

Hiroshi IMAI

Integrated Arts and Science Area of the Research and Education Assembly
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(as of 1 October 2023)

Research Interests:

- Radio astronomy, especially using interferometry techniques including very long baseline interferometry (VLBI).
- Astrophysical masers (mainly OH, H₂O, and SiO lines) associated with young stellar objects at the earliest stage of star formation process and evolved stars such as long period variables including Mira and semi-regular variables in the asymptotic giant branch (AGB) and post-AGB phases, some of which exhibit significant asymmetric stellar mass loss such as collimated, fast bipolar stellar jets or asymmetric planetary nebulae.
- VLBI astrometry yielding measurement of kilo-parsec scale trigonometric parallax distances as well as systematic secular and internal motions of maser sources, enabling to explore the star formation process and stellar evolution with energetic mass loss, and to trace the birth places and the origins of the maser sources in the Milky Way Galaxy. The evolution of the nuclear bulge and disk of the Milky Way Galaxy probed by maser sources is also in my scope of research interest.
- Development of automatic pipelines for VLBI data calibration and image cube synthesis, which works on the Astronomical Image Processing System (AIPS) using ParselTongue/Python scripts in the data analyses mainly for the VLBI Exploration of Radio Astrometry (VERA) and the East Asian VLBI Network (EAVN).
- Promotion of scientific large projects such as those with the combined array of the Korean VLBI Network (KVN) and VERA (KaVA), RadioAstron (Russian space VLBI project), EAVN.
- Planning new science cases with EAVN, the Square Kilometre Array (SKA) and currently the Australian SKA Pathfinder (ASKAP).
- Development of a triple-band (22/43/86 GHz) simultaneous VLBI observation system installed in the Nobeyama 45 m radio telescope, yielding 48 Gbps signal recording (planned in 2024).

Education:

- **Ph.D. in Science (major in Astronomy)** *Tohoku University* 1999 March *Tohoku University*
Dissertation: Internal Motions and Fine Structures of Astronomical Masers
— Application to Stellar Astrophysics and High Precision Astrometry —
Supervisors:
Prof. Munezo Seki, Prof. Tetsuo Sasao (National Astronomical Observatory of Japan)
- **Master's Degree in Science (major in Astronomy)** 1996 March
Tohoku University
Dissertation: Study on Massive-Star Formation Process Based on VLBI Observations of Water Maser Sources
Supervisors:
Prof. Mine Takeuti, Prof. Tetsuo Sasao (National Astronomical Observatory of Japan)
- **Bachelor of Science (major in Astronomy)** 1994 March
Theme: Very Long Baseline Interferometry in Astronomy
Supervisor: Prof. Mine Takeuti

Academic Appointments and Positions:

- **Professor** Kagoshima University 2023 October — present
Center for General Education, Institute for Comprehensive Education and Amanogawa Galaxy Astronomy Research Center (AGARC), Graduate School of Science and Engineering
Works on research supervision of bachelor and graduate (Ph.D. and master course) students in the study of astrophysical masers and data calibration techniques in radio astronomy.
- **Associate Professor** Kagoshima University 2008 March — 2023 September
Center for General Education, Institute for Comprehensive Education and Amanogawa Galaxy Astronomy Research Center, Graduate School of Science and Engineering
- **Visiting Associate Professor** 2012 April — 2013 March
International Center for Radio Astronomy Research (ICRAR)
(Researcher of the “Strategic Young Researcher Overseas Visits Program for Accelerating Brain Circulation” in JSPS)
Promoting the Science Study Phase activity of the Galactic Australia SKA Pathfinder Spectral Line Survey (GASKAP) project.
- **Visiting Astronomer** 2016 January – March and 2017 June–July
Square Kilometer Array Organisation
Secondment work on Japanese contributions to SKA promotion from scientific, technical, and industrial interests.
- **Guest Associate Professor** 2013 April — 2015 March
..... 2009 April – 2012 March and 2013 April — 2015 March
Mizusawa VLBI Observatory, NAOJ

Study on stellar masers using the wide-band VLBI system recently installed in VERA and planned on the basis of VLBI observations with KaVA.

