

Hamiltonian framework and the origin of Energy-momentum and angular momentum

Introduction to Black holes

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Abstract

As requested by the organizers, these lectures will be addressed to graduate students and non-experts to introduce them to the themes covered by more technical lectures in this workshop. The first lecture will complement those of Gerhard Huisken, explaining the physical origin of the notion of total energy-momentum and angular momentum in general relativity. We will use the initial value formulation introduced in Huisken's first lecture as a point of departure, introduce the Hamiltonian framework for general relativity and show how conserved quantities arise as generating functions of asymptotic symmetries. This notion of energy will be used in Huisken's second lecture on positive energy theorems. In the second lecture, I will present a brief overview of black holes which will provide the background material for Workshop lectures dealing with Penrose inequalities, and properties of various horizons.