

Applications for externally funded and Institute Funded PhD positions in Department of Earth Sciences (DES)

The Department of Earth Sciences (DES), IISER Kolkata is looking for bright and motivated students, who have completed their M.Sc./MS/M.Sc. Tech/M. Tech (with **minimum of 55% marks**) in: 1) Geology/Applied Geology/Geophysics /Earth Sciences/Marine geology/Environmental Sciences/Environmental Studies/Atmospheric Science/Environmental Engineering/Civil Engineering or any other branch of Geological sciences.

Or

2) Physics/Chemistry/Mathematics/Biological Sciences/Computational Seismology/interested to pursue research with the DES faculty member in the matching specialization.

Final year post-graduate students who are yet to obtain their degree may also apply; however, they must have completed their degree at the time of admission. Some of the important information about this program is provided below.

Department is looking for externally funded students and also a few will be funded from the Institute in some specific area of research as following-

Eligibility for externally funded students: Candidates having valid **CSIR NET JRF / UGC-NET JRF / DST-INSPIRE / other equivalent fellowship** would be eligible to apply.

- Candidates must have **physics, chemistry and mathematics at 10+2 level**, and at least one of these subjects at their bachelor level.
- They can work with any faculty member in DES based on mutual research interest. The research areas in which department is looking for young and bright minds are listed below-

1. Computational Mineral Physics Group- The Earth's interior is inaccessible to mankind. However, the evolution of the Earth and the other planets, as well as their present structure and dynamics, depends on processes that take place in their deep interiors. There are several ways in which the Earth's interior can be probed indirectly. First principles quantum mechanical based studies being one of them. In the last two decades it has progressively grown into an indispensable tool which is employed in conjugation with results flowing out of seismology, cosmochemistry, geochemistry, meteoritics, and