

Latest achievements and activities of the Okayama 188cm telescope

Bun'ei Sato (Tokyo Institute of Technology), 188cm-user group

Summary of operations and achievements

Operational framework for 188cm telescope since 2018



Operations group

- Participation of a total of 40 researches including students
- Regular maintenance of telescope and dome
- Re-aluminization of mirrors (188cm, Kanata, Kiso)

Number of nights used by researchers in FY2018-2022

FY	Number of nights	Institute	Number of nights
2018	154	Tokyo Tech	383
2019	295	NAOJ	299
2020	273	Univ. of Tokyo	195
2021	257	ABC	158
2022	128 (as of Sep.)	Okayama Sci. Univ.	38
		SOKENDAI	17
		Kyoto U.	7
		Hiroshima U.	5
		Kogakuin U.	3
		Nagoya U.	1
		JAXA	1



Re-aluminization in 2021

Research and education achievements

FY	Refereed paper	Thesis (B)	Thesis (M)	Thesis (D)
2018	10	1	2	3
2019	7	1	2	0
2020	16	1	0	2
2021	15	1	1	2
2022	13	0	1	1
2023	11	2	1	2

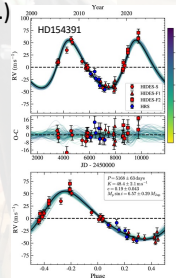
- Regular observations under the current framework started in 2019, but have been suspended since Sep. 2022 due to the dome trouble.
- The publication records are comparable to those in 2013-2017, when the telescope was operated by NAOJ open-use.

Research Highlights

HIDES-F: Precision RV and Spectroscopy

◆ Planet searches around various types of stars

- Discoveries of **18 new planets around evolved stars**
 - Multiple sub-jupiter-mass planets (Teng et al. 2022, PASJ, 74, 92)
 - Rarely found short-period planets (Takarada et al. 2018, PASJ, 70, 59; Teng et al. 2023, PASJ, 75, 169)
 - A trio of giant planets (Teng et al. 2022, PASJ, 74, 1309)
 - A giant planet at the widest orbit ($a=7.5$ au, $P=5160$ d) ever found around giants (Xiao et al. 2024, AJ, 167, 59; right fig.)
 - Statistical properties of planets around giants (Teng et al. 2023, PASJ, 75, 1030)
- Discovery of **a benchmark brown-dwarf** orbiting a Hyades sun-like star (Kuzuhara et al. 2022, ApJ, 934, L18)
- A planet search and statistical studies for short-period planets in the open cluster **Pleiades** (Takarada et al. 2020, PASJ, 72, 104)



◆ Spectroscopic monitoring of various types of stars

- Magnetic activity** variability of nearby **sun-like stars** (Lee et al. 2023, PASJ, 75, 446; Lee et al. 2024, PASJ, in press)
- Optical spectroscopic monitoring of **a symbiotic star** (Ando et al. 2021, PASJ, 73, L1; Ando et al. 2021, 73, L37)
- Spectroscopic Characterization of Four Young **Dippers** (Kasagi et al. 2022, ApJS, 259, 40)
- Spectroscopic study of **a Be star** γ Cas (Tujimoto et al. 2023, PASJ, 75, 177)

MuSCAT: Precision Photometry

◆ Detection and characterization of exoplanets

- Discoveries of **11 transiting planets around M dwarfs**
 - **a volcanic Earth** (Peterson et al. 2023, Nature, 617, 701)
 - **hot super-Earths** (e.g., Hirano et al. 2021, AJ, 162, 161)
 - **warm sub-Neptunes** (e.g., Kawauchi et al. 2022, A&A, 666, A4; Mori et al. 2022, AJ, 163, 298)
 - **warm Jupiters** (e.g., Parviainen et al. 2021, A&A, 645, A16)
- Observation of **nodal precession** in a hot Jupiter (Watanabe et al. 2022, MNRAS, 512, 4404) (*also observed with HIDES-F)
- Characterization of the **closest planetary microlensing event** (Fukui et al. 2019, AJ, 158, 206)



(credit: NASA's Goddard Space Flight Center/Chris Smith (KRBwyle)).

Illustration of the potentially volcanic Earth-sized planet LP 791-18d. The planet was first identified by the TESS survey, and then confirmed by various telescopes including 188cm/MuSCAT.

◆ Characterization of stars

- Novel method to unveil the nature of **multiple-star systems** (Miyakawa et al. 2021, AJ, 161, 276)
- Characterization of **flares** on TRAPPIST-1 (Maas et al. 2022, A&A, 668, A111)

JOVIAL: Precision Doppler-Imager for Jovian Seismology

- Three high-precision **Doppler imager** installed on three different telescopes around the Earth, in **Okayama, Japan, France and USA**, aiming to observe continuously **Jupiter** for several weeks thanks to the repartition in longitude between the three sites in 2020-2025 (Schmider et al. 2020, SPIE, 11447, 114473D; Schmider et al. 2024, arXiv:2312.16888)
- The instrument has been ready for observations at the Okayama since 2020, but unsuccessful due to COVID-19 pandemic (2020), record-long rain in western Japan (2021), and dome trouble (2022) so far.