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Coping with Point Absorbers in Advanced Virgo

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The increase of the optical power expected for the new observing run (O4) will lead to an improvement of the interferometer (ITF) sensitivity with a consequently increase of the detection volume and the number of candidate sources. At this condition, the thermal distortions, induced by absorption inside the optics, degrade the ITF performance reducing the quality of the control signals and the duty cycle of the instrument. The correction of optical aberrations through adaptive optical systems is crucial to reach the design performances. In addition, during the previous run (O3), highly absorbing areas on the surfaces of the main optics of Advanced Virgo have been observed. These anomalous micron-scale absorbers produce distortions as additional thermo-elastic deformation of the high reflectivity mirrors surfaces and thermal lensing in the optics substrate.
With the aim to understand and mitigate their effects in the interferometer, a detailed and quantitative study of their characteristics has been carried out. The information about their position and fraction of absorbed power allows to put the basis for the development of an adaptive actuator, able to correct these aberrations in the Advanced Virgo Plus (AdV+) test masses. In this talk, the analysis of AdV+ input mirrors surfaces, point absorbers identification and characterization, the corresponding thermo-elastic deformation and its compensation are illustrated. An overview of the study and characterization process of the new actuator will be also presented.

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