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Memory-like effects due to relative velocity and acceleration

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A burst of gravitational waves creates a permanent change in separation between two initially comoving test particles; this is known as the gravitational wave memory effect. Near null infinity, two contributions to the memory effect arise: linear memory, which appears in linearized gravity and is due to changes in conserved quantities, and nonlinear memory, which arises due to the nonlinear nature of general relativity. Moreover, the nonlinear memory is expected to be the dominant contribution to the memory effect for binary black hole mergers, such as those detected by LIGO and Virgo. In this talk, we discuss the case where the particles have initial relative velocity and acceleration, and determine the contributions of each to the final separation. Each contribution provides additional memory-like effects, and we show that a similar linear vs. nonlinear split arises near null infinity.

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