

Cryogenic interferometric inertial sensors for penultimate mirror residual vibration monitoring

Tuesday 7 May 2024 17:49 (1 minute)

The poster aims to present highly sensitive inertial sensors developed for future gravitational-wave detectors. E-TEST (Einstein Telescope Euregio Meuse-Rhine Site & Technology)[1,2] is an international collaboration that consists of a prototype suspension combining passive and active isolation techniques for a 100 kg silicon mirror cooled down radiatively to 25 K in a suspended cryostat. It is aimed at validating R&D to meet Einstein Telescope's requirements in the relevant environment [3]. This unprecedented seismic isolation calls for highly sensitive inertial sensors at each stage of the isolation chain to monitor its efficiency, as well as the performance of the low-vibration cooling strategy by characterizing the residual motion at the mirror level. Several sensors have been developed either as part of the isolation stage of the suspension or as witness sensors in the harsh cryogenic environment close to the mirror. Cryogenic and vacuum compatible horizontal and vertical cryogenic inertial sensors were developed to monitor the cryogenic penultimate stage down to 1 fm/ $\sqrt{\text{Hz}}$ from 1 Hz onwards.

[1] A. Sider, C. D. Fronzo, L. Amez-Droz, A. Amorosi, F. Badaracco, P. Baer, A. Bertolini, G. Bruno, P. Cebeci, C. Collette, et al., *Classical and Quantum Gravity* 40, 165002 (2023), URL <https://dx.doi.org/10.1088/1361-6382/ace230>

[2] A. Sider, L. Amez-Droz, A. Amorosi, F. Badaracco, P. Baer, G. Bruno, A. Bertolini, C. Collette, P. Cebeci, C. D. Fronzo, et al., *E-test prototype design report* (2022), 2212.10083.

[3] S. Di Pace, V. Mangano, L. Pierini, A. Rezaei, J.-S. Hennig, M. Hennig, D. Pascucci, A. Allocca, I. Tosta e Melo, V. G. Nair, et al., *Galaxies* 10 (2022), ISSN 2075-4434, URL <https://doi.org/10.3390/galaxies10030065>

Primary authors: AMOROSI, Anthony (Université de Liège); COLLETTE, Christophe; ZEOLI, Morgane (Université Catholique de Louvain-la-Neuve)

Co-authors: SIDER, Ameer (PML - Precision Mechatronics Laboratory, Université de Liège, B-4000 Liège, Belgium); THIBAUT, Brieux (Université de Liège); DI FRONZO, Chiara (Université de Liège); LAKKIS, Haidar (Université de Liège); AMEZ-DROZ, Loïc (Université Libre de Bruxelles); TELOI, Mayana (Université Libre de Bruxelles); JAMSHIDI, Rasa (Lab Motion Systems)

Session Classification: Posters

Track Classification: Instrument Science Board (ISB)