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Insights into the gravitational wave memory effect[1]

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A major breakthrough of General Relativity (GR) happened in 2015 with LIGO's first detection of gravitational waves. Typical sources for gravitational radiation are mergers of binary black holes, binary neutron stars and core-collapse supernovae. In these processes mass and momenta are radiated away in form of gravitational waves. GR predicts that these waves leave a footprint in the spacetime, that is they change the spacetime permanently, which results in a permanent displacement of test masses. This effect is called the memory. In this talk, I will explore the gravitational wave memory. We will see that there are two types of memory, one going back to Ya. B. Zel'dovich and A. G. Polnarev and one to D. Christodoulou. Then I will discuss recent work including my collaboration with D. Garfinkle, S.-T. Yau, P. Chen, focusing on how neutrinos or electromagnetic fields contribute to the memory effect, and work with D. Garfinkle and N. Yunes on cosmological memory.

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