- **Guest Associate Professor** 2009 April — 2012 March
Mizusawa VLBI Observatory, NAOJ
Study on VSOP-2 Science and development of the pipelines for automatic VLBI data analyses. Ultra wide-band VLBI observations for multiple maser lines are also explored.
- **Assistant Professor** 2003 September – 2008 February
Faculty of Science, Kagoshima University Supporting astronomical education of bachelor and graduate (master course) students.
- **JIVE Support Scientist** 2002 April – 2003 August
Joint Institute of Very Long Baseline Interferometry in Europe (JIVE) A post-doctoral fellow in charge of user support in observational data calibration for the European VLBI Network (EVN).
- **JSPS Post-doctoral Fellow (PD)** 1999 April – 2002 March
Mizusawa Astrogeodynamical Observatory, National Astronomical Observatory of Japan In major of maser physics, star formation, stellar mass loss, and high precision astrometry based on the very long baseline interferometry (VLBI) technique. Contributing to data analysis and scientific observation planning for the VLBI Exploration of Radio Astrometry (VERA) of the National Astronomical Observatory of Japan (NAOJ).
- **JSPS Doctoral Fellow (DC1)** 1996 April – 1999 March
Tohoku University
In major of maser physics, star formation and stellar mass loss based on VLBI technique using the Japanese VLBI Network (J-Net). Software development of scientific operation for the 10 m dish radio telescope at the Mizusawa Astrogeodynamical Observatory, NAOJ.

Publications:

- 33 refereed papers published or currently been in press as the first author,
- 7 papers published in Japanese as the first author,
- and 100 refereed papers published as one of the co-authors.

See in detail URL: <http://milkyway.sci.kagoshima-u.ac.jp/imai/HI-achievements.doc> .

Professional Affiliations and Activities:

Professional society membership

- Full member of the Astronomical Society of Japan (ASJ)since 1995
- Member of the International Astronomical Union (IAU)since 2000
- Senior member of the Union of Radio Science International (URSI)since 2022
- URSI member since 2001

- The SKA Japan Consortium since 2008
- The Japan Scientists' Association (JSA)since 2004
- The Japanese VLBI Consortium since 1995
- Japan Radio Astronomy Forum (JRAF)since 1995
- The Japan Square Kilometre Array Consortium (SKA-JP) since 2008
- ASJ representative 2020 April–2024 March
- JRAF Secretary-general 2020 April–2022 March
- Councilor of the JRAF 2007 April–2011 March
- Councilor of the Japanese VLBI Consortium 2006 April–2009 December, 2018 January–2023 December
- A councilor of ASJ 1996 April–2000 March
- A vise-chief of the bureau in the Association of the Young Astronomers and Astrophysists in Japan 1997 September–1998 August

Working Group/ Committee Membership

- The VLBI Science Advisory Committee in NAOJ Since 2019 August
- The VLBI Steering Committee in NAOJ 2016 August – 2019 July
- The Time Allocation Committee of Nobeyama Radio Observatory
..... 2014 August – 2016 July
- Japan ALMA Science Advisory Committee 2014 April–2018 March
- Working Group of Pulsar Study in the International SKA Science Working Group
..... Since 2013 February
- Chairperson of the Science Working Group on Evolved Stars for the KaVA and EAVN
..... Since 2011 June
- Coordinator of the sub-Working Group on SKA-VLBI in the SKA Japan Consortium
..... Since 2020
- Coordinator of the sub-Working Group on Astrometry in the SKA Japan Consortium
..... 2008–2018
- Steering Committee of GASKAP Since 2009 February
- The Radio Astronomy Frequency Committee in Japan since 2005 July
- Science Organization Committee of the East Asia SKA Workshop 2013 and 2019

