Preface

Since the discovery of the first optical jet in the galaxy Messier 87 (M87) in 1918, and the discovery of the first 'micro-quasar' in the Galactic source GRS 1915+105 in 1994, it has become clear that relativistic outflows are a ubiquitous feature in both stellar black hole X-ray binaries and active galactic nuclei (AGNs).

The properties of the radio jets in Galactic black holes depend on the X-ray spectral state and history of the source. Steady, compact radio jets are emitted in the hard X-ray state; in contrast, the jets become eruptive as the sources move toward the soft state, and then disappear completely when they reach the soft state. Models for this pattern have been proposed, and there is general agreement about the nature of the accretion disk around the black hole, but a complete and consistent physical picture of the appearance and disappearance of the radio jets is not yet available. On the other hand, accreting supermassive black holes show a clear division into a minority that exhibit radio jets (radio-loud) and a majority that do not (radio-quiet). There have also been some hints of possible connections between the birth of superluminal knots in radio-loud AGNs and dips of their X-ray flux, suggesting a similar phenomenology to that observed in black hole X-ray binaries. However, overall it remains unclear what determines the presence or absence of radio jets in AGNs.

One thing does seem clear, though: much of the physics governing these two types of relativistic outflows must be common, but acting on very different spatial and temporal scales. It is believed that, in both cases, magnetic fields play a fundamental role in the formation and powering of the jets, but the study of how they interact with the strong gravitational field of the central black hole and generate highly relativistic collimated outflows is a formidable problem of modern astrophysics.

We tried to address all of the above issues during a one-day Special Session on 'The Formation and Disruption of Jets in Black-Hole Binaries and AGNs' that we organized as part of the 2012 European Week of Astronomy and Space Sciences (Rome, July 6, 2012). Our experience with this Session provided the motivation for the present volume. Our aim has been to present reviews of the

varied phenomenology regarding the radio to X-ray spectra of stellar binaries and the properties of AGN jets on the wide range of scales through which they propagate, as well as recent theoretical efforts to understand the physical mechanisms that contribute to the origin of black hole jets on all scales. We have given particular emphasis to the role and the origin of the black hole magnetosphere and the magnetic fields that drive, collimate, and accelerate the jets.

This project has been an exciting opportunity for us to try to put together a consistent, unified physical picture of the formation and disruption of jets in accreting black hole systems. New observational and theoretical results are piling up every day, so the contents of this volume only represent our current best ideas. Time will tell how close our present understanding is to reality.

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