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Error Sources for Gravitational Wave Sensors using Atom Interferometry PETER L. BENDER, JILA/Univ. of Colorado — Proposals were made in 2008 for using two atom interferometers with laser links between them as gravitational wave sensors (S. Dimopoulos et al., PRD 78, 122002 (2008)). However, the importance of fluctuations in the laser wavefront aberrations over periods of seconds to minutes was overlooked in these proposals. For the AGIS-Sat 3 proposal, the total path length would be 10,000 km, and the laser wavefront aberration fluctuations would have to be attenuated to a level of $2\text{x}10^{-9}$ wavelengths in order to achieve the quoted gravitational wave sensitivity. For the AGIS-Sat 2 proposal, the requirement would be a factor 10 less severe. In addition, the atom cloud temperature fluctuations from cloud to cloud would have to be less than 0.2 pK and 2 pK for the two proposed missions. More recently, a proposal for a gravitational wave mission called AGIS-LEO at 1000 km altitude in Earth orbit has been made (J. M. Hogan et al., arXiv:1009.2702v1, 14 Sept. 2010). For this mission, the atom interferometer separation would be 30 km, and the wavefront aberration jitter would need to be reduced to $2\text{x}10^{-8}$ wavelengths. Some steps toward mitigation of the wavefront aberration jitter problem are mentioned, including possible use of an extra initial laser propagation path and a mode-scrubbing cavity. However, the requirements on such filtering systems appear to be severe.

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