

Mingjie Jian

Research Associate, Institute of Astronomy, University of Cambridge
Cambridge, United Kingdom | mj688@cam.ac.uk | mingjiejian.github.io
[ORCID](#) | [GitHub](#) | [SciX bibliography](#)

RESEARCH PROFILE

Stellar spectroscopist investigating how subtle chemical fingerprints and stellar ages record the evolution of stars and the Milky Way. My work combines phosphorus and helium diagnostics, physics-based spectral modelling through PySME, and survey-scale analysis for 4MOST. I develop interpretable methods that connect detailed spectral physics to stellar evolution and Galactic archaeology.

RESEARCH POSITIONS

Oct 2025–present	University of Cambridge Research Associate working on 4MOST Level-1 data processing and survey operations, Cambridge, United Kingdom.
Nov 2022–Oct 2025	Stockholm University Postdoctoral Researcher in the 4MOST Galactic Pipeline and stellar-cluster science teams, Stockholm, Sweden.
2022	The University of Tokyo JSPS PD Fellow, Tokyo, Japan Extended Ph.D. work to open-cluster stars and obtained the first positive result on measuring helium abundance in late-type stars.

EDUCATION

2018–2022	The University of Tokyo Ph.D. in Astronomy, Tokyo, Japan Thesis: “The behavior of the chromospheric lines of helium at 10830 Å in late-type stars and the measurement of helium abundance.” Supervisor: Prof. Noriyuki Matsunaga.
2016–2018	The University of Tokyo M.A. in Astronomy, Tokyo, Japan Thesis: “Line-depth ratios as indicators of stellar parameters in near-infrared high-resolution spectra.” Supervisor: Prof. Noriyuki Matsunaga.
2012–2016	Beijing Normal University B.A. in Astronomy, Beijing, China Supervisor: Prof. Biwei Jiang.

RESEARCH EXPERIENCE

Physics-based stellar spectroscopy and modelling | 2018–present

Connecting spectral-line formation and radiative-transfer physics with reliable stellar parameters and abundances.

- Led the development of [PySME](#), a physics-based NLTE spectrum-synthesis and fitting framework for stellar-parameter and abundance analysis.
- Developed near-infrared spectral diagnostics of effective temperature, surface gravity, metallicity, and helium-sensitive chromospheric lines.
- Investigated how radiative-transfer assumptions and model-atmosphere geometry propagate into systematic differences in synthetic spectra and inferred stellar labels.

Chemical tracers of stellar and Galactic evolution | 2021–present

Using difficult-to-measure elements and stellar ages to recover evolutionary structure hidden in conventional abundance relations.

- Combined phosphorus abundances with stellar ages to reveal age-dependent chemical structure in the young Milky Way.
- Established observational foundations for constraining helium abundance in late-type stars using the He I 10830 Å line across open- and globular-cluster populations.

Survey-scale stellar analysis | 2022–present

Building physically interpretable analysis and quality-control infrastructure for large spectroscopic surveys.

- Developed the radial-velocity module for the 4MOST Galactic Pipeline.
- Developed PySME-based stellar analysis for survey-scale stellar-parameter and abundance determination.
- Implemented the 4MOST Level-1 quality-control workflow at Cambridge, translating processed spectra into operational decisions on data quality and observing completeness.

RESEARCH GRANTS

2025–2028	NSFC General Program Co-Investigator (PI: Baitian Tang) Project: “Co-evolution of the Milky Way, its satellite galaxies, and globular clusters.” Contribute to stellar-parameter and abundance analysis with PySME and collaborate with the 4MOST and WEAVE teams.
2021–2023	Grant-in-Aid for JSPS Fellows Principal Investigator Project: “Direct determination of stellar helium abundance using near-infrared chromospheric absorption line.” Developed a method to directly measure stellar helium abundance in late-type stars.
2018	Hayakawa Satio Fund Principal Investigator Supported travel to attend international conferences outside Japan.

HONOURS AND SCHOLARSHIPS

2021–2022	Japan Society for the Promotion of Science PhD Fellowship Awarded through the competitive national JSPS fellowship programme.
2016	National Observatory of China Scholarship National scholarship award.
2013–2016	Jingshi Scholarship, Beijing Normal University Awarded three times.

SOFTWARE DEVELOPMENT

May 2024–present	PySME Project leader Led the development of PySME, an NLTE stellar spectrum synthesis and parameter-fitting code. The work connects radiative-transfer assumptions, spectral modelling reliability, and survey-scale abundance analysis, with adoption in major spectroscopic surveys including 4MOST, WEAVE, and GALAH.
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Earlier software: Creator and former maintainer of [pymoog](#), a Python interface to MOOG.

TEACHING, MENTORING & RESEARCH COORDINATION

Teaching experience: Delivered tutorials and practical training in stellar spectroscopy, spectral synthesis, and stellar-parameter estimation at international schools and workshops.

