

**Título/Title:**

Extending General Relativity using black holes

**Orientadores/Supervisors:**

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**Descrição/Description:**

Despite the experimental success of Einstein's General Theory of Relativity, there are strong arguments, both theoretical and experimental supporting the convenience of extending this theory both at short and long scales. By doing this, current difficulties and trends of the standard cosmological paradigm (including space-time singularities, dark matter/energy, inflation or late-time singularities) can be tackled from a different perspective.

In this project we propose to study the motivations behind these extensions of General Relativity, the different competing approaches and the basic mathematical description. As an application of these models, the student will be driven to study the modifications to the structure of black holes beyond General Relativity, so as to understand the relevance and ways out of the space-time singularity problem. The main goal of this project is to provide the student with the basic geometrical and physical tools to allow him to improve his understanding on gravitation, black hole physics and Cosmology, so as to set the ground for a potential future research on these topics at the MSc/PhD level.

**Requisitos/Requirements:**

To have taken a previous course on differential geometry and/or General Relativity would be certainly helpful, but it is not a prerequisite. The level/deep of the topic will be properly adjusted to student's knowledge and skills.