Preface

The aim of this book is to offer a comprehensible monograph on black hole quantum radiance and black hole evaporation. Most of the existing books on quantum field theory in curved spacetimes describe with detail the Hawking effect. However none of them extensively treats the issue of the backreaction of the evaporation process. Since this is a rather involved topic we shall take a modest, but pedagogical line to approach the subject.

The history of research on black holes tells us that important physical insights have been gained through the study of simplified models of gravitational collapse. The paradigm is the Oppenheimer and Snyder model (1939). Despite its simplicity, forced by the difficulties of the technical treatment of more realistic situations, it turns out to produce a very accurate picture of the gravitational collapse and its final outcome. All the main ingredients were there: different descriptions for external and infalling observers, divergent redshift at the horizon and existence of the internal singularity. The assumption of perfect spherical symmetry, the main criticism of black hole opponents, was not, in the end, a real drawback to invalidate the full picture offered by the model. In recent years, a model inspired by string theory, and proposed by Callan, Giddings, Harvey and Strominger (1992), also offers a simplified scenario which allows to study analytically the process of black hole formation and subsequent evaporation, including semiclassical backreaction effects. The results and techniques generated by this model renewed the interest in black hole evaporation.

Motivated by these two paradigmatic models, we take this line of thought and try to present a pedagogical view of the subject of black hole radiance and black hole evaporation. This is the reason for calling "modeling" the approach we take in this book.

The style and presentation of the different aspects involved have been

chosen to make them accessible to a broad audience. We want to stress that we assume a basic knowledge of general relativity and also of quantum field theory, at the level of introductory graduate courses. Therefore, a wide spectrum of physicists, ranging from particle physicists to astrophysicists, and from beginner graduate students to senior researchers, can follow all chapters. Even those who are not very familiar with either general relativity or quantum field theory can find, we hope, this monograph accessible. With this respect we want to remark that this is indeed a book on quantum aspects of black holes and not on "quantum field theory in curved spacetimes". Since the latter subject plays a fundamental role to address the backreaction problem, we approach it following a simple, although somewhat unconventional, way. We try to escape from the standard technicalities of regularization schemes to derive conformal anomalies, effective actions, etc. Rather we try to present and rederive the fundamental results on a physically motivated basis.

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