# GENERALIZAD NO-HAIR THEOREM FOR ULTRACOMPACT ALTERNATIVES TO BLACK HOLES

Carlos Barceló [1], Raúl Carballo-Rubio [2,3,4] and Stefano Liberati [2,3,4]

[1] Instituto de Astrofísica de Andalucía (IAA-CSIC),
Glorieta de la Astronomía, 18008 Granada, Spain
[2] SISSA - International School for Advanced Studies,
Via Bonomea 265, 34136 Trieste, Italy
[3] IFPU - Institute for Fundamental Physics of the Universe,
Via Beirut 2, 34014 Trieste, Italy
[4] INFN Sezione di Trieste, Via Valerio 2, 34127 Trieste, Italy

An important result of classical general relativity is that black holes have no hair. Therefore, in principle one way to distinguish whether a black-hole candidate is an actual black hole with a horizon or an ultracompact objects without a horizon is to probe its multipolar structure to seek for some hair. For example, this will be doable with LISA, detecting the gravitational wave signal of Extreme Mass Ratio Inspirals. Given that the no-hair theorem does not apply to ultracompact objects without horizon, one might think that ultracompact objects would exhibit all sorts of multipolar structures. Then, measuring no trace of hair could be taken as a strong further indication of the reality of black holes.

However, in this work we show that this view is not correct. By analyzing geometries for ultracompact objects close to spherical symmetry we show that there is a strong indication that the presence of hair is highly suppressed in ultracompact objects: the further the more compact the object is. Our analysis involves the construction of a generalized no-hair theorem for ultracompact object without horizon. Unfortunately we conclude that looking for hair does not have strong prospects for being very discriminating about the ultimate reality of black hole candidates; other properties might.