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Modifying Gravity at the strong field regime

One of the better-known modifications to general relativity is the spontaneous scalarisation scenario in scalar-tensor theories of gravity. In this phenomenon, scalar fields naturally grow near the immense gravity of neutron stars in a manner similar to spontaneous magnetization. The scalar fields cause order-of-unity deviations from general relativity near the neutron star's core, but die off fast with distance to satisfy the weak field tests. Due to large deviations from general relativity, signs of it can be observed relatively easily especially using gravitational waves. In this talk I will give a short summary of spontaneous scalarisation and explain how it can be generalized to a much larger class of alternative theories of gravitation named "spontaneous tensorization". I will speculate on the prospects of observing/ruling out modifications to general relativity using gravitational wave science and neutron star-black hole merger events. The days when theorists could come up with any fancy modification to general relativity in the strong field are over. It is the age of gravitational waves, and none shall pass without observational tests.