GR 1: CQG I

Time: Monday 16:45–18:30 Location: ZHG008

Invited Talk GR 1.1 Mon 16:45 ZHG008

Classical post-newtonian gravitational fields in quantum mechanics — •Domenico Giulini — Leibniz Universität Hannover — ZARM Bremen

The problem of coupling classical gravitational fields to quantum-mechanical systems is considered within post-newtonian approximation schemes. I will show how to compute the approximate Hamiltonian for the centre-of-mass and internal dynamics of an electromagnetically bound two-particle system. This, in turn, can be used to derive algebraic expressions for phases in light-pulse atom-interferometers of various geometries. Finally I will comment on some conceptual issues that we encountered in this field. The talk will be based on doi: 10.1103/PhysRevA.100.052116, 10.1103/PhysRevD.109.022008, 10.1088/1361-6382/ad079c.

GR 1.2 Mon 17:30 ZHG008

Understanding gravitationally induced decoherence parameters in neutrino oscillations using a microscopic quantum mechanical model — Alba Domi[1], Thomas Eberl[1], Max Joseph Fahn[2], Kristina Giesel[1], Lukas Hennig[1], Ulrich Katz[1], •Roman Kemper[1], and Michael Kobler[1] — [1]Friedrich-Alexander Universität Erlangen-Nürnberg, Germany — [2]Università di Bologna, Italy

In this talk, the role of gravitationally induced decoherence in open quantum systems is explored in the context of neutrinos. A microscopic quantum mechanical model introduced by Blencowe and Xu is applied to neutrino oscillations, motivated by the coupling between neutrinos and the gravitational wave environment suggested by linearised gravity. The analysis demonstrates that, for neutrino oscillations in vacuum, gravitationally induced decoherence matches phenomenological models, with decoherence parameters exhibiting an inverse quadratic energy dependence. When matter effects are included, the decoherence parameters depend on the varying matter density across the Earth's layers. Moreover, the form of the decoherence parameters is explicitly derived from the microscopic model, providing a physical interpretation. This talk is based on the work in "Understanding gravitationally induced decoherence parameters in neutrino oscillations using a microscopic quantum mechanical model", published in JCAP, 2024, 11, 006.

GR 1.3 Mon 17:50 ZHG008

The nature of gravity — •Piero Nicolini — Universität Triest, Triest, Italien — INFN, Triest, Italien — Johann Wolfgang Goethe-Universiät Frankfurt am Main, Frankfurt am Main, Deutschland

Gravity is well known at the classical level, both in Newtonian and GR terms. However, understanding gravity at the fundamental level requires a quantum formulation. In this talk I will review recent findings on the static interaction between two point-like masses to reveal that the conventional attractive nature of gravity is only a low-energy effect.

GR 1.4 Mon 18:10 ZHG008

LISA - a data perspective — •Sarah Paczkowski — Max Planck Institute for Gravitational Physics (Albert Einstein Institute), D-30167 Hannover, Germany — Leibniz Universität Hannover, D-30167 Hannover, Germany

The Laser Interferometer Space Antenna (LISA) is an ESA-led mission to observe gravitational waves from space. In this presentation, I will introduce LISA from a data perspective, focusing on the anticipated characteristics of the data in terms of gravitational wave signals and noise sources from the instrument. I will also discuss the strategies employed to mitigate noise during data processing on Earth and the projected timeline for data availability.