

# Are Black Holes 5 Dimensional

**Jaipal K. Tuttle**

Mathematical Theory of Black Holes in Higher Dimensions Petya Nedkova, Stoytcho Yazadjiev, 2024-08-16 This book portrays the mathematical theory which lies behind black hole solutions in spacetimes with an extra dimension. Step by step the authors build a comprehensive picture of the main concepts and tools necessary to understand these geometries. In this way the book addresses questions like: How do we describe black holes in higher dimensions? How can we construct such geometries explicitly as exact solutions to the field equations? How many independent solutions can exist and how are they classified? The book concentrates on five-dimensional stationary and axisymmetric spacetimes in electro-vacuum and systematically introduces the most important black geometries which can arise in these settings. The authors follow the natural progress of the research area by initially describing the first results that were obtained intuitively and sparked interest in the community. Then the elaborate mathematical techniques are introduced which allow to systematically construct exact black hole solutions. Topics like the integrability of the theory, the hidden symmetries of the field equations, the available Bäcklund transformations and solution generation techniques based on the inverse scattering method are covered. The last part of the book is devoted to uniqueness theorems showing how to classify the black hole spacetimes and distinguish the non-equivalent ones. The book is not just a mere collection of facts but a methodological description of the most important mathematical techniques and constructions in an active research area. The discussion is pedagogical and all the methods are demonstrated on a variety of examples. Most of the book is adapted to the level of a graduate student possessing a basic knowledge of general relativity and differential equations, and can serve as a practical guide for quickly acquiring the specific concepts and calculation techniques. Both authors have contributed to the research area by their original results, and share their own experience and perspective.

**Black Hole Physics** V. Frolov, I. Novikov, 2012-12-06 It is not an exaggeration to say that one of the most exciting predictions of Einstein's theory of gravitation is that there may exist black holes: putative objects whose gravitational fields are so strong that no physical bodies or signals can break free of their pull and escape. The proof that black holes do exist, and an analysis of their properties, would have a significance going far beyond astrophysics. Indeed, what is involved is not just the discovery of yet another even if extremely remarkable, astrophysical object, but a test of the correctness of our understanding of the properties of space and time in extremely strong gravitational fields. Theoretical research into the

properties of black holes, and into the possible corollaries of the hypothesis that they exist, has been carried out with special vigor since the beginning of the 1970's. In addition to those specific features of black holes that are important for the interpretation of their possible astrophysical manifestations, the theory has revealed a number of unexpected characteristics of physical interactions involving black holes. By the middle of the 1980's a fairly detailed understanding had been achieved of the properties of the black holes, their possible astrophysical manifestations, and the specifics of the various physical processes involved. Even though a completely reliable detection of a black hole had not yet been made at that time, several objects among those scrutinized by astrophysicists were considered as strong candidates to be confirmed as being black holes.

**Hidden Symmetries and Black Holes' Spacetimes** Christina Rugina, 2024-12-21 This book provides a brief, graduate level introduction to the topics of classical and quantum black holes. It also details examples of integrable systems and black holes' spacetime in hidden symmetries, and resolutions to the black hole information paradox. More specifically, it presents an overview of the cutting-edge research regarding the mathematics of hidden symmetries, of black holes' interiors, entanglement wedge reconstruction and minimal gauged 5-dimensional supergravity. It also presents novel supporting results pertaining to Kovalevskaya gyrostats spacetimes and other integrable models, a 5-dimensional minimal gauged supergravity result, fuzzball microstate solutions to non-collinear black holes' bubbling geometries obtained from compactifying down from 11-dimensional supergravity, and an entanglement wedge reconstruction result, reconstructing a spin  $1/2$  from deep bulk on the boundary using a bounded operator raised at a complex power.

*Physics of Black Holes* Eleftherios Papantonopoulos, 2008-11-25 Black Holes are still considered to be among the most mysterious and fascinating objects in our universe. Awaiting the era of gravitational astronomy, much progress in theoretical modeling and understanding of classical and quantum black holes has already been achieved. The present volume serves as a tutorial, high-level guided tour through the black-hole landscape: information paradox and blackhole thermodynamics, numerical simulations of black-hole formation and collisions, braneworld scenarios and stability of black holes with respect to perturbations are treated in great detail, as is their possible occurrence at the LHC. An outgrowth of a topical and tutorial summer school, this extensive set of carefully edited notes has been set up with the aim of constituting an advanced-level, multi-authored textbook which meets the needs of both postgraduate students and young researchers in the fields of modern cosmology, astrophysics and (quantum) field theory.

