total measurement time of 100 s. The authors point out that many sources of errors in measuring GW signals cancel because they are nearly the same for both parts of the split atom wave functions and/or for both interferometers. Thus a much reduced sensitivity to laser frequency noise is reported. However, it seems that the requirements on this kind of mission are still very demanding. For example, large differences in phase between the 2 parts of the wavefunction for each interferometer appear to be expected due to jitter in the timing of the laser pulses. This makes it more difficult to determine the signs of the desired GW signals. And, because of the 2400 successful state transitions required for an atom to contribute to the signal, even the atom cloud temperature of 100 pK assumed in previous proposals would cause a large loss in signal. In addition, consideration of atom cloud mean velocity differences as low as 1 micron/s and of laser frequency noise of around 1 Hz appears to be needed.

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