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String Theory in Greater Paris

Rencontres Théoriciennes

“Supergravité, théorie des cordes et théorie M”

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IAP

An effective field theory for gravitating spinning objects in the PN scheme

Over the last decade considerable worldwide efforts have been invested in order to detect gravitational radiation. Inspiralling binary systems of black holes, which can be described analytically by the post-Newtonian (PN) approximation of GR, are promising candidate sources of gravitational waves signals. For a successful detection of such signals, PN corrections are required to high orders. We will present the main ideas of the Effective Field Theory (EFT) approach to the PN formalism of the binary inspiral problem.We formulate an EFT for gravitating spinning objects. We aim at an effective action, where all field modes below the orbital scale are integrated out. We point out the relevant degrees of freedom, in particular the rotational ones, and the associated symmetries. Building on these symmetries, we introduce the minimal coupling part of the point particle action in terms of gauge rotational variables. We proceed to construct the spin-induced nonminimal couplings, where we obtain the leading order couplings to all orders in spin for the first time. We specify the gauge for the rotational variables, where the unphysical degrees of freedom are eliminated already from the Feynman rules, and all the orbital field modes are conveniently integrated out. The equations of motion of spin are then directly obtained via a proper variation of the action, and they take on a simple form. Finally, the corresponding Hamiltonians are also straightforwardly obtained from the potentials derived via this formulation. This effective field theory for spin is thus ideal for the treatment of higher order spin dependent sectors. We conclude with implementations, presenting some new results obtained, and results underway.

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