

FY 2024 Annual Report



Unit Name

Nonlinear and Non-equilibrium Physics Unit

Collaborations

Term 1 2024 - Term 1 2024

Dr. Meta Virant-Doberlet, National Institute of Biology, Slovenia, The Spider Web: Mechanics of an extended phenotype

Dr. Antonio Celani, Senior Scientist, International Centre for Theoretical Physics, Trieste, Italy, The Spider Web: Mechanics of an extended phenotype

Professor Dov Levine, Technion - Israeli Institute of Technology, Haifa, Israel, Information theoretical analysis of the Von Karman Vortex Street

Professor Paul Chaikin, Department of Physics, New York University, New York, USA, Information Theoretic analysis of the Von Karman Vortex Street

Professor Andres Concha, Adolfo Ibanez University, Santiago, Chile, Classical analogues of the Aharonov-Bohm effect

Professor Luiza Angheluta-Bauer, University of Oslo, Norway, Classical analogues of the Aharonov-Bohm effect

Professor Shreyas Mandre, University of Cambridge, Cambridge, UK, Cellular particle patterns on surfactant laden fluid interfaces

Term 3 2024 - Term 3 2024

Professor Daisuke Mizuno, Department of Physics, Kyushu University, Fukuoka, Japan, Joint meeting in Nonlinear, Non-equilibrium and Soft Matter Physics

Mentorship / Supervision

Jan 2025 - Present Thesis Supervisor, Sayan Mitra, OIST Student

Sep 2024 - Present Thesis Supervisor, Ilhem Nadia Rabehi, OIST Student

Jan 2024 - Present Thesis Supervisor, Diala Joy Edde, OIST Student

Jan 2024 - Apr 2024 Host (RI, SRS, VRS, VS), Veronika Leonie Bachleitner, Research Intern

Sep 2023 - Present Thesis Supervisor, Aditya Singh, OIST Student

Mentor, Andrii Yakymenko, OIST Student

May 2023 - Apr 2024	Host (RI, SRS, VRS, VS), Diya Shaji, Research Intern
May 2023 - Present	Third Committee Member, Monika Leigh Eggenberger, OIST Student
Sep 2022 - Dec 2024	Third Committee Member, Ilhem Nadia Rabehi, OIST Student
Sep 2022 - Present	Thesis Supervisor, John Derek Featherstone, OIST Student
Sep 2021 - Present	Third Committee Member, Jiahao Zhang, OIST Student

Scholarly Contributions and Creative Productions

Journal Article

Completed/Published

Ghosh, A.; Bandi, M. M.; Ghosh, S. Popping: A Granular Transition. *Physical Review Research* **2024**, 6, 033255.

<https://journals.aps.org/prresearch/pdf/10.1103/PhysRevResearch.6.033255>

Ziadi-Künzli, F.; Maeda, K.; Punchenkov, P.; Bandi, M. M. Anatomical Insights into Fish Terrestrial Locomotion: A Study of Barred Mudskipper (*Periophthalmus Argentilineatus*) Fins Based on μ CT 3D Reconstructions. *Journal of Anatomy* **2024**, 245, 593–624.

<https://onlinelibrary.wiley.com/doi/10.1111/joa.14071>

Bel, G.; Bandi, M. M. Spectral Analysis of Solar-Irradiance Fluctuations. *Physical Review Applied* **2024**, 21, 034019.

<https://journals.aps.org/prapplied/abstract/10.1103/PhysRevApplied.21.034019>

Presentation at Conference

Completed/Published

Bandi, M. M.; To, K.-I. Fast Particle Dispersion at Air-Water Interfaces. *CompFlu 2024* **2024**.