Student mentoring: Mentor student researchers in stellar spectroscopy, stellar atmospheres, and time-domain astrophysics, providing guidance from project design and scientific programming to data interpretation, presentation, and manuscript preparation.

Research coordination: Lead and coordinate collaborative software and research projects, including PySME development, student-led studies, and contributions across international spectroscopic-survey teams.

SELECTED PUBLICATIONS

Selected publications are listed below; a complete and current publication record is available via [SciX](#).

Manuscript under review

1. **An all-sky catalogue of Be transition stars from WISE and Gaia**
Jia, Q.; Jian, M.*; Li, G.; Cui, Q.; Li, C.
MNRAS, under review.

Selected refereed publications

1. **PySME v1.0: Improved Modelling of Stellar Spectra for Survey-scale Applications**
Jian, M.*; Piskunov, N.; Valenti, J.; et al.
A&A, 711, A168 (2026).
2. **Stellar population astrophysics (SPA) with the TNG. The phosphorus abundance on the young side of Milky Way**
Jian, M.*; Fu, X.; Bragaglia, A.; et al.
MNRAS, 545, staf1797 (2026).
3. **Differentiable Stellar Atmospheres with Physics-Informed Neural Networks**
Li, J.[†]; Jian, M.[†]; Ting, Y.-S.[†]; Green, G.
3rd Machine Learning for Astrophysics Workshop at ICML, peer-reviewed workshop paper (2025).
4. **Stellar Population Astrophysics (SPA) with the TNG. Measurement of the He I 10830 Å line in the open cluster Stock 2**
Jian, M.*; Fu, X.; Matsunaga, N.; et al.
A&A, 687, A189 (2024).

5. Exploring Be phenomena in OBA stars: A mid-infrared search

Jian, M.*; Matsunaga, N.; Jiang, B.; et al.

A&A, 682, A59 (2024).

6. The effect of surface gravity on line-depth ratios in the wavelength range 0.97–1.32 μm

Jian, M.*; Taniguchi, D.; Matsunaga, N.; et al.

MNRAS, 494, 1724–1734 (2020).

* Corresponding author. † Equal contribution.

SELECTED INVITED TALKS, TUTORIALS & PRESENTATIONS

Invited talk

Jul 2026

Implementation Matters: Hidden Choices in Spectral Synthesis for FGK Stars

Invited talk; European Astronomical Society Annual Meeting 2026, Special Session 33; Lausanne, Switzerland.

Tutorials

Sep 2024

PySME/pymoog tutorial on spectral synthesis and stellar-parameter estimation

Tutor; INAC International School and Pre-Symposium; Beijing, China.

Jul 2024

Analysing high-resolution stellar spectra with PySME

Tutor; Astronomy Big Data Exploration Camp II; Kunming, China.

Selected oral presentations

Sep 2024

The impact of stellar helium content and recent measurement efforts

Oral presentation; 17th International Symposium on Origin of Matter and Evolution of Galaxies; Chengdu, China.

May 2024

The outburst of Be stars viewed in the infrared

Oral presentation; LAMOST-Kepler/TESS Workshop; Beijing, China.

SELECTED OBSERVING PROGRAMMES

PI-led observing programmes

2024

FIES / Nordic Optical Telescope; 16 hours

Search for signatures of accretion-induced collapse.

2022

X-shooter / VLT; 18 hours

Calibration of He I 10830 Å as a helium diagnostic in globular-cluster giants.

2020

iSHELL / IRTF; 1.5 nights

Helium spectroscopy of giants in the globular cluster M22.

Selected co-investigator programmes

2026

HARPS-N + GIANO / Telescopio Nazionale Galileo; 30.4 hours

Phosphorus evolution in the Milky Way.

2025

MIKE / Magellan Telescope; 18 hours

Remote globular clusters E3 and Pyxis as probes of Galactic merger history.

2024–2025

X-shooter / VLT; 19 hours

Chemical tagging of unbound young stellar groups.

PROGRAMMING & LANGUAGE SKILLS

- **Python**: proficient; extensive use with PySME and pymoog.
- **IDL**: familiar; used in first-author research work.
- **FORTRAN**: familiar; used in the core of SME and MOOG.
- **MATLAB**: basic working knowledge.
- **Languages**: native Mandarin and Cantonese; proficient in English; fluent in Japanese.

SERVICE & RESEARCH LEADERSHIP

Aug 2024–Jun 2025

Seminar organiser, Stockholm University

Organised and hosted the departmental seminar series.

Jul 2024

Scientific Organising Committee, Astronomy Big Data Exploration Camp II: High-Resolution Spectroscopy

Kunming, China.

Jan–Dec 2023

Working environment group member, Stockholm University

Helped improve the working conditions of students and staff in the Department of Astronomy.

Last updated: October 2026