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Dynamical Masses of Local Group Galaxies

Edited by

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DYNAMICAL MASSES OF LOCAL GROUP GALAXIES

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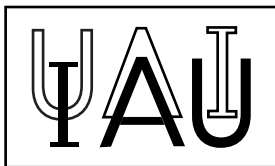
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POTSDAM, GERMANY
20–24 AUGUST, 2023

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Preface

Mass is one of the most fundamental quantities that characterise a stellar system, from star clusters to large galaxies. It determines both the internal dynamics of the system and its gravitational interaction with other systems. We know from the fluctuations in the microwave background and the standard cosmological model that mass comes in two flavours: baryonic and non-baryonic. The latter is often simply referred to as “dark matter”. Contrary to baryons, which form stars that emit light, non-baryonic matter does not possess electromagnetic interaction and does not emit light. Therefore, in general we cannot simply rely on the light to determine the mass of a system. Instead, we have to use dynamics that take into account both components. Unfortunately, such determinations of masses are generally fraught by large uncertainties. However, for what concerns the galaxies in the Local Group, a real revolution in the topic has occurred with the Gaia satellite that provides six-dimensional data (three-dimensional positions and velocities) for almost 1.5 billion sources, located both in the Milky Way and in Local Group galaxies.

We therefore thought it timely to gather the community working on this topic in an IAU Symposium, to discuss and collect recent advances and provide an opportunity for researchers to meet, exchange ideas, and compare methods and hypothesis. In spite of the very focused topic the symposium addressed a very broad range of astronomical fields (from studies of variable stars for estimating distances, to dynamical modelling), of wavelengths to be investigated (from radio and optical for estimating the HI gas and stellar content and their motions, to X-rays for estimating the warm and hot ionised gas), and has major implications for fundamental questions (from the distribution and nature of dark matter to alternative models of gravity). Measuring galaxy masses at different scales in the Local Group impacts a broad range of astronomy, from stars, star clusters, to the Milky Way, distant galaxies, and Cosmology.

The meeting took place in Potsdam, on the historic Telegrafenberg, from March 20–24, 2023. We are grateful to the Leibniz-Institut für Astrophysik, Potsdam (AIP) for the support and for hosting the symposium. We also thank the International Astronomical Union for supporting the meeting and for sponsoring travel grants, and the Deutsche Forschungsgemeinschaft (DFG, German Research Foundation) for funding in support of the meeting (project number 514600258).

The topics covered where:

- Astrometry and 3D velocities: Gaia and HST
- Distances, Chemistry & Star formation in the Local Group: large surveys of resolved stars
- The Galaxy mass and size: rotation curve, halo stars, globular clusters
- Galactic halo dwarf spheroidal and ultra-faint dwarfs
- Magellanic System: the Magellanic Clouds, the Stream and the Leading Arm
- Dwarf irregular galaxies: dynamics, ram pressure effects
- Andromeda System: rotation curve, halo dwarfs
- Galaxy formation: histories of the Milky Way, of Andromeda, compared to field galaxies
- Near field cosmology: galaxy dynamics, dark matter content, cosmological models

The papers assembled in this volume capture the essence of the material presented at the symposium. We are grateful to all participants for contributing to a lively and discussion-heavy meeting, and in particular wish to thank all the authors of these proceedings for their contributions. We also attempted to capture the discussions that took

place during the meeting, adding questions and answers at the end of the papers, whenever possible. We hope this volume will be a valuable reference for the next years, at least until the field will have undergone further advances by when a new Symposium may be timely.

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