CIDMA's Great Young Researchers
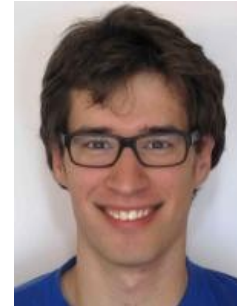
CIDMA]

Pedro Cunha, 14h00 to 14h20

Title: Testing the Kerr hypothesis using strong gravitational lensing

Abstract: The question of whether astrophysical Black Holes are described by the Kerr geometry, in Einstein's theory of General Relativity, or instead by some other alternative compact objects, is not yet settled. The applicant has considered a diverse range of metric models with possible astrophysical relevance, and how their predictions impact on observations, namely on Black Hole imaging and null geodesic motion. In particular, a theorem will be discussed showing that an equilibrium Black Hole must possess, under generic conditions, at least one Light Ring orbit outside the horizon, the existence of which is critical for Black Hole imaging. The mathematical argument is of a topological nature and does not use the field equations of any theory of gravity, but only geometrical regularity requirements.

Alberto Debernardi, 14h25 to 14h45

Title: Beyond Fourier bases: generalizations and limitations

Abstract: Classical Fourier orthonormal bases are a central tool both in analysis and in other sciences. However, their framework is rather restrictive, and therefore it is desirable to have more general structures, as for example Gabor systems, or Riesz basis of exponential functions. In this talk we will briefly discuss regularity properties of Gabor orthonormal basis and link them to an important conjecture of Liu and Wang. We will also discuss the nonexistence of Fourier orthonormal bases in certain natural frameworks, and explain how to construct Riesz bases of exponentials instead, which are the best structures one can hope for whenever orthonormal bases are not available.

Ivan Beschastnyi, 14h50 to 15h10

Title: From singular geometry to singular analysis and back

Abstract: In this talk I will report on some of my works concerning the study of partial differential equations on smooth manifolds. I will put the whole discussion in a broader context of geometric analysis and more precisely of the study of singular spaces and their many potential applications.