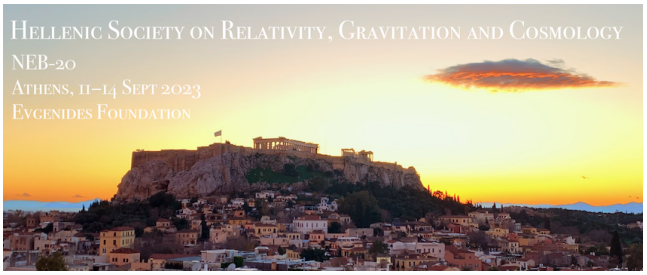

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Second-order gravitational self-force in a highly regular gauge: Covariant and coordinate punctures

Monday, 11 September 2023 17:20 (20 minutes)

Gravitational self-force theory is the primary way of modelling extreme-mass-ratio inspirals (EMRIs). One difficulty that appears in second-order self-force calculations is the strong divergence at the worldline of the small object, which causes both numerical and analytical issues. Previous work [Phys. Rev. D 95, 104056 (2017); ibid. 103, 124016 (2021)] demonstrated that this could be alleviated within a class of highly regular gauges and presented the metric perturbations in these gauges in a local coordinate form. We build on this previous work by deriving expressions for the highly regular gauge metric perturbations in both fully covariant form and as a generic coordinate expansion. With the metric perturbations in covariant or generic coordinate form, they can easily be expressed in any convenient coordinate system. These results can then be used as input into a puncture scheme in order to solve the field equations describing an EMRI.

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