Superradiance Richard Brito, Vitor Cardoso, Paolo Pani, 2020-08-21 This book focuses on one mechanism in black hole physics which has proven to be universal, multifaceted and with a rich phenomenology: rotational superradiance. This is an energy extraction process, whereby black holes can deposit their rotational energy in their surroundings, leading to Penrose processes, black-hole bombs, and even Hawking radiation. Black holes are key players in star formation mechanisms and as

engines to some of the most violent events in our universe. Their simplicity and compactness make them perfect laboratories, ideally suited to probe new fields or modifications to the theory of gravity. Thus, black holes can also be used to probe some of the most important open problems in physics, including the nature of dark matter or the strong CP problem in particle physics. This monograph is directed to researchers and graduate students and provides a unified view of the subject, covering the theoretical machinery, experimental efforts in the laboratory, and astrophysics searches. It is focused on recent developments and works out a number of novel examples and applications, ranging from fundamental physics to astrophysics. Non-specialists with a scientific background should also find this text a valuable resource for understanding the critical issues of contemporary research in black-hole physics. This second edition stresses the role of ergoregions in superradiance, and completes its catalogue of energy-extraction processes. It presents a unified description of instabilities of spinning black holes in the presence of massive fields. Finally, it covers the first experimental observation of superradiance, and reviews the state-of-the-art in the searches for new light fields in the universe using superradiance as a mechanism.

**Observational Evidence for Black Holes in the Universe** Sandip K. Chakrabarti, Archan S. Majumdar, 2008-10-16 The main objective of the conference was to focus on whether we have enough evidence for existence of black holes, starting from primordial to galactic, extragalactic. Experts from various communities such as, quasars of several billion solar mass to nano quasars of a few solar mass, presented their views and were unanimous that matter has been found to disappear behind event horizons and that the “standard” view of accretion requires major changes to understand the observations. These proceedings contains the most recent results on black hole astrophysics and astronomy, the multiwavelength satellite observations and on future space missions. Recent findings on the relationship among the compact sources and Gamma-ray bursts have been presented.

**Black Holes in Higher Dimensions** Gary T. Horowitz, 2012-04-19 The first book devoted to black holes in more than four dimensions, for graduate students and researchers.

Physics Letters , 2001

**Black Holes and Galaxy Formation** Adonis D. Wachter, Raphael J. Propst, 2010 Galaxies are the basic unit of cosmology. The study of galaxy formation is concerned with the processes that formed a heterogeneous universe from a homogeneous beginning. The physics of galaxy formation is complicated because it deals with the dynamics of stars, thermodynamics of gas and energy production of stars. A black hole is a massive object whose gravitational field is so intense that it prevents any form of matter or radiation to escape. It is hypothesised that the most massive galaxies in the universe -- elliptical galaxies -- grow simultaneously with the supermassive black holes at their centres, giving us much stronger evidence that black holes control galaxy formation. This book reviews new evidence in the field.

**Recent Developments in Gravitation and Cosmology** Alfredo Macias, Claus Lämmerzahl, Dario Nuñez, Abel

Camacho,2008-02-14 The Third Mexican Meeting on Mathematical and Experimental Physics brought together scientists from many different fields. The Meeting was divided into three Symposia: (i) Physical Chemistry, (ii) Biological Physics, (iii) Gravitation and Cosmology. This proceedings presents the papers of the Gravitation and Cosmology Symposium. The main goal of the Gravitation and Cosmology Symposium was to present the perspectives of scientists in the fields of cosmology and gravitation regarding their current work as well as the anticipated development of their research fields in the near future.

**Physics and Mathematics of Gravitation** Kerstin E. Kunze,Marc Mars,Miguel Angel Vázquez-Mozo,2009-05-29 The Spanish Relativity Meeting is an annual meeting providing a forum where all subjects in relativity and gravitation can be discussed. During the Spanish Relativity Meeting 2008 topics in general relativity, mathematical relativity, cosmology, astrophysics, numerical relativity, black holes, theories of gravity and string theory were treated.

**The Journal of High Energy Physics** ,2000

**Two-dimensional Quantum Black Holes** Jaipal K. Tuttle,1993

Internal Structure of Black Holes and Spacetime Singularities Lior M. Burko,Amos Ori,1997 The physics of black holes and spacetime singularities is now a well established area of research in gravitation theory. Over recent years researchers have begun to study the internal structure of black holes and spacetime singularities. This book is primarily the proceedings of a workshop devoted to the subject. The chapters are mainly written versions of the talks given at the workshop. However, the authors have written extended introductions to their contributions, so that a reader, well versed in gravitation theory, but unaware of the current research in this subfield, should be able to follow the text Several topics are considered by more than one author, bringing into the text different viewpoints on these topics. As a result, this book is suitable for graduate students who wish to familiarize themselves with the various aspects of the structure of black holes, and for researchers who wish to learn about advances in subfields other than their own. Topics covered include: the nature of the singularities (both null and spacelike) and the spacetime inside black holes coupled to various matter fields in classical and semiclassical gravity, as well as in alternative gravity theories; the cosmic censorship hypothesis and its connection to black hole interiors; cosmological singularities and their relation with black hole singularities; and black hole entropy and evaporation.

**Canadian Journal of Physics** ,2013

*Chemical Abstracts* ,2002

**Atti Del ... Congresso Internazionale Dei Matematici ...** ,1998

**Proceedings of the International Congress of Mathematicians** Ulf Rehmann,1998

**Index to Theses with Abstracts Accepted for Higher Degrees by the Universities of Great Britain and Ireland and the Council for National Academic Awards** ,2002

**High Energy Physics Index** ,1994

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