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978-1-107-02151-8 - The Physics and Evolution of Active Galactic Nuclei
Hagai Netzer
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THE PHYSICS AND EVOLUTION OF ACTIVE GALACTIC NUCLEI

Research into active galactic nuclei (AGNs) – the compact, luminous hearts of many galaxies – is at the forefront of modern astrophysics. Understanding these objects requires extensive knowledge in many different areas: accretion disks, the physics of dust and ionized gas, astronomical spectroscopy, star formation, and the cosmological evolution of galaxies and black holes. This new text by Hagai Netzer, a renowned astronomer and leader in the field, provides a comprehensive introduction to the theory underpinning our study of AGNs and the ways that we observe them. It emphasizes the basic physics underlying this phenomenon, the different types of active galaxies and their various components, and the complex interplay between them and other astronomical objects. Recent developments regarding the evolutionary connections between active and dormant black holes and star-forming galaxies are explained in detail. Both graduate students and researchers will benefit from Netzer's authoritative contributions to this exciting field of research.

PROFESSOR HAGAI NETZER is a world-class expert in the area of active galaxies and super-massive black holes. He has been at Tel Aviv University since 1977, was the director of the Wise Observatory and the Chair of the Department of Astronomy and Astrophysics, was a visiting professor at numerous other universities, and won several prizes and awards. He has written several advanced and introductory texts in astronomy, as well as a popular science book about the search for life in the universe.

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To my students and colleagues who helped me appreciate
the beauty and complexity of Astronomy.

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Preface

The field of active galactic nuclei (AGNs) is exploding. From a narrow discipline dealing with massive active black holes (BHs) and their immediate surroundings, it now includes the host galaxies of such BHs, the correlated evolution of BHs and galaxies, and the physics of extremely energetic phenomena like γ-ray jets. More than 1000 articles are being published in refereed journals every year about this topic, and the numbers are still growing. The equivalent number in the mid-1970s was about 200.

This book, *The Physics and Evolution of Active Galactic Nuclei*, is an attempt to cover most of the central topics in this large field in a way that emphasizes the basic physics and the complex connections between AGNs and other astronomical objects. It grew from a graduate-level course taught at Tel Aviv University over many years and from numerous international schools on this topic where I participate as a lecturer, and it contains three main themes. The first is a comprehensive description of the more important physical processes associated with AGNs: the physics of photoionized gas; dust in AGNs; nonthermal processes; and various modes of accretion onto BHs, including accretion disks and accretion flows. The second is a detailed description of various subgroups of AGNs and the main components in individual sources. These include radio-loud and radio-quiet AGNs, type-I and type-II sources, LINERs, blazars, broad and narrow emission line regions, broad and narrow absorption lines, megamasers, dusty tori, and X-ray-emitting gas near the BH. The third part deals with the various connections, evolutionary and others, between BHs and their host galaxies, including star-forming galaxies.

The book is meant to be self-contained, an almost impossible mission given the nature of the field. There is no way to pay justice to all the papers that were used in writing this text – there are simply too many of them and, no doubt, others that are as important but escaped my notice. Instead, I chose to give itemized references at the end of each chapter to help guide the reader to other books, to important

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review articles, and to central papers that were used in the writing. These lists are "references to references" and should be viewed as shortcuts to a more thorough study of this vast area of modern research.

Hagai Netzer
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