- Advisory Committee of the Radio Astronomy Division in NAOJ 2010 July–2012 June
- Local Organization Committee of the East Asia VLBI Network Workshop 2010, hosted by Kagoshima University 2010 April 22–25
- The VLBI Programming Committee in NAOJ FY2009–FY2016
- The National Radio Astronomy Observatory (NRAO, in USA) Users Committee 2009 January – 2012 December
- Coordinator of the working group to plan the maser source study in the VSOP-2 Key Science Program FY2007–FY2010
- Organizer of the NAOJ Workshop on VLBA Science 2008 September
- Science Organization Committee of the IAU Symposium 242: Astrophysical Masers and their Environments 2006 April–2007 March
- Coordinator of the working group to develop the data calibration schemes for VERA astrometry FY2004–FY2007
- Coordinator of the VERA Data Analysis Working Group FY1999–2001
- Principal Investigator of the Nobeyama Long-term SiO Maser Survey Project 2000 April–2002 November

Referee / Time Allocation Committees of radio telescopes

- Proposals of ATNF (Australia Telescope National Facility, including ATCA, Parkes, LBA).
- Proposals of ALMA (Atacama Large Millimeter-submillimeter Array).
- Proposals of the UK's e-MERLIN (Multi-Element Radio Link Network).
- Proposals of the 45-m dish telescope of Nobeyama Radio Observatory.
- Proposals of the 10-m dish telescope of the Atacama Submillimeter Telescope Experiment (ASTE).
- Proposals of VERA, KaVA (KVN and VERA combined Array), and EAVN (East Asia VLBI Network).
- Proposals of NRAO's Very Long Baseline Array (VLBA) and the Very Large Array (VLA).

26 papers of the refereed journals in astronomy and astronomical instruments.

Grants:

- JSPS Bilateral Collaboration Program (Project code: JPJSBP120239936, JPN 4,000,000) 2023 September–2025 August for visit to ATNF, Macquarie University, University of Tasmania, and ICRAR

- Grant-in-aid of the Japan Society for the Promotion of Science (JSPS) and MEXT (KAKENHI) (16H02167, JPY 4,940,000)FY2021–2022
for study on interstellar tiny-scale molecular gas structures explored in VLBI.
- KAKENHI (16H02167, JPY 46,670,000) FY2016–2019
for developing the triple-band receiving systems in Nobeyama 45 m telescope.
- JSPS Invitation Program for Research in Japan (for Dr. Willem Baan) 2016
February–April 2014–2018
for four researchers including Dr. José Francisco Gómez and Prof. José Maria Torrelles
- KASI Commissioning Program (JPY 6,000,000) 2015–2017
for promoting KaVA Large Program.
- JSPS Bilateral Collaboration Program 2014 July–2016 June
for collaboration in ASKAP (GASKAP) and MWA, lead by Dr. Keitaro Takahashi
- JSPS Invitation Program for Research in Japan (for Dr. José Francisco Gómez) 2014
November–December
- JSPS Invitation Program for Research in Japan (for Dr. Andrey Sobolev) 2014
February–April
- KAKENHI (70374155, JPN 2,900,000) FY2013–2015
for promoting GASKAP and L-band (1.6 GHz) VLBI astrometry
- JSPS Strategic Young Researcher Overseas Visits Program for Accelerating Brain Circulation
(granted for long stay in ICRAR) 2011 December–2014 March
- JSPS Bilateral Researcher Exchange Program (for visit to the University of Tasmania and
Australia Telescope National Facilities) 2012 November 4–25
- Grant of the Yamada Science Foundation for the Promotion of the Natural Science (JPN
1,000,000) 2011 October–2013 March
- Grant-in-aid of JSPS for Foreign Post-doctoral Fellow (Dr. Daniel Tafoya, 22-00022, JPN
1,900,000)
..... FY2010–2011
- Grant-in-aid for NAOJ guest associate professor (JPN 500,000/year) FY2009–2011, FY2013
- KAKENHI (20540234, JPN 3,300,000) FY2008–2010
- KAKENHI (18740109, JPN 1,900,000) FY2006–2007
- JSPS Grant for Attendance to International Conferences: For IAU Symposium 234 .. 2006
April 3–7
- Grant of Sachio Hayakawa Foundation for Young Astronomers:
For attendance in IAU Symposium 203 2001 November 25–30

- Grant of Sachio Hayakawa Foundation for Young Astronomers: For attendance in the Workshop for Astronomical Molecules, held in the Netherlands ...2004 February 18–20

