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Post-Newtonian limit of general scalar-torsion theories of gravity

Abstract

For more than a century Einsteins theory of gravity has passed most of the observational tests. Nevertheless it is still open for discussion if the underlying structure of spacetime is curvature, torsion or non-metricity. One of the most important frameworks to test these alternative theories of gravity is the parametrized post-Newtonian (PPN) formalism, where the metric is described by 10 free parameters. The post-Newtonian approximation of the metric of a perfect fluid of many theories of gravity can be written in the standard PPN form. Using the bounds from observations on the PPN parameters we can determine bounds on the parameters of an alternative theory of gravity. In this talk we derive the post-Newtonian limit of a general class of teleparallel theories of gravity, where the action is a free function of the Torsion scalar and several quantities derived from a dynamical scalar field. In order to use the PPN formalism without modifications, such as introducing an effective gravitational constant, we restrict the analysis to a massless scalar field. This class of theories is fully conservative, with only two non-vanishing PPN parameters. For a particular choice of the free function, the theory is even indistinguishable from General Relativity in its post-Newtonian approximation.