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Causality in Curved Spacetimes

Wednesday 23 September 2020 09:10 (40 minutes)

I will investigate the propagation of gravitational waves on curved spacetimes within the low energy effective field theory of gravity, where effects from heavy fields are captured by higher dimensional curvature operators. Depending on the spin of the particles integrated out, the speed of gravitational waves at low energy can be either superluminal or subluminal as compared to the causal structure observed by other species. I will clarify why a mild level of superluminality is not in contradiction with causality, analyticity or Lorentz invariance and show how consistent gravitational low energy effective theories can self-protect by ensuring that any time advance and superluminality calculated within the regime of validity of the effective theory is necessarily unresolvable for such theories. These considerations are particularly relevant for putting constraints on cosmological and gravitational effective field theories and I will provide explicit criteria to be satisfied so as to ensure causality.

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