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Sizing the effect of dust particles in interferometric detectors of gravitational waves

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Dust particles (diameter ⊠0.5um) present inside the clean environments of the ground based interferometric detectors of gravitational waves can contribute to scatter light significantly, adding to the residual scattering originated by imperfections of high quality optical components. Stray light, i.e. light that leaves the main optical beam, picks up phase noise by reflecting off of mechanically noisy surfaces and couples back in the main beam, is suspected to contribute much of the unexplained excess noise observed in the mid-low frequency band. Dust particles can scatter light either when deposited on the optics as well as by crossing the beam while they move in space. Knowing the amount and size distribution of dust particles present in the different environments we can predict the amount of scattered light they generate and elaborate mitigation strategies. We describe the dust monitoring system we have set up at Virgo to size the amount of dust that deposits, both on in-air benches and in vacuum towers, as both a check of cleanliness procedures and an alert system. We also describe a work to estimate the effect of dust particles in the beam pipes of the future Einstein Telescope: this is fundamental for setting cleanliness requirements for the production and installation of the ~100 km of vacuum tubes of the interferometer's main arms. Finally we describe an experimental facility to measure the particles deposited on witness samples, and to measure the scattering properties of surfaces, both clean and contaminated by dust.

Collaboration / Activity

Virgo &ET Collaborations

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