

Andrea Bocchieri

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Telescope Scientist for ESA's *Ariel* mission specialising in exoplanet characterisation through spectroscopic observations, data analysis, optimisation of space instrumentation, especially optical aspects, and control of experimental systematics.

APPOINTMENTS

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| • Research Associate , CNR-IFN - Padova | 2025 – Present |
| • Telescope Scientist , ESA's <i>Ariel</i> Space Mission | 2024 – Present |
| • Research Associate , INAF - Arcetri Astrophysical Observatory | 2024 – Present |
| • Postdoctoral Fellow , Sapienza University of Rome | 2023 – Present |

EDUCATION

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| • Ph.D. in Astronomy, Astrophysics and Space Science , Sapienza University of Rome | 2020 – 2023 |
| Summa cum Laude – <i>Characterisation of the Atmospheres of Extrasolar Planets with the Ariel Space Mission</i> | |
| • M.Sc. in Astronomy and Astrophysics , Sapienza University of Rome | 2018 – 2020 |
| Summa cum Laude – <i>Learning from Exoplanetary populations: Data Analysis for the Ariel Space Mission</i> | |
| • B.Sc. in Physics , Sapienza University of Rome | 2015 – 2018 |

LEADERSHIP AND SERVICE

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| • Member – GAPS Collaboration | 2025 – Present |
| • Founder, coordinator – <i>Ariel</i> Stellar Obliquity WG | 2025 – Present |
| • Chair – <i>Ariel</i> Telescope Assembly Mounting-Correlation Working Group | 2025 – Present |
| • Member – <i>Ariel</i> Instrument Scientist Team as the Telescope Scientist | 2024 – Present |
| • Member – <i>Ariel</i> Telescope Assembly Project Office | 2024 – Present |
| • Chair – <i>Ariel</i> Telescope Assembly Tiger Team | 2024 – Present |
| • Member – <i>Ariel</i> Data Challenge organising team | 2024 – Present |
| • Coordinator – <i>Ariel</i> -IT Dry Run simulations and retrievals | 2023 – Present |
| • National contact – Exoclock Collaboration | 2023 – Present |
| • Member – <i>Ariel</i> Instrument Operations & Science Data Centre Working Group | 2022 – Present |
| • Chair – <i>Ariel</i> Simulators Software, Management and Documentation Working Group | 2022 – Present |
| • Member – <i>EXCITE</i> Team and Data Analysis Working Group | 2021 – Present |
| • Chair – <i>Ariel</i> Science Brainstorms Working Group | 2021 – 2024 |
| • 13 peer-reviewed journal articles as author or co-author; 5 submitted | |
| • 41 conference proceedings, 10+ technical notes, 4 invited talks, 13 observing proposals | |
| • 4 observing nights at TNG with HARPS-N and GIANO-B | |

TECHNICAL SKILLS

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| • Programming: Python, C, Git, Bash, LaTeX | • Codes: ExoRad2.0; ExoSim2.0; Alfnoor; TauREx3.x |
| • Software: Office Suite, Adobe Suite | • OS: Linux (Ubuntu, Debian), Windows, macOS |
| • Optical design: Zemax OpticStudio; PAOS | • Linux server administration: <i>melodie</i> and <i>flounder</i> |

LANGUAGES

Italian (Native)	English (C2)	French (C1)	German (C1)	Spanish (B1)
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SELECTED PUBLICATIONS AND PROJECTS