Teaching/Supervising Experiences:

- Supervisor of five Ph.D. program studentssince FY2009
- Supervisor of nine master course studentssince FY2008
- Supervisor of 18 bachelor students since FY2008
- Supervisor of a JSPS foreign post-doctoral fellowFY2010–2011
- Supervisor of a KAKENHI research assistantFY2016–2019
- Lecture courses on fundamental analysis in astrophysics and Earth science, ..since FY2020 in project-based learning in group working the Center for General Education, Institute for Comprehensive Education
- Lecture courses on mathematics, physics, information science,FY2003–2017 observational astronomy, and scientific English in the Faculty of Science.
- Lecture courses on academic and research skills since FY2018 in the Center for General Education, Institute for Comprehensive Education
- Guest supervisor of a master course student in the University of Hong Kong2009–2011
- Invited lectures in senior high school1–2 lectures every year since FY2005
- Vice-supervisors of bachelor and master course studentssince FY2003
- Advanced lecture of radio interferometry in the Graduate School since FY2015
- Advanced lecture of observational astronomy in the Graduate School since FY2008–FY2014
- Lecture of Scientific EnglishFY2013–2016
- Lecture of Fundamental Physicssince FY2013
- Practice of fundamental calculation in space sciencesince FY2010
- Lecture of space scienceFY2006–FY2009, FY2013–present
- In charge of the class of fresh students admitted in FY2009
- Lecture of information literacyFY2006–FY2011
- Lecture of C-language FY2004–FY2011
- Practice of fundamental experiments in physics FY2004–FY2011
- Practice of public outreach FY2004–FY2009

- Practice of astronomical experiments FY2003–FY2011
- Tutor of the practice for VLBI data analysis in Korea 2005 April
- Tutor of the JIVE Summer Studentship 2003 June–August
- Tutor of the Radio Interferometry Summer School in Nobeyama 2000 August, 2001 August

Management Experiences:

- The Chair of the Branch Meeting of Liberal-Arts Lecture Courses Since FY2023 in Center for General Education
- The Chair of the Committee of Faculty Development FY2019–2022 in Center for General Education
- The Committee of Admission in the Faculty of Science FY2015
- The Committee of Public Outreach in the Faculty of Science . FY2006–2007, FY2013–2014
- The Committee of International Exchange in the University FY2013
- The Committee of the Research-Educational Program Promotion FY2008–2009, FY2011, FY2014
- Chair of the Committee of Students' Life in the Faculty of Science FY2009, FY2016
- Vice-chair of the Committee of Students' Life FY2008
- The Committee of Students' Life in the University FY2008–FY2009, FY2011
- The Committee of the Education Affair in the Faculty of Science FY2009, 2011, 2014
- The Committee of the Education Affair in the Graduate School of Science and Engineering FY2008, FY2014
- The Committee of the Traffic Management in the Faculty of Science FY2004–FY2005

Public Outreach Experiences:

- Public outreach events organized by ICRAR FY2012
- Coordinator of the annual open house of the 6-m dish telescope operation facility in Kagoshima City FY2007–FY2011, FY2014–2015
- The annual open house of the Kagoshima/Iriki Astronomical Observatory ... since FY2004
- Public outreach events organized by the Youth Association in Kagoshima City FY2005–2009
- Science Partnership Program with senior high schools FY2007–2009

- Open house of NAOJ at Mizusawa, Mitaka, and Nobeyama FY1995–2001

Scientific and Technical Skills:

- Computer Programming: excellent at FORTRAN, Python, and BASIC, good at Visual Basic and C-language.
- Astronomical Data Analysis: excellent at Astronomical Image Processing System (AIPS), including construction of POPS RUN and ParselTongue scripts for VLBI data analysis.
- Good at CASA, NewStar (for single-dish radio telescope data of Nobeyama Radio Observatory), and *miriad*.
- Operation of the 10 m telescope of Mizusawa VLBI Observatory, the VERA 20 m telescope (including some experiences of telescope maintenance), and the Nobeyama 45 m telescope including the VLBI backend system.