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# Early Disk-Galaxy Formation from JWST to the Milky Way

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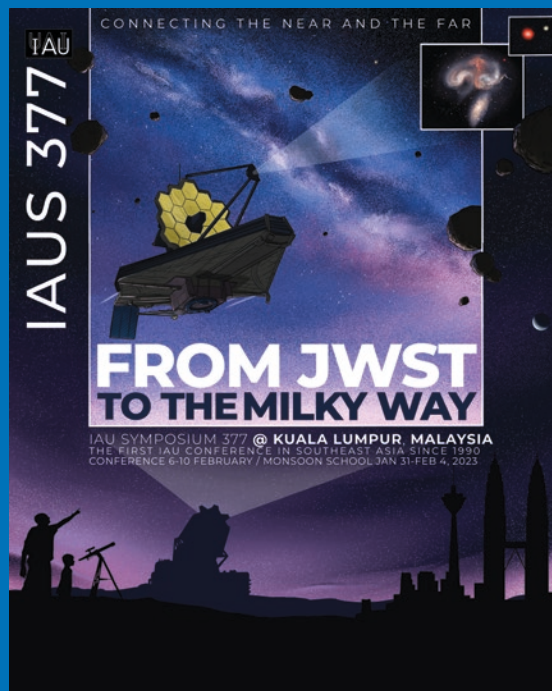
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EARLY DISK-GALAXY FORMATION FROM  
JWST TO THE MILKY WAY

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**EARLY DISK-GALAXY  
FORMATION FROM JWST  
TO THE MILKY WAY**

**PROCEEDINGS OF THE 377th SYMPOSIUM OF  
THE INTERNATIONAL ASTRONOMICAL UNION  
KUALA-LUMPUR, MALAYSIA  
6–10 FEBRUARY 2023**

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## Preface

In recent years, the field of galaxy evolution has witnessed remarkable advancements that have revolutionised our comprehension of both nearby and distant galaxies. Spectroscopic surveys and Gaia have endowed us with unprecedented knowledge of the Milky Way. At the same time, the launch of the James Webb Space Telescope has opened new pathways for studying high-redshift galaxies. Integral field unit studies and ALMA have extended our insights into kinematics, chemistry, and star formation processes in galaxies. The study of galaxy evolution, especially in its early stages, has ushered in an exciting new era.

These advancements have led to many intriguing enigmas. Early discoveries from the James Webb Space Telescope have revealed high-redshift galaxies that defy our expectations. To comprehensively resolve these conundrums, a thorough understanding of galaxy evolution, both near and far, is essential. Historically, studies on galaxy evolution have been fragmented into various sub-communities, with few conferences bringing together these experts. This prompted the organisation of the IAU Symposium, which united specialists from diverse domains and fostered lively and insightful discourse.

The conference covered a diverse array of topics, emphasising the importance of multi-wavelength observations, simulations, and theoretical models in advancing our understanding of galaxy formation, evolution, and interaction. Key themes included the early stages of galaxy formation, focusing on gas accretion in driving the formation of disk galaxies and their interactions with the large-scale structure. Throughout the high-resolution simulations, and advanced statistical techniques.

The properties and evolution of galaxy disks were another central focus, with discussions on the role of gas flows in regulating star formation, the formation of metallicity gradients, and the impact of stellar feedback on disk structure and stability. The conference also explored the role of mergers and interactions in galaxy evolution, including the impact of major and minor mergers on the growth of galaxies and the complex interplay between gas, stars, and dark matter in these processes. The influence of tidal interactions and environmental effects, as well as AGN feedback effects on galaxy evolution, was also discussed.

The role of massive stars in galaxy evolution was a critical theme, with multiple presenters discussing their impact on the chemical evolution of galaxies and their role in driving feedback processes that regulate star formation and overall structure. The importance of studying nearby galaxies to understand the role of massive stars at early cosmic epochs was also emphasised. The Milky Way and its satellite galaxies were significant topics, with discussions on merger history, the role of satellite galaxies in shaping its structure, and the importance of studying resolved stellar populations. The potential of JWST in investigating globular clusters and their multiple stellar populations and ages was highlighted.

The conference delved into the Andromeda Galaxy and its merger history, discussing the recent major merger of Andromeda and its impact on the formation of the galaxy's inner halo and disk. The role of the Giant Stellar Stream in forming Andromeda's disk was also discussed. Galactic outflows and the circumgalactic medium (CGM) were another key focus, covering the role of massive-star feedback in driving outflows at low metallicity and the connection between episodic star formation and the large-scale angular-momentum environment through the CGM. The potential insights the James Webb Space Telescope can provide into these processes were also highlighted.

But besides the scientific highlights, this IAU Symposium held special significance as it introduced science to Malaysia, which had never before hosted an IAU event or an international astronomy conference of this magnitude. In fact, this symposium was



the first in Southeast Asia since 1990. Growing up in Malaysia, I have observed a deep fascination with space science among the people. While there is no shortage of interest and talent in the region, opportunities have been limited. However, the situation is gradually improving. Neighbouring countries like Thailand and Indonesia have made significant investments in astronomy. Malaysia, too, has seen various efforts that have transformed the landscape, with leading tertiary education institutions such as Universiti Malaysia now hosting dozens of astronomers and participating in cutting-edge research.

Hosting an IAU Symposium in Malaysia could not have been more timely. Three weeks before the event, Malaysia held its first all-Malaysian astronomer conference, uniting Malaysian astronomers worldwide to inspire a new generation and influence Malaysia's education policy. As a companion event to the IAU Symposium, a "monsoon school" taught the basics of astronomy and programming to help local students benefit from the conference. The school generated immense interest in the region, and many students told us that the monsoon school further inspired them to pursue a career in astronomy.

The IAU Symposium was truly a remarkable event, bringing together experts from various sub-communities of galaxy evolution. Despite challenges posed by, then, the ongoing pandemic and travel restrictions, the conference successfully brought leading experts together to discuss pressing issues in galaxy evolution. The event attracted 180 participants, with more than 140 attending in person and the rest participating in a hybrid format. Hosting the conference was no small feat. Most Local Organizing Committee members consisted of local PhD students from Universiti Malaya and staff from the National Planetarium, who never had before organised such a large-scale event. Their dedication and professionalism, along with the invaluable contributions of international experts who made up the Scientific Organizing Committee, made the conference possible.

On a personal note, despite having lived in Malaysia for most of my life, the enthusiasm for astronomy in the region continues to surpass my expectations. Some amateur astronomers, aged in their mid-40s to mid-50s, have shared that they have waited their whole lives to see an event like this. It is disheartening to hear that some PhD students in the region find it extremely challenging to attend international conferences due to unfavourable currency exchange rates. This conference allowed them to connect with prominent astronomers and learn firsthand.

It may be challenging for some to comprehend the significance of such events, as those fortunate enough to study astronomy in well-developed countries can travel anywhere to collaborate with colleagues and advance their careers. However, such privileges are not universally available. We hope that this event, even in a small way, will bring some light to regions largely overlooked by the astronomy community.

The enthusiasm, passion, and collaborative spirit displayed during the IAU Symposium are a testament to the potential for growth in astronomy, especially in the Southeast Asian region. This conference has not only brought attention to the significant advancements in galaxy evolution research but has also fostered an environment for budding astronomers to develop their skills and engage with experts from around the world. We look forward to more events like this, which will further bridge the gap between established and emerging astronomy communities, promoting a bright future for the field as a whole.

Yuan-Sen Ting  
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Steering Committee Chair  
IAU Symposium 377

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