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Rotation compensation system for MAGIS-100 and measurement of laser pointing jitter

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The next generation of long baseline atom interferometers is under construction; these will look for ultralight dark matter and mid-band gravitational waves. Atom interferometers are also susceptible to the Coriolis force, which can cause unwanted phase shifts and obscure signals. The design and characterisation of an ultra-high-vacuum bottom reflecting mirror system for the active compensation of the Coriolis effect and the implementation of phase-shear readout for the MAGIS-100 experiment are reported. A measurement of the bottom reflecting mirror's pointing jitter noise with an analysis of how this noise source impacts the atomic phase is presented. The analysis demonstrates that the system has an rms angular jitter of 33 nrad, and the total phase shift due to the pointing jitter is calculated to be 1.1 mrad, well below the expected atom shot noise limit. The analysis is then further extended to cover a range of future experimental parameters that MAGIS-100 will cover, and it is found that this systematic error is of low order.

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