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Gravitational Wave Polarization Detection with the Tetrahedron Constellation of Gravitational Wave Observatory

For the first time, we have introduced the Tetrahedron Constellation of Gravitational Wave Observatory (TEGO) composed of four identical spacecrafts (S/Cs).
The laser telescopes and their pointing structures are mounted on the S/C platform and are evenly distributed at three locations 120 degrees apart.
These structures form automatically a stable mass center for the platform.
The time delay interferometry (TDI) is used to suppress the frequency noise of Gravitational Wave (GW) detector. The unequal arm Michelson TDI configuration and the Sagnac TDI configuration are equally effective at eliminating the laser frequency noise based on the TEGO configuration.
Furthermore, comparing to the configurations of LISA, Taiji, and TianQin, the TEGO has more combinations of optical paths in its TDI system sensitive to GW signals.
The six arms of TEGO are simultaneously sensitive to the six polarization modes of GWs. The sensitivity implies that GW modes beyond the predictions of general relativity (GR) can be detected directly. For instance, a scalar longitudinal mode of GWs, which is not predicted by GR, has been identified as a dominant polarization component. This mode is found to be evident in the response amplitudes of the TEGO arms, such as between S/C1 and S/C4, and S/C3 and S/C4, at certain orbital positions.

Collaboration you are representing

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