Compact Objects and Binaries in Dense Star Clusters
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Preface

IAU Symposium 398 (also designated as MODEST-25) was held at Seoul National University and brought together an international community of researchers to discuss the formation, evolution, and observational signatures of compact stars and binaries in dense stellar systems. These systems—including globular clusters, nuclear star clusters, and young massive clusters—provide extreme environments in which stellar dynamics and stellar evolution interact to produce a diverse population of compact and exotic objects.

This symposium follows a sequence of symposia related to the dynamics of star clusters, including IAUS 69 in Besançon, France (1969; *Dynamics of Stellar Systems*), IAUS 113 in Princeton, New Jersey, United States (1984; *Dynamics of Star Clusters*), IAUS 174 in Tokyo, Japan (1995; *Dynamical Evolution of Star Clusters – Confrontation of Theory and Observations*), IAUS 246 in Capri, Italy (2007; *Dynamical Evolution of Dense Stellar Systems*), IAUS 312 in Beijing, China (2014; *Dynamics of Star Clusters Across Cosmic Time*), IAUS 351 in Bologna, Italy (2019; *Star Clusters: from the Milky Way to the Early Universe*), and Focus Meeting 4 during the General Assembly in Busan, Republic of Korea (2022; *UV insights into massive stars and young stellar clusters*). Some of the organizers of this IAU symposium were founding members of the MODEST (Modeling and Observations of Dense Stellar Systems) community and have also participated in the organization of the recent MODEST-24 meeting, held in August 2024 at the Nicolaus Copernicus Center in Warsaw, Poland.

The timing of the symposium was particularly appropriate. The fourth observing run (O4) of the LIGO–Virgo–KAGRA network is currently delivering an unprecedented volume of data on compact binary mergers, while new optical, infrared, and radio facilities—such as MeerKAT, FAST, ASKAP, Chandra, and HST/JWST—are transforming our understanding of globular clusters and galactic nuclei. The meeting therefore offered an important forum in which theoretical models could be confronted with rapidly expanding observational evidence.

Discussions at IAU Symposium 398 highlighted the central role of dense stellar systems in advancing our understanding of stellar evolution, compact-object physics, and gravitational-wave astrophysics. These environments serve both as relics of early star formation and as ongoing factories of compact binaries. The symposium emphasized the importance of close interaction between observers and theorists, as well as between the electromagnetic and gravitational-wave communities.

As astrophysics enters an era of routine multi-messenger detections and large-scale numerical simulations, the key questions addressed at the symposium—such as the retention of black holes in clusters, the existence of intermediate-mass black holes, and the dynamical origin of compact-object mergers—are expected to shape research in the coming decade. The discussions in Seoul outlined a clear path forward through coordinated international efforts, ensuring that dense stellar systems remain essential laboratories for

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understanding the origin of compact objects and the evolution of the gravitational-wave universe.

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