

Subhajit Kar

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Profile

Expertise in Physical Oceanography, Fluid Dynamics, and Scientific Software Design

Education

- 2020–2025; **Ph.D. (Geophysics)**, *Tel Aviv University*, Tel Aviv, Israel
Thesis: Breaking the Balance: Mechanisms of Oceanic Kinetic Energy Transfers from Geostrophic to Ageostrophic Motions | *Advisor*: Roy Barkan
- 2011–2013 **M.Tech. (Mechanical Engineering)**, *IIT Kanpur*, Kanpur, India
Thesis: Determination of mass diffusivity using shadowgraph | *Advisors*: K. Muralidhar, Y. M. Joshi

Research Experience

- 2019–2020 **Research Assistant**, under prof. Anirban Guha at *IIT Kanpur*
○ 3D vortex-sheet solver to simulate Kelvin–Helmholtz instability.
- 2017–2018 **Research Assistant**, under prof. Anirban Guha at *IIT Kanpur*
○ Inverse bathymetry from free-surface data (hydraulics theory; validated with MITgcm & reanalysis).
○ Density stratification retrieval from IGW surface signatures.
- 2014–2016 **Research Assistant**, under prof. Binod Sreenivasan at *IISc, Bangalore*
○ Rapidly rotating dynamos: scale-dependent helicity and axial-dipole selection mechanisms.

Publications

1. D. Ghosh, **S. Kar**, S. Chakravorty, S. Sinha, S. Mukherjee, “Effect of variation of inter particle distance on the erodibility of a riverbank under cohesive and viscous forces,” *Journal of the Association of Engineers India*, 82, 25–34 (2012).
2. B. Sreenivasan, **S. Kar**, “Scale dependence of kinetic helicity and selection of the axial dipole in rapidly rotating dynamos,” *Phys. Rev. Fluids*, 3, 09380 (2018).
3. **S. Kar**, A. Guha, “Letter: Ocean bathymetry reconstruction from surface data using hydraulics theory,” *Physics of Fluids*, 30, 121701 (2018). **Featured & AIP Scilight**.
4. **S. Kar**, A. Guha, “An inverse technique for reconstructing ocean’s density stratification from surface data,” *Ocean Modelling*, 17, 101561 (2020).
5. **S. Kar**, R. Barkan, “Energy exchange between near-inertial waves and 2D front,” *Journal of Physical Oceanography* (2023).
6. **S. Kar**, R. Barkan, J. McWilliams, J. M. Molemaker, “Spontaneous emission of internal wave by a radiative instability,” *Journal of Physical Oceanography* (2025).
7. **S. Kar**, R. Barkan, J. R. Taylor, “Linear stability analysis of an oceanic front at finite Rossby number,” *Journal of Fluid Mechanics* (submitted).
8. **S. Kar**, “BiGSTARS.jl: A Julia package for bi-global stability analysis for rotating stratified flows” *Journal of Open Source Software* (submitted).

9. **S. Kar**, D. Ghosh, Linear stability of vortices in rotating shallow water magnetohydrodynamics (under-going).
10. **S. Kar**, R. Barkan, Assessing the skill of surface semigeostrophic (SSG) theory in predicting balanced flows: comparisons with realistic ocean simulations and SWOT observations (under-going; developed a Julia-based SSG turbulence solver using a multigrid algorithm).

Conferences

1. C. Paul, **S. Kar**, M. K. Das, “Simulation (3D) of oscillatory flow through bulge filled with porous media: A comparative study with clear media,” FMFP Conference (2012), India.
2. B. Sreenivasan, V. Gopinath, **S. Kar**, “Magnetic confinement of polar vortices in the Earth’s core,” SEDI (2016), France.
3. **S. Kar**, R. Barkan, “Energy exchange between near-inertial waves and 2D front,” TRR Eddy-Wave Meeting (online, 2020), Germany.
4. **S. Kar**, R. Barkan, “Energy exchange between near-inertial waves and 2D front,” Ocean Science Meetings (online, 2022), USA.
5. **S. Kar**, R. Barkan, “Energy exchange between near-inertial waves and 2D front,” EGU (online, 2022), Austria.
6. **S. Kar**, R. Barkan, “Energy exchange between near-inertial waves and 2D front,” AOFD (online, 2022), USA.
7. **S. Kar**, R. Barkan, J. McWilliams, J. M. Molemaker, “Spontaneous emission of internal wave by a radiative instability,” EGU (2025), Austria.

Awards & Patent

2021–22 Academic Excellence Award, Tel Aviv University.

2014 Patent (with Y. Nimdeo, Y. M. Joshi): Light-streak imaging for binary mass diffusivity (Ref. 904/DEL/2014).

Skills

Programming: Python, Julia, Fortran; MPI/parallel computing.

Modelling: UCLA-ROMS

Software developed

1. BiGSTARS.jl: A Julia package for bi-global stability analysis for rotating stratified flows. <https://github.com/subhk/BiGSTARS.jl>
2. FeastKit.jl: A Julia implementation of FEAST solver for finding eigenvalues and eigenvectors of large-scale eigenvalue problems within a specified region. <https://github.com/subhk/FeastKit.jl>
3. VortexMethod.jl: A Julia package for 3D Lagrangian vortex method to simulate KH instability. <https://github.com/subhk/VortexMethod.jl>
4. SHTnsKit.jl: A Julia implementation of the SHTns C library (<https://nschaeff.bitbucket.io/shtns/>). <https://github.com/subhk/SHTnsKit.jl>