Boğaziçi Math Seminar

What can we learn about black holes when we do not know their metrics?

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Abstract:

Black holes, now known to be ubiquitously present in our universe, have their mathematical origin as solutions to the Einstein equation of General Relativity. In this talk, we aim to find such black hole solutions in a theory of General Relativity coupled to additional fields, namely a scalar and a vector (the so called Einstein-Maxwell-Dilaton system) in four dimensions. Such a theory is governed by a real parameter known as the coupling of the vector field to gravity, and we ask the question whether black holes exist in this theory for an arbitrary value of this coupling. Intriguingly, it turns out that although one cannot find the explicit closed form of the metric for arbitrary coupling, there is a novel way of expressing the physical properties of black holes such elusive metrics would describe, namely their mass and charges, via a first order non-linear ODE, and capture the entire spectrum of black holes which are possible in such a theory (for any value of the coupling). If time permits, we will discuss the same technique in a modified theory, where a topological Chern-Simons term is added to the Einstein-Maxwell-Dilaton system.

Date : Wednesday, March 6, 2024
Time: 13:30
Place: TB 130, Boğaziçi University