MP 11: Various Topics in Relativity

Time: Thursday 16:15–18:00 Location: KH 00.015

MP 11.1 Thu 16:15 KH 00.015

A witness of superluminal signalling in quantum theory and its modifications. — •Aritro Mukherjee — University of Duisburg-Essen

Linearity of the master equations in quantum theory and in many of its proposed modifications is often taken to guarantee the absence of superluminal signalling, thereby preserving causality. However, in many scenarios master equations are not always available in closed analytic form, limiting the applicability of this argument. To address this, we first introduce a general operational witness for detecting superluminal signalling that does not rely on explicit knowledge of a master equation and may be easily assessed when analytical methods are not available. Furthermore, applying this witness reveals a surprising result: even linear master equations can permit superluminal signalling unless a specific locality condition is satisfied. Hence we show that linearity of the corresponding master equations is not a sufficient criteria for causality. In contrast, the witness we propose provides a necessary and sufficient criterion for ruling out superluminal signalling in full generality.

MP 11.2 Thu 16:30 KH 00.015

Velocity dependent potential — •Lars Callenbach — Frankfurt am Main, Germany

The four-dimensional wave equation can be transformed to Laplace's equation applying a change of coordinates. In these four-dimensional Laplace coordinates a velocity dependent potential is derived from first principles for relative coordinates and velocities and its properties are analyzed. Especially this potential is the classical three-dimensional potential when the particles are at rest with respect to each other and in general this potential represents a central force interaction. Applying the Lagrange and Hamilton formalism the solutions of the dynamics are derived - with a simple structure: a bounded periodic motion on a circle in four dimensions. The explicit formulas for gravitational (and electrodynamical) equations underlying the motion are presented and the theoretical results are applied to data of our solar system showing that the bounded motion on a circle in four dimensions has many scalar constants of motion.

MP 11.3 Thu 16:45 KH 00.015

Euclidean Relativity Describes A Mathematical Reality — •Markolf H. Niemz — Heidelberg University

Special/general relativity (SR/GR) work for all observers, but they do not provide diagrams of nature that work for all observers. This is because they do not describe nature as an absolute manifold, where all action is due to an absolute parameter. We show: Euclidean relativity (ER) achieves precisely that. It describes a mathematical Master Reality, which is *absolute* 4D Euclidean space (ES). All objects move through ES at the dimensionless speed C. There is no time in ES. All action in ES is due to an *absolute*, external evolution parameter θ. Every object experiences two projections from ES as space and time: The axis of its current 4D motion is its proper time τ. Three orthogonal axes are its 3D space x_1, x_2, x_3. An observer's physical reality is the Minkowskian reassembly of his axes x_1, x_2, x_3, τ. In this "τ-based Minkowskian spacetime" (τ-MS), τ is the new time coordinate and θ converts to parameter time ϑ. ER reproduces the Lorentz factor and gravitational time dilation, but gravity is Newtonian. Action at a distance is not a problem: Information is instantaneous in timeless ES. Only in τ-MS does the time coordinate cause a delay. Presumably, gravity is carried by gravitons and manifests itself in τ-MS as waves. ER rejects curved spacetime, cosmic inflation, expanding space, dark energy, and non-locality. Nevertheless, ER predicts time's arrow, the Hubble tension, and entanglement. There are two options: Physics either sticks to SR/GR and highly speculative concepts, or it breaks new ground with ER. www.preprints.org/manuscript/202207.0399

MP 11.4 Thu 17:00 KH 00.015

Negative square roots: Wishful thinking in spacetime physics — •René Friedrich — Strasbourg

The current approaches to quantum gravity are all based on the fundamental assumption of a Lorentzian spacetime manifold as it was understood by Minkowski in his famous lecture "Space and Time" in 1908. However, this assumption is far from being free of inconsistencies:

a) The squared metric "F" used by Minkowski does not apply to spacelike spacetime intervals (problem of negative squares), revealing that spacetime is not continuous in spacelike direction.

b) To remedy this, Minkowski introduced a sort of twofold patchwork metric ("F" and "-F").

c) This handling of the problem was not acceptable for many physicists and led to the proliferation of a multitude of different "conventions" for the spacetime interval which have become a veritable "elephant in the room" of spacetime physics.

d) Misner-Thorne-Wheeler took the problem to extremes, by setting two opposite metrics equal, a positive square with a negative square, implying a real number equal to an imaginary number. Real equals imaginary: That is just the definition of wishful thinking (!).

e) The current approaches to quantum gravity should check the basic assumptions they are relying on, because every theory is only as good as its underlying assumptions.

MP 11.5 Thu 17:15 KH 00.015

The tiny theory: a single fundamental principle yielding general relativity and the standard model — •Christoph Schiller — Motion Mountain Research, Munich

The Lagrangians of general relativity and of the standard model of particle physics with massive neutrinos, including elementary particle masses and the other fundamental constants, can be deduced from a single fundamental principle based on fluctuating strands of Planck radius. In particular, the fundamental principle explains the principle of least action, the equality of inertial and gravitational mass, and allows estimating the mass values of the elementary particles.

[1] The tiny theory: a single fundamental principle yielding general relativity, particle physics, and gauge anomaly cancellation, https://www.researchgate.net/publication/397264142

[2] https://tiny.motionmountain.net

[3] Testing a model for emergent spinor wave functions explaining elementary particles, gauge interactions and fundamental constants, https://www.researchgate.net/publication/361866270

[4] Testing the uniqueness of a unified theory based on topology and geometry, https://www.researchgate.net/publication/389673692

MP 11.6 Thu 17:30 KH 00.015

From Relativistic Conversation Law of Charged Particles to Creating of Photons — •Bin Su — Institut für theoretische Physik, TU Berlin

An application of relativistic dynamics of charged particles in Mankowski force [1] on strengthen accelerated electrons till almost to speed of light is suitable in terms of their relativistic kinematic energy and momentum to discuss. The accelerated charged particles would under the certain settings of electromagnetic apartment for example [2], create synchrotron rays, say photons, which carry the interaction between the accelerated electrons and their located electromagnetic fields and mediate their obtained Minkowski force. The both - particles and fields constitute a conservation system. The possible area of produced radiated frequency could be asserted from the parameters both of particles and their circumstance such as orbital and fields according to relativistic dynamics[1]. This frequency area and the rays direction could be roughly estimated from assumed values of velocities of accelerated electrons in a defined percentage of light velocity. For example the synchrotron ray from electron with two digit light velocity under the certain strength of the magnetic field attains nearly Hundert petaherz, are expected to be experimentally verified.

[1] B. Su *relativistic dynamics of electrical matter in Minkowski force*, Scientific Programme 2025 [2] elektronen-Stretcher: https://www.pi.uni-bonn.de/elsa/de

MP 11.7 Thu 17:45 KH 00.015

Rest length and dilated time in five-dimensional spacetime — •Roland Alfred Sprenger — Herford, Germany

This talk presents a geometric method for determining time dilation and proper length of relativistically moving bodies without the use of an affine coordinate system or scale transformations. Based on special relativity, a five-dimensional spacetime is introduced in which the constructions can be formulated consistently. The additional dimension

is timelike and serves to accommodate time components that lead to formal mixing of spatial and temporal quantities in four-dimensional representations. Time dilation and proper length follow from simple geometric relations, with simultaneity defined by light spheres rather than spatial hyperplanes. The rest frame of the moving body appears as a reference system rotated about the time axis. Superluminal velocities may occur, but they affect only components associated with the additional timelike dimension and not the observable spatial direction.