

Testing General Relativity with Cosmological observations

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General Relativity (GR) is immensely successful. With the late discovery of gravitational waves from black hole and neutron star mergers, it has passed all the tests with flying colors. But so far, all observations have mainly tested the vacuum equations of GR. The most important non-vacuum case, cosmology, is in agreement with GR only after the introduction of two otherwise unknown components, 'Dark Matter' and 'Dark Energy' which amount to about 96% of the total energy budget of the present Universe. This lets us question the validity of GR for cosmology. Might it be that GR is flawed on large, cosmological scales? Or in the presence of matter in general?

But how can we test Einstein's equation in the presence of matter. Can't we simply move any modification of the Einstein tensor to the right hand side and call it a 'dark matter/dark energy' component?

In my talk I shall discuss possible ways (partially) out of this dilemma. How to test both, the left and the right hand side of Einstein's equations with cosmological observations.

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