- **Bocchieri et al.** (2025). *ExoNAMD: Leveraging the spin-orbit angle to gauge multi-planet systems*. Submitted to A&A
- **Bocchieri et al.** (2025). *Exploring Synergies between Twinkle and Ariel: A Pilot Study*. Submitted to Exp. Astr.
- **Bocchieri et al.** (2025). *De-jittering Ariel: an optimised algorithm*. Exp. Astr.
- Mugnai+**Bocchieri et al.** (2025). *ExoSim 2.0: the new Exoplanet Observation Simulator [...]*. Exp. Astr.
- Changeat et al. (2025). *On the synergetic use of Ariel and JWST for exoplanet atmospheric science*. arXiv
- **Bocchieri et al.** (2024). *PAOS: a fast, modern, and reliable Python package for Physical Optics studies*. SPIE
- Zak+**Bocchieri et al.** (2024). *Stellar obliquity measurements of six gas giants*. A&A
- Mugnai+**Bocchieri et al.** (2024). *ExoRad 2.0: The generic point source radiometric model*. JOSS
- **Bocchieri et al.** (2023). *Detecting molecules in Ariel low resolution transmission spectra*. Exp. Astr.
- **Creator, maintainer** – **PAOS**: Generic physical optics model of wavefront propagation through complex space telescopes.
- **Creator, maintainer** – **ExoNAMD**: Codebase to compute the Normalised Angular Momentum Deficit of planetary systems.
- **Creator, maintainer** – **STOP-utils**: Utilities for wavefront error analysis using externally simulated error maps.
- **Creator, maintainer** – **TIGRO**: Tool analysing interferometric surface error measurements with nanometer precision.
- **Creator, maintainer** – **taurex-emcee**: A plugin for TauREx 3.1 that provides the Emcee sampler for the retrieval.
- **Co-creator** – **ExoRad2.0**: Generic radiometric point source simulator of exoplanet observations.
- **Co-creator** – **ExoSim2.0**: Generic time-domain point source simulator of exoplanet observations.
- Interferometric testing of Ariel M1 structural model of the 1.1 m aluminium primary mirror (May – August 2024).

GRANTS AND AWARDS

- **Organiser** – *Ariel Data Challenge* - NeurIPS, Kaggle [\$100,000] 2024, 2025
- **Co-PI** – INAF USC VIII - Ariel-IT Dry Run: simulation and retrieval [3 M CPUh] 2023
- **PI** – Avvio alla Ricerca - Sapienza University of Rome [\$4,000] 2022, 2024
- **Collaborator** – Progetti di Ricerca - Sapienza University of Rome [\$50,000] 2021, 2022, 2023, 2024
- Winner of the *Excellence track* during M.Sc. - Sapienza University of Rome 2020

OBSERVING PROPOSALS

1. **LBT** (PI) 2025
The evolutionary history of the ~ 60 Myr multiplanetary system TIC 434398831
Instrument: PEPsi, Telescope time: **6.1h**
2. **ESO/VLT** (Cycle P116, dPI) 2025
Cliff Hanger system TOI-942: aligned or misaligned orbit? Escaping or stable atmosphere?
Instrument: ESPRESSO, Telescope time: **6h 42m**
3. **TNG** (PI) 2025
GIARPS characterization of the super-puff transiting planet TOI-1420 b
Instrument: HARPS-N/GIANO-B, Telescope time: **12.1h**
4. **ESO/VLT** (Cycle P115, dPI) 2024
Breaking the chains of near-resonant systems
Instrument: ESPRESSO, Telescope time: **6h 18m**
5. **HST** (Cycle 32 & 33, CoI) 2024
FUV flux of nearby exoplanet host stars in the Ariel target list
Instrument: COS/G140L, 137 Snapshot Targets
6. **ESO/VLT** (Cycle P114, PI) 2024
Unruly mini-Neptunes: constraining the evolution of the very young transiting system TOI-1097
Instrument: ESPRESSO, Telescope time: **4h 38m**
7. **ESO/VLT** (Cycle P114, CoI) 2024
Planet evolution in- and around the desert: measuring masses of the young Neptunes orbiting TOI-942
Instrument: ESPRESSO, Telescope time: **28h 23m**
8. **ESO/VLT** (Cycle P114, dPI) 2024
Vanishing Worlds: Comparative Study of Atmospheric Mass Loss of Two Very Young Neptunes
Instrument: CRISP, Telescope time: **6h 50m**

