A Gauge-Invariant graviton mass in Very Special Linear Gravity

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Linearized gravity in the Very Special Relativity (VSR) framework is considered. A non-zero graviton mass m_g without breaking gauge invariance nor modifying the relativistic dispersion relation is allowed. Moreover, we explicitly show that the massive graviton has only two physical degrees of freedom. Finally we compare some results for classical gravitational waves (GW) with the VSR ones, using the geodesic deviation equation: we find that the ratios between VSR effects and classical ones are proportional to $(m_g/E)^2$, E being the energy of a graviton in the GW. For GW detectable by the interferometers LIGO and VIRGO this ratio is at most 10^{-20}. For GW in the lower frequency range of future detectors, like LISA, the ratio increases significantly to 10^{-10}, that combined with the anisotropic nature of VSR phenomena may lead to observable effects.

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