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Resolving the Rise and Fall of Star Formation in Galaxies

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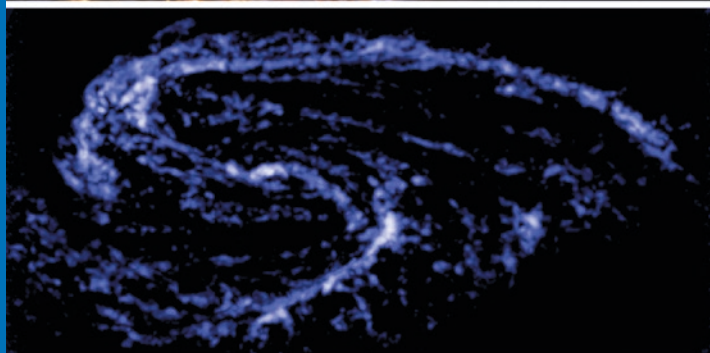
Tony Wong
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RESOLVING THE RISE AND FALL OF STAR FORMATION IN GALAXIES

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COVER ILLUSTRATION:

The nearby barred galaxy NGC 3627 in its optical light as seen by VLT/MUSE (top) and in its CO(2-1) line emission as captured by ALMA (bottom).

Credit: NASA/HST, ESO/VLT, ALMA, PHANGS team & J. Neidel/MPIA.

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International Astronomical Union



**RESOLVING THE RISE AND
FALL OF STAR FORMATION
IN GALAXIES**

**PROCEEDINGS OF THE 373rd SYMPOSIUM OF
THE INTERNATIONAL ASTRONOMICAL UNION
HELD IN BUSAN, REPUBLIC OF KOREA
9–11 AUGUST, 2022**

Edited by

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and

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Preface

Star formation is relevant to nearly every area in astrophysics, from planetary science to galaxy evolution. Yet the physical processes that determine the rate of star formation and its spatial and temporal distribution are still poorly understood. This Symposium focused on the impact that resolved studies of galaxies, both observational and theoretical, are having on the understanding of star formation on all scales. Its goal was to highlight the latest advances in understanding star formation in its galactic context (via resolved studies) and how it drives galaxy evolution.

The general picture of galaxy evolution is one of steady, inside-out growth and maturation of galaxy disks accompanied by rapid aging of the highest mass galaxies due to internal and/or external processes that inhibit star formation. Yet the roles of various factors in the aging process – e.g., galaxy mergers, gas consumption, environmental refueling (or lack thereof), and nuclear activity – remain poorly understood. Integrated over the galaxy population, the effect of galactic aging can be seen as a dramatic decline in the cosmic star formation rate since the epoch of “cosmic noon” at a redshift $z \sim 2$. This is the “rise and fall of star formation” as measured across the galaxy population. For galaxies that are still forming stars today, the star formation rate is strongly correlated with the stellar mass and the supply of molecular gas. However, the exact form of these star formation (scaling) relations, their universality, and the role of additional physical parameters (including galaxy conditions and environment) remain important topics of discussion. Moreover, these relations have provided limited insight into the cessation of star formation, commonly termed “quenching”, which can occur locally well before the star formation of an entire galaxy shuts down. This is the “rise and fall of star formation” as measured within individual galaxies.

Until fairly recently, the communities that studied star formation in galaxies were divided into those who studied small scale processes at high resolution in very nearby galaxies (including our own), and those who treated star formation as a galaxy-scale process, studied out to high redshifts. In the last decade, the study of star formation has been undergoing a revolution that has connected these communities in both theory and observations. The key advance has been the ability to spatially resolve the sub-kiloparsec scales on which star formation relations are established, bridging the gap between resolved studies in the local neighborhood and large-scale galaxy surveys. Helping to interpret these new data are a new generation of cosmological simulations, fully resolved ISM simulations, and new techniques for confronting them with observations.

IAU Symposium 373, running from 9–11 August 2022 at the XXXI General Assembly meeting in Busan, Republic of Korea, provided an opportunity to share the latest findings in the field of star formation on sub-galactic scales. It included 21 invited talks, 36 contributed talks, 78 e-posters, and 78 e-talks. Owing to the COVID-19 pandemic, 20 of the talks were given remotely. It is a great pleasure to acknowledge the support of the NOC of the General Assembly in Busan.

*Tony Wong (co-chair, SOC) and Woong-Tae Kim
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