Semiclassical gravity effects near horizon formation

Carlos Barceló[1], Valentin Boyanov[2], Raúl Carballo-Rubio[3] and Luis J. Garay[2,4]

[1]Instituto de Astrofísica de Andalucía (IAA-CSIC), Glorieta de la Astronomía, 18008 Granada, Spain

[2]Departamento de Física Teórica and IPARCOS, Universidad Complutense de Madrid, 28040 Madrid, Spain

[3]SISSA, International School for Advanced Studies, Via Bonomea 265, 34136 Trieste, Italy

[4]Instituto de Estructura de la Materia (IEM-CSIC), Serrano 121, 28006 Madrid, Spain

E-mail: carlos@iaa.es, vboyanov@ucm.es, raul.carballorubio@sissa.it and luisj.garay@ucm.es

February 2019

Abstract. Using the formalism of quantum field theory in curved spacetimes, we study semiclassical effects in geometries which get close to the formation of an event horizon. These geometries are such that they imprint special features on the quantum vacuum of the fields. Specifically, we will present a series of asymptotically flat, spherically symmetric spacetimes which get close to the formation of a horizon (representing matter which gets close to crossing its Schwarzschild radius), and calculate the values of the renormalized stress-energy tensor for the *in* vacuum state. We will also obtain the values of the effective temperature function of the outgoing fluxes of radiation, a generalization of Hawking temperature introduced in *Barceló et al. PRD83, 041501(R)* (2011), which allows for a comparison of values of the renormalized stress-energy tensor between the *in* state and the referential static Boulware vacuum state (this latter having a divergence at the Schwarzschild radius). This allows us to identify the dynamical characteristics of the spacetimes for which back-reaction of the quantum field on the geometry may be large enough to lead to significant deviations from a purely classical behaviour.