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The seismic isolation system of AdVirgo+ Phase II

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The Advanced Virgo+ gravitational wave interferometer (AdVirgo+) has recently completed the first phase of its upgrades and is currently being commissioned for O4 observing run, scheduled for December 2022 and expected to last one year.

O4 run will be followed by a major upgrade, called phase II, that has as its main objective the reduction of thermal noise, expected to increase the observing horizon to more than 150 Mpc. This will be done by enlarging the laser beam size on end test masses and by implementing better coatings with lower mechanical losses on mirrors. To do so the most critical mirrors (test masses and recycling mirrors) must be changed. In particular, end mirrors will have to be larger and therefore heavier to deal with the larger beam size. To this purpose mirrors 55 cm in diameter and about 105 kg in weight will be used.

Seismic isolation of AdVirgo+ mirrors and of the injection and detection benches will be provided, both in phase I and phase II, by the SuperAttenuator (SA), a passive attenuation system capable of reducing the seismic noise by more than 10 orders of magnitude in all six degrees of freedom above a few Hz.

In order to be able to implement the design changes of phase II upgrade, SAs of end towers will need to be upgraded. In particular the payload will be re-scaled and all the elastic elements (blade springs, suspension wires, magnetic antisprings and inverted pendulum flex joints) will need to be re-designed in order to stiffen the suspension in the vertical direction to sustain the new loads. Several studies are being performed in order to identify and validate the required mechanical updates to the SA. Such studies are also providing useful insights on the design of seismic isolation systems for third generation detectors.

Collaboration

Virgo

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