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The gravitational-wave phase at 4.5PN

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The main observable for the detection of gravitational waves in general relativity generated by compact binary systems is the phase of the wave. Within the post-Newtonian approximation, where the objects are assumed to be well-separated and to have small velocities, one can obtain analytical expressions for the phase as a series in $(v/c)^2$. Before this work, the phase (as well as the complete waveform) was known up to 3.5 post-Newtonian (PN) order. In this talk, I will discuss our recent computation of the flux and phase at 4.5PN order, as well as the $(\ell, m) = (2, 2)$ mode at 4PN order. I will then give a brief overview of the tails-of-memory computation, which was a difficult but crucial step of the computation. Finally, I will discuss what is needed to obtain all the (ℓ, m) modes entering the 4PN waveform, and how the tail-of-memory methodology will be central to it.

Auteur principal: TRESTINI, David (IAP et LUTH)

Co-auteurs: LARROUTUROU, François (IAP); FAYE, Guillaume (Institut d'Astrophysique de Paris); BLANCHET, Luc (C.N.R.S.); HENRY, Quentin (Albert Einstein Institut)

Orateur: TRESTINI, David (IAP et LUTH)

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