AGPhil 5: Semi-Classical Gravity 1

Time: Tuesday 9:30–11:00 Location: PTB SR AvHB

Invited Talk AGPhil 5.1 Tue 9:30 PTB SR AvHB

The road to Hawking radiation — •Klaas Landsman[1] and Jeroen van Dongen[2] — [1]Radboud University Nijmegen — [2]University of Amsterdam

Almost exactly 50 years ago, the March 1, 1974 issue of Nature contained a short (1.5 page) article by Stephen Hawking called "Black hole explosions?" in which the author showed that black holes evaporate due to the emission of black body radiation, culminating in an explosion "equivalent to 1 million Mton hydrogen bombs." His obituary published by the Royal Society in 2019 stated that "it is fair to say that Stephen's discovery ranks as one of the most important results ever in fundamental physics." Using both public and private sources (including oral history), we sketch the context and history of Hawking's calculation and interpretation, both within his own career and in comparison with his peers in the U.S., the U.K., and the Soviet Union. Our detailed analysis provides clear reasons why at the time it was Hawking who pulled this through, despite being a novice in quantum field theory.

Invited Talk AGPhil 5.2 Tue 10:15 PTB SR AvHB

The Hawking Effect, Its Desiderata and Its Discontents — •Erik Curiel — Lichtenberg Group for History and Philosophy of Physics Universität Bonn — Black Hole Initiative, Harvard University

I give a heuristic overview of the emission of radiation by black holes when quantum effects are taken into account—the "Hawking effect". I will not work through any particular derivation of the effect in detail, as the rough, intuitive ones tend to be badly misleading, and the precise, rigorous ones are too technically demanding given the constraints of this talk. I will rather sketch the basic ingredients any derivation requires, the choices one must make in constructing a derivation, including what exactly it is one hopes to show, and discuss physical and conceptual problems those ingredients and conclusions raise and face. I focus on apparent inconsistencies among several of the most popular approaches, and how they may (or may not) be resolved. I also discuss whether or not the different derivations can be understood as all sharing a common core of empirical content. I conclude with some thoughts on how to understand the possible bearing of these issues on the widespread use of black hole thermodynamics in general, and the Hawking effect in particular, as a guide in the search for a theory of quantum gravity.