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A Large-Area Atom Interferometer based on a Parabolic Trajectory for High Sensitive Rotation Measurement

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Matter-wave sensors with cold atoms have progressed tremendously over recent decades. Here we demonstrate a large area atom gyroscope with matter-wave interferometry in HUST, this atom gyroscope program is started in 2013, and reaches the state of the art in 5 years. In this report, we show that the HUST atom gyroscope achieves a short-term sensitivity of 150 nrad/s/Hz$^{1/2}$ with 5.8cm^2 Sagnac area. In the large area atom gyroscope, the tilt alignment and the parallel alignment of the Raman beams are the most critical keys to observe interference fringes, we show the recipes of the Raman beams alignment in the HUST atom gyroscope. During the beam alignment experiment, we also demonstrate a sensitive tilt sensor based on quantum technology employing cold atoms, This quantum tiltmeter achieves a sensitivity of 1 .3 μrad/Hz$^{1/2}$, with resolution down to 55 nrad at an integration time of 1000 s. The deformation of the Earth's surface has been monitored in a continuous run of 31 h, showing that a quantum tiltmeter can be applied to record tilt tides and can be an valuable sensor in geophysics and various scientific facilities. Finally, the limitation of the short-term sensitivity and long-term stability of the HUST atom gyroscope are also discussed in the report.