**FEZA GÜRSEY**
CENTER FOR
PHYSICS AND
MATHEMATICS

*Dual Perspectives Meetings*

# Non-Lorentzian Geometry

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Abstract: Non-Lorentzian geometry refers to a differential geometric framework for space-times with a degenerate metric structure and a local causal structure that differs from the one of Lorentzian geometry. It has recently found new applications, e.g., in the study of field and gravitational theories in non- and ultra-relativistic regimes. In the first of these two lectures, I will provide an introduction to non-Lorentzian geometry, focusing on the examples of Galilean and Newton-Cartan geometry that describe non-relativistic space-times. I will discuss their metric structure and metric-compatible affine connections with and without torsion in a frame formulation. I will furthermore comment on the physical interpretation of these structures and outline differences with Lorentzian geometry.

The second lecture will focus on the appearance of non-Lorentzian geometry in non-relativistic string theory, a consistent and UV-complete string theory whose excitations exhibit non-relativistic dispersion relations and Newtonian gravitational interactions. After an introduction to non-relativistic string theory, I will argue that its target space-time geometry is given by an extension of Newton-Cartan geometry, called string Newton-Cartan geometry. I will discuss the structure of string Newton-Cartan geometry and show how it can be viewed as a particular limit of Lorentzian geometry equipped with an extra two-form Kalb-Ramond gauge field. If time permits, I will outline how this limit can be used to obtain effective gravitational field equations for non-relativistic string theory and comment on T-duality in non-relativistic string theory.

Date: Friday, April 7, 2023

Program: Morning session 10:30-12:00, Afternoon session 13:30-15:00

Location: Boğaziçi University, Kandilli Campus, Üsküdar-İstanbul