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| 9. Gemini-North (Semester 2024A, CoI) | 2024 |
| <i>How do resonant planetary chains form and survive?</i> | |
| Instrument: MAROON-X, Telescope time: 7h 30m | |
| 10. JWST (Cycle 3, CoI) | 2024 |
| <i>Contextualising our solar-system: Atmospheric characterization of the Jupiter-analogue Kepler-167e</i> | |
| Instrument: NIRISS, Telescope time: 39h 16m [ADS] | |
| 11. ESO/VLT (DDT P112, dPI) | 2024 |
| <i>How do resonant planetary chains form and survive?</i> | |
| Instrument: ESPRESSO, Telescope time: 5h 12m | |
| 12. ESO/VLT (Cycle P112, PI) | 2023 |
| <i>Unruly Neptunes: constraining the evolution of the very young transiting system TOI-942</i> | |
| Instrument: ESPRESSO, Telescope time: 7h 15m | |
| 13. ESO/VLT (Cycle P112, dPI) | 2023 |
| <i>Vanishing Worlds: Comparative Study of Atmospheric Mass Loss of Two Very Young Neptunes</i> | |
| Instrument: CRIRES, Telescope time: 12h 45m | |

CONFERENCES AND WORKSHOPS

INVITED TALKS

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| 1. Notti d'Estate (Arcetri, ITA) | 22 Jul 2025 |
| <i>Characterisation of exoplanet atmospheres with Ariel: scientific and technological challenges</i> | |
| 2. First PLATOSpec science workshop (Ondřejov, CZ) | 22 May 2025 |
| <i>Know Thy Star, Know Thy Planet: PLATOSpec's Crucial Context for the Ariel Survey</i> | |
| 3. ESO: Stellar Coffee (Garching, GER) | 10 Jun 2024 |
| <i>Summoning the Science Simulators Applied to the Ariel Space Mission</i> | |
| 4. MIAPbP: Habitability: the astrophysical, atmospheric, and geophysical implications (Garching, GER) | 4 Jun 2024 |
| <i>An overview of the Ariel simulators framework and the Ariel Data Challenge 2024</i> | |

ORGANISATION

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| 1. Convener and Chair at Europlanet Science Congress (Helsinki, FIN) | 7–12 Sep 2025 |
| <i>Future and current instruments to detect and characterise extrasolar planets and their environment</i> | |
| 2. Convener and Chair at Europlanet Science Congress (Berlin, GER) | 8–13 Sep 2024 |
| <i>Future and current instruments to detect and characterise extrasolar planets and their environment</i> | |
| 3. SOC member at Ariel-IT Science (Palermo, ITA) | 20–22 May 2024 |
| <i>4th Meeting of the Italian community dedicated to Ariel's scientific preparation</i> | |
| 4. Convener at NeurIPS – Ariel Data Challenge (San Diego, USA) | 2–7 Dec 2025 |
| <i>Extracting exoplanetary signals from the Ariel Space Telescope</i> | |
| 5. Convener at NeurIPS – Ariel Data Challenge (Vancouver, CAN) | 10–15 Dec 2024 |
| <i>Extracting exoplanetary signals from the Ariel Space Telescope</i> | |

SELECTED TALKS

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| 1. Europlanet Science Congress (FIN) | 7–12 Sep 2025 |
| <ul style="list-style-type: none"> • <i>The Atmospheric Remote-sensing Infrared Exoplanet Large-survey (Ariel) sensitivity and performance</i> • <i>ExoNAMD: a community tool to gauge multi-planetary systems</i> | |
| 2. Detection and Dynamics of Exoplanets (Coimbra, PO) | 7–11 Jul 2025 |
| <i>ExoNAMD: a community tool to gauge multi-planetary systems</i> | |
| 3. Chianti Topics (Florence, ITA) | 3–6 Jun 2025 |
| <ul style="list-style-type: none"> • <i>Ariel-IT end-to-end exercise from the astrophysical scene to planetary spectra: simulations and retrieval</i> • <i>ExoNAMD: a community tool to gauge multi-planetary systems</i> | |
| 4. Ariel Consortium Meeting (Leiden, NL) | 8–11 Apr 2025 |
| <ul style="list-style-type: none"> • <i>Ariel S2MD: working group update (plenary)</i> • <i>An end-to end experiment on a small sample of targets: simulations and retrieval</i> | |
| 5. Ariel Consortium Meeting (Lisbon, PO) | 28–30 Oct 2024 |
| <i>Ariel S2MD: working group update (plenary)</i> | |

