

Measurement and Analysis of Backscattered Light for Advanced Virgo+

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The sensitivity of the gravitational wave detectors interferometer are impacted by backscattered light in the cavities, which can be recombined and interferes with the main beam creating unwanted background noise. This risk of interference is particularly acute when the light is back-scattered along the direction of propagation of the incident beam. Backscattered light can originate from defects on optical components such as surface imperfections, optical coatings or interference with other optical components. An experiment called the backscatter meter [1] has been set up at LAPP to measure backscattered light from optics intended to be deployed on the optical benches used to extract the Virgo interferometer beams. In the context of the installation of new stable recycling cavities foreseen for the next Advanced Virgo+ phase 2 upgrade scheduled to start in 2026-2027, a new telescope will be developed and installed on the optical bench used to detect the interferometer output beam. In order to help identifying the best design for this telescope, a test campaign is being carried out on the scatter meter at LAPP to test refractive and reflective optics and quantify the contribution to back-scattered light of each type of considered telescope configurations - those with low-incidence curved mirrors or a simple telescope with lenses. In this talk we will introduce this backscatter meter, show preliminary results obtained with this experiment and give some perspectives for the backscatter meter experiment.

[1] M. Was and E. Polini, "High-angular-resolution interferometric backscatter meter," *Opt. Lett.* 47, 2334-2337 (2022)

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