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Testing the no-hair nature of binary black holes using the consistency of multipolar gravitational radiation[1] TOUSIF ISLAM, Univ of Mass - Dartmouth, AJIT KUMAR MEHTA, ABHIRUP GHOSH, Albert Einstein Institute, VIJAY VARMA, Caltech, PARAMESWARAN AJITH, ICTS-TIFR, B.S. SATHYAPRAKASH, Pennsylvania State University — Gravitational-wave (GW) observations of binary black holes offer the best probes of the relativistic, strong-field regime of gravity. Gravitational radiation, in the leading order is quadrupolar. However, non-quadrupole (higher-order) modes make appreciable contribution to the radiation from binary black holes with large mass ratios and misaligned spins. The multipolar structure of the radiation is fully determined by the intrinsic parameters (masses and spin angular momenta of the companion black holes) of a binary in quasi-circular orbit. We develop multiple ways of testing the consistency of the observed GW signal with the expected multipolar structure of radiation from binary black holes in general relativity. We call this a "no-hair" test of binary black holes as this is similar to testing the "no- hair" theorem for isolated black holes through mutual consistency of the quasi-normal mode spectrum. We use Bayesian inference on simulated GW signals that are consistent/inconsistent with binary black holes in GR to demonstrate the power of the proposed tests. We also estimate systematic errors arising as a result of neglecting companion spins.

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