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Gravitational wave Memory Effect

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Gravitational waves offer a unique window to study the strong-field regime of general relativity. In 1916-18, Einstein showed their existence in linearized approximation which was followed by a period of confusion. Finally cemented theoretically by Bondi, Sachs, Trautman gravitational waves are an important tool to discover new information about fundamental gravity effects.

One of the persistent gravitational wave effect called memory effect forms an interesting proposition theoretically and astrophysically. It is essentially a permanent displacement between particles after GW passes. It's linear and non-linear form will be important for the future GW detections from compact binary sources. This effect gives information about the asymptotic nature of spacetime and is relevant for a large number of detections by LIGO/VIRGO. The linear part discovered by Zel'dovich & Polnarev and the nonlinear part discovered by Christodoulou help us understand the nature of spacetime and explore further the nonlinear part of general relativity.

We plan to study the linear memory effect for different wave profiles under the exact plane wave solution of Einstein's vacuum equations and then look for other solutions. The displacement and velocity memory effects are studied by analyzing the geodesic equation for test masses under exact plane wave spacetime. The aim is to look for different gravitational spacetimes and study the memory effect within them.

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