Contribution ID: **16** Type: **not specified**

Tight constraints on Einstein-dilation-Gauss-Bonnet gravity from GW190412 and GW190814

Friday, 5 May 2023 12:05 (15 minutes)

Gravitational-wave (GW) data can be used to test general relativity in the highly nonlinear and strong field regime. Modified gravity theories such as Einstein-dilation-Gauss-Bonnet and dynamical Chern-Simons can be tested with the additional GW signals detected in the first half of the third observing run of Advanced LIGO/Virgo. Specifically, we analyze gravitational-wave data of GW190412 and GW190814 to place constraints on the parameters of these two theories. Our results indicate that dynamical Chern-Simons gravity remains unconstrained. For Einstein-dilation-Gauss-Bonnet gravity, we find $\sqrt{\alpha_{\rm EdGB}} \leq 0.40\,{\rm km}$ when considering GW190814 data, assuming it is a black hole binary. Such a constraint is improved by a factor of approximately 10 in comparison to that set by the first Gravitational-Wave Transient Catalog events.

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