Contribution ID: **3** Type: **Talk**

Glass sensors as an inertial sensing solution for future gravitational wave detectors

Future gravitational wave observatories require significant advances in all aspects of their seismic isolation; inertial sensors being a pressing example. Inertial sensors using gram-scale, high Q factor, glass mechanical resonators combined with compact interferometric readout are promising alternatives to kilogram-scale conventional inertial sensors. We have developed a novel technique for manufacturing glass resonators based upon wafer bonding, which removes the previous size limitations on the design of such sensors, which otherwise limited their performance. The manufacturing technique works with fused silica for room-temperature applications and is adaptable to silicon for cryogenic ones. We have produced fused silica resonators using this method and demonstrated that Q factors of over 100,000 are possible. One resonator we produced was combined with a state-of-the-art interferometric readout to form an inertial sensor. The resulting sensor was tested against other commercial, bulky inertial sensors in AEI's 10m prototype gravitational wave detector. In addition to showing the best performance demonstrated by any gram-scale sensor to date, we achieve comparable sensitivity to the significantly bulkier sensors used in gravitational wave detectors today. The scalability of the novel manufacturing method will be used to make much larger fused silica resonators, which will significantly improve future sensor sensitivity. The compact size, inherently precise calibration, and vacuum compatibility of these sensors make them ideal candidates for the inertial sensing requirements in future gravitational wave detectors.

Primary author: CARTER, Jonathan

Co-authors: BASALAEV, Artem; BÄUERLEIN, Johannes (Max Planck Institute for Gravitational Physics (AEI) Hannover, Laserinterferometrie & Gravitationswellen-Astronomie); LEHMANN, Johannes

Presenter: CARTER, Jonathan

Track Classification: Instrument Science (ISB): Active Noise Mitigation