25 - 27 September 2019 – GRK Autumn workshop

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Gauge-invariant approach to the parameterized post-Newtonian> formalism and the post-Newtonian limit of teleparallel gravity

Abstract

The parameterized post-Newtonian (PPN) formalism is an invaluable tool to assess the viability of gravity theories using a number of constant parameters. These parameters form a bridge between theory and experiment, as they have been measured in various solar system experiments and can be calculated for any given theory of gravity. The practical calculation, however, can become rather cumbersome, if the field equations involve couplings to additional fields. In addition, the PPN formalism relies on the choice of a particular gauge (or coordinate system), which is determined only after solving the field equations. These difficulties can be overcome by applying a gauge invariant formalism, which is conventionally used in cosmological perturbation theory. The particular nature of the PPN formalism requires perturbations of at least quadratic order to be considered, as well as a different treatment of space and time directions. In the first half of my talk I show how to develop such kind of formalism for gravity theories in metric and tetrad formulation.

In the second half of my talk I show the application of the PPN formalism to a class of teleparallel gravity theories. These theories are based on the idea that gravity is not mediated by the curvature of the Levi-Civita connection, as it is the case in general relativity, but by the torsion of a flat (curvature-free) connection. The class of theories I discuss is derived from a Lagrangian which is a free function of three scalar terms formed from this torsion. I show how the post-Newtonian limit is derived and discuss the implications for the viability of such teleparallel gravity theories.