6. Europlanet Science Congress (Berlin, GER)	8–13 Sep 2024
<i>The Atmospheric Remote-sensing Infrared Exoplanet Large-survey sensitivity and performance</i>	
7. SPIE Astronomical Telescopes & Instrumentation (Yokohama, JP)	16–21 Jun 2024
<i>The atmospheric remote-sensing infrared exoplanet large-survey (Ariel) sensitivity and performance</i>	
8. Ariel-IT Science (Palermo, ITA)	22 May 2024
<i>Updates on Ariel simulations and detrending</i>	
9. Ariel Consortium Meeting (Tartu, EST)	23–26 Apr 2024
<ul style="list-style-type: none"> <i>Ariel S2MD: working group update (plenary)</i> <i>Updates on Ariel performance analyses</i> <i>Ariel long-term detrending</i> 	
10. Ariel Consortium Meeting (Budapest, HUN)	24–27 Oct 2023
<i>Breakthrough in Ariel jitter detrending</i>	
11. ExoClock Annual Meeting (Thessaloniki, GR)	21–22 Oct 2023
<ul style="list-style-type: none"> <i>The Ariel mission and population studies</i> <i>A vanilla introduction to jitter detrending for Ariel</i> 	
12. Ariel Science Ground Segment Workshop at ESAC (Madrid, ES)	12–14 Sep 2023
<i>Ariel Exposure Time Calculator (ETC) Status and Plans</i>	
13. Ariel Consortium Meeting (Tenerife, ES)	6–9 Jun 2023
<i>Ariel Reconnaissance Survey Targets: Detection of Molecules and Promotion to Higher Tiers</i>	
14. Ariel-IT Meeting (Palermo, ITA)	16–18 May 2023
<ul style="list-style-type: none"> <i>Ariel Reconnaissance Survey Targets: Detection of Molecules and Promotion to Higher Tiers</i> <i>The ExoClock Project: an open platform for maintaining the Ariel target ephemerides</i> 	
15. Disks and Planets across ESO Facilities (Garching, GER)	28 Nov–2 Dec 2022
<i>Detecting molecules in Ariel low resolution transmission spectra</i>	
16. Ariel Consortium Meeting (Bologna, ITA)	10–12 Oct 2022
<i>Ariel PSF sampling analysis with PAOS</i>	
17. Ariel Consortium Meeting (Paris, FR)	14–17 Jun 2022
<i>Ariel Tier 1 population analysis</i>	

TEACHING EXPERIENCE

1. Co-Advisor – Syty, A. (Paris-Saclay University)	2024
Research project: <i>Detrending techniques for the Ariel space mission</i>	
2. Co-Advisor – Polci, A. (Sapienza University of Rome)	2023–2024
M.Sc. thesis: <i>Exoplanet observations through the lens of the Fisher information formalism</i>	
3. Co-Advisor – Syty, A. (Paris-Saclay University)	2023
Research project: <i>Line of sight jitter detrending techniques for the Ariel space mission</i>	
4. Co-Advisor – Carrarini, T. (Sapienza University of Rome)	2023
M.Sc. thesis: <i>Transit spectroscopy with the James Webb Space Telescope: the impact of noise and saturation</i>	
5. Tutor – Hall, H. (ESA Mission Performance Engineering YGT)	2022–2023
Research project: <i>Linear drift creation and detrending in presence of pointing jitter</i>	
6. Co-Advisor – Altamura, L. (Sapienza University of Rome)	2022
M.Sc. thesis: <i>Pointing jitter noise reduction in HD209458 out-of-transit observation</i>	
7. Co-Advisor – D'Alessandro, A. (Sapienza University of Rome)	2021
M.Sc. thesis: <i>Phase-resolved spectroscopy with EXCITE for exoplanet atmospheric characterization</i>	
8. Co-Advisor – Masciulli, C. (Sapienza University of Rome)	2021
M.Sc. thesis: <i>Synergies and complementarities between JWST and EXCITE</i>	