Ronning, J.; Singh, A.; Liu, C.-C.; Angheluta, L.; Concha, A.; Bandi, M. M. Emergent Nodal Lines in a Classical Analogue of the Aharonov-Bohm Effect. *Frontiers in Non-equilibrium Physics II* **2025**.

https://www.imsc.res.in/frontiers_non_equilibrium_physics_fnep_ii

Seminars

Completed/Published

Bandi, M. M.; Sardonia, J. E.; Lakhal, S. E. Intermittency of Aggregated Wind Power Production. **2025**.

https://www.linkedin.com/posts/applied-mechanics-biomedical-engineering_we-have-prof-mahesh-bandi-visiting-us-and-activity-7279853283622477826-WlWwA

Scholarly Contributions (Unit Members)

Term 1 2024

- Jack Featherstone, Seminars, Widow Spiders and Their Webs, Widow Spiders and Their Webs, 2024, Completed/Published
- Dr. Jonas Ronning, Seminars, Dynamics of topological defects in active fluids due to self-induced flows, Adolfo Ibanez University, Santiago, Chile, 2024
- Dr. Samy Lakhal, Presentation at Conference, Collective intermittency of wind power production, APS Division of Fluid Dynamics Annual meeting, Salt Lake City, Utah
- Dr. Hirokazu Maruoka, Presentation at Conference, Impact-induced hardening of the suspension of millimeter-sized particles, 72nd Annual Meeting of the Japanese Society for Rheology, Completed/Published
- Dr. Hirokazu Maruoka, Presentation at Conference, Impact-induced hardening on suspension of millimeter-sized particles, Japanese Society for Fluid Mechanics Annual Meeting 2024, Completed/Published
- Dr. Hirokazu Maruoka, Presentation at Conference, Cellular spatial patterns on the air-liquid interface driven by Marangoni flow in Glycerol/Oleic Acid system., 79th Annual Meeting of the Japan Physical Society
- Dr. Chien Chia Liu, Presentation at Conference, Traveling waves in soap-film turbulent channel flow, Annual Meeting of the Japan Society of Fluid Dynamics, Sendai., 2024, Completed/Published
- Dr. Chien Chia Liu, Presentation at Conference, Traveling waves in soap-film turbulent channel flow, 77th Annual Meeting of the APS Division of Fluid Dynamics, Salt Lake City, USA, 2024
- Dr. Kha-I To, Presentation at Conference, Hands-on Research School in Complex Systems, International Centre for Theoretical Physics, Italy
- Dr. Samy Lakhal, Poster Presentation at Conference, Scaling of aggregated wind productions, Frontiers in Non-equilibrium Physics 2024, Kyoto U
- Dr. Samy Lakhal, Poster Presentation at Conference, Multifractal fields, Current Advances in Turbulence and multiphase flows - 24CATS
- Dr. Samy Lakhal, Poster Presentation at Conference, Champs multifractals, Journées de la physique statistique, Paris, France
- Dr. Samy Lakhal, Poster Presentation at Conference, Intermittency of wind production, 79th Annual Meeting of the Japan Physical Society
- Dr. Hirokazu Maruoka, Poster Presentation at Conference, Impact-induced hardening on suspension of large particles, OIST-Kyudai Joint Symposium Series 1: Bio-Inspired Wonders and Energy Innovations, Completed/Published
- Jack Featherstone, Poster Presentation at Conference, Predatory Trapping by Widow Spiders, OIST, Researcher Appreciation Month; 2024, 2024, Completed/Published
- Dr. Kha-I To, Other Scholarly Work, Mini course in soft matter physics, OIST Graduate School, 2024, Completed/Published
- Dr. Jonas Ronning, Other Scholarly Work, Minicourse in soft matter physics, OIST Graduate School, 2024, Completed/Published
- Dr. Christian Vaquero-Steiner, Journal Article, U-shaped disks in Stokes flow: chiral sedimentation of a non-chiral particle, Journal of Fluid Mechanics, Cambridge University Press, 2024, Completed/Published

Ilhem Nadia Rabehi, Journal Article, Unraveling the Morphological and Energetic Properties of 2PACz Self-Assembled Monolayers Fabricated With Upscaling Deposition Methods, Energy & Environmental Materials, Wiley, 2024, Completed/Published

Dr. Jonas Rønning, Journal Article, ComFiT: a Python library for computational field theory with topological defects, Journal of Open Source Software, 2024, Completed/Published

Term 2 2024

Sayan Mitra, Presentation at Conference, Nonlinear time-series analysis of electrical consumer demand

Sayan Mitra, Presentation at Conference, Nonlinear time-series analysis of consumer demand, Shinka Meeting, OIST

Dr. Chien Chia Liu, Presentation at Conference, Traveling waves in soap-film turbulent channel flow, Japan Science and Technology Agency (JST) Mirai Program–Common Platform Technology, Facilities, and Equipment Mission Area: Sakajo Project Group Meeting, 2025, Completed/Published

Dr. Samy E. Lakhal, Journal Article, Wrapping and unwrapping multifractal fields: Application to fatigue and abrupt failure fracture surfaces, Physical Review Research, American Physical Society, 2025, Completed/Published

Term 2 2025

Hirokazu Maruoka, Journal Article, Data-driven discovery of self-similarity using neural networks, Physical Review E, American Physical Society, 2025, Completed/Published

Honors, Awards & Fellowships

Jan 2018 - Present	Fluid Dynamics Research (FDR) Prize, 流体力学研究（FDR）賞, 2018, Japan Society of Fluid Mechanics
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External Service

May 2023 - Apr 2024	Journal referee, Journals, Reviewed 1 manuscript for Journal of Fluid Mechanics, 9 manuscripts for Physics of Fluids, 1 manuscript for Renewable & Sustainable Energy Reviews, 1 manuscript for Atmosphere, 1 manuscript for Energies, 1 manuscript for ANZIAM journal, 1 manuscript for Nonlinear Dynamics, 1 grant for the European commission, and 1 manuscript for Sustainability
Jan 2024 - Apr 2024	Scientific policy advisory meeting, Ministry of New and Renewable Energy, Government of India, Provided scientific policy advice for the Ministry of New and Renewable Energy, Government of India on setting scientific policy milestones for India's renewable energy transition roadmap External Referee for Tenure Evaluation, Academia Sinica, Taiwan, I served as the external referee for a tenure and promotion review for a candidate at the Institute of Physics, Academia Sinica, Taiwan

External Thesis Examiner, Tata Institute of Fundamental Research, I served as the external thesis evaluator for a PhD student at the Tata Institute of Fundamental Research, India

- May 2023 - Dec 2024 Advisory board meetings , Ministry of Science and Technology, State of Israel, Participated in two meetings (May 2024 and December 2024) of 1 day each as a member of the Energy Advisory Board for the Ministry of Science & Technology State of Israel. This was my last year as a member of the board.
- Sep 2024 - Dec 2024 External Referee, Nanyang Technological University, I served as an external referee for a tenure candidate in the Department of Physics, Nanyang Technological University, Singapore
- Advisory Committee Meeting, OIST Lifetime Ventures, I serve as one of three advisors for the OIST Lifetime Venture Fund. I participated in an hour long committee meeting as part of this external service. The fee of JPY 100,000 was donated towards travel support for OIST student team shortlisted to present their Carbon Capture Prototype in New York in late summer 2024.
- Advisory Committee Meeting of the CMU Electricity Industry Center, Carnegie Mellon University, I serve on the advisory committee of Carnegie Mellon University's Electricity Industry Center. I participated in their 2 day annual advisory committee meeting October 16-17, 2024

Outreach Activities (For Unit Members Only)

- Jan 2024 Jack Featherstone, Junior Science and Humanities Symposium, OCSI
Jack Featherstone, Miyazaki Nishi Super Science High School visit, OIST
Jack Featherstone, OIST Science Festival, OIST
Dr. Soumen Das, Miyazaki Nishi Super Science High School Visit to OIST, OIST
Dr. Hirokazu Maruoka, Miyazaki Nishi Super Science High School Visit to OIST, OIST
Diala Edde, Student, OIST
- Sep 2024 Jack Featherstone, Researcher Appreciation Month, OIST
- Jan 2025 Dr. Hirokazu Maruoka, OIST Science Festival, OIST