IAU Symposium

380

20–24 March 2023
Kagoshima, Japan

Proceedings of the International Astronomical Union

Cosmic Masers: Proper Motion toward the Next-Generation Large Projects

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ISSN 1743-9213

International Astronomical Union

IAU

CAMBRIDGE
UNIVERSITY PRESS

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IAU SYMPOSIUM 380

COVER PICTURE: The Sakura-jima volcano viewed from Kagoshima-city.

The Sakura-jima mountain is one of the most active volcanos in Japan, whose altitude is 1117 m. It is located ∼10 km east of the downtown Kagoshima-city on the opposite side across the Kinko-wan Bay. Although it was quiescent during the IAU Symposium 380 held in Kagoshima-city from March 20 to 24, 2023, one can usually see a variety of interesting phenomena analogous to astrophysical maser activities: Intermittent eruptive events are observed frequently at the southern peak of Sakura-jima. In some cases, a large amount of volcanic dust and smoke are ejected from the crater up to a few 1000 m above the top of the mountain, and obscure the surrounding regions. Thanks to its activity, there are a number of hot springs in/around Sakura-jima including the central part of Kagoshima-city. As such, Sakura-jima is recognized as a symbolic landmark of Kagoshima-city.

The photograph was taken by Hiroshi Imai.

https://doi.org/10.1017/S1743921323004325 Published online by Cambridge University Press

IAU SYMPOSIUM PROCEEDINGS SERIES

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https://doi.org/10.1017/S1743921323004325 Published online by Cambridge University Press

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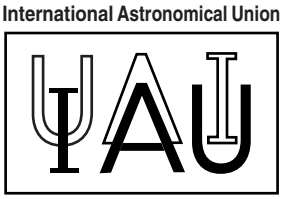

COSMIC MASERS: PROPER MOTION TOWARD THE NEXT-GENERATION LARGE PROJECTS

PROCEEDINGS OF THE 380th SYMPOSIUM OF THE INTERNATIONAL ASTRONOMICAL UNION KAGOSHIMA, JAPAN 20–24 March, 2023

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https://doi.org/10.1017/S1743921323004325 Published online by Cambridge University Press

CAMBRIDGE UNIVERSITY PRESS
University Printing House, Cambridge CB2 8BS, United Kingdom
1 Liberty Plaza, Floor 20, New York, NY 10006, USA
10 Stamford Road, Oakleigh, Melbourne 3166, Australia

First published 2024

Printed in Great Britain by Henry Ling Limited, The Dorset Press, Dorchester, DT1 1HQ

Typeset in System LaTeX 2ε

A catalogue record for this book is available from the British Library of Congress Cataloguing in Publication data

This journal issue has been printed on FSC™-certified paper and cover board. FSC is an independent, non-governmental, not-for-profit organization established to promote the responsible management of the world's forests. Please see www.fsc.org for information.

ISBN 9781009398923 hardback
ISSN 1743-9213

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Preface

The International Astronomical Union (IAU) Symposium 380 entitled *Cosmic Masers: Proper Motion toward the Next-Generation Large Projects* (IAUS 380) was held from March 20 (Mon) 2023 to March 24 (Fri) 2023 in Kagoshima, Japan. Kagoshima-city is located in the south-western region of Japan, and provides grand views of an active volcano, Sakura-jima, which was the location of the IAUS 380 excursion. At the local Kagoshima University, there is an active and large astronomy community which is involved in many aspects of maser research. Staff members and students from this community contributed to the IAUS 380 by serving on the LOC and as symposium volunteers.

Considering the unexpected situation due to the world-wide COVID-19 pandemic, the IAUS 380 was planned as a hybrid conference. At the time of the registration in late 2022, both in-person and online participants were accepted. Finally, because the COVID-19 situation eased in Japan in early 2023, in total 102 people participated in-person in Kagoshima and 70 participated online. In total 28 countries were represented. Among the 172 registered participants, 43 (25%) were at an early career stage before having received their PhD degrees.

Since the discovery of the strong molecular lines of OH and H_2O in 1960s, cosmic masers have been employed as unique probes of various astronomical objects, ranging from newly born stars and evolved stars, the interstellar medium to active galactic nuclei. The maser scientific community is diverse and multidisciplinary but has long been tied together through the common background physics and observational techniques. To connect and build new collaborations, international meetings focusing on masers have been organized regularly since 1992 in US, including the past IAU symposia 206 in Brazil (2001), 242 in Australia (2007), 287 in South Africa (2012), and 336 in Italy (2017). The IAUS 380 is the 6th big international maser conference and the first one in Asia. It took place about 5.5 years after the last meeting and thus filled in the final gap in global coverage and time.

In the science sessions we discussed seven major themes of maser research, from maser theory, cosmology, galaxies, the Milky Way Galaxy, star-formation, evolved stars, to future projects. In order to allow online speakers from outside of Japan to join the meeting during their convenient time zones, we divided each science topic into 2 or more sessions at time ranges. There were 8 review talks including a summary talk of the IAUS 380, 19 invited talks, 37 contributed talks, and 55 poster presentations including 1-minute flash talk for every poster.

As explicitly defined in the sub-title, we organized intensive discussion sessions for currently on-going and future projects related to most of the maser science topics. Taking the opportunity of the IAUS framework, several informal satellite meetings were held during lunch breaks to discuss international collaborations for future studies. An emphasis was on time-domain studies from daily to decadal monitoring of maser sources that were reported using a variety of telescopes from many different research teams in all regions of the world. Furthermore, multi-wavelength studies of maser sources thrived over the last decade exploiting synergies with large facilities such as ALMA, JVLA, Gaia and various VLBI networks.

It is a great pleasure to acknowledge the financial support of all the sponsors listed on the next page of these Proceedings. We would like to thank the active support of the LOC and SOC members to prepare and realize the IAUS 380 under the difficult conditions of

the COVID-19 pandemic. In particular, we are grateful to volunteer members of the IAUS 380, and local staff members related the conference venue with organizing the logistics, excursion, coffee/tea breaks, and banquet during the meeting.

Tomoya Hirota, Hiroshi Imai, Karl Menten, & Ylva Pihlström

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Acknowledgements

The symposium is sponsored and supported by the IAU Divisions H (Interstellar Matter and Local Universe), B (Facilities, Technologies and Data Science), G (Stars and Stellar Physics), and J (Galaxies and Cosmology).

Funding and support by the
International Astronomical Union,
Amanogawa Galaxy Astronomy Research Center, Kagoshima University,
National Astronomical Observatory of Japan,
KAKENHI, Grants-in-Aid for Scientific Research,
Foundation for Promotion of Astronomy,
Inoue Foundation for Science,
Kajima Foundation,
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Kagoshima Convention & Visitors Bureau,
are gratefully acknowledged.

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