Poster Session #B
Observational and space tests of gravitation

B15

The Most Stringent Test of the Strong Equivalence Principle with Gravitational Waves

CS Unnikrishnan (TIFR Mumbai)

The Strong Equivalence Principle (SEP) holds the full essence and meaning of the General Theory of Relativity as the nonlinear relativistic theory of gravitation. It asserts the universal coupling of gravity to all matter and its interactions including the gravitational interaction and the gravitational self energy. We point out that the confirmation of the gravitational coupling to gravitons, and hence to the gravitational waves, is the most direct test of the SEP. We show that the near simultaneous detection of gravitational waves and gamma rays from the merger of binary neutron stars provides a unique and the most stringent test of the SEP, better than a part in 10^9, which is also the only test of the SEP in the radiation sector. This direct test surpasses the previous tests from Lunar Laser Ranging (10^{-4}) and the Triple compact star system (10^{-5}). Further, several more instances of similar detections are expected, which will improve the precision and the reliability of this unique test.
(with George T. Gillies of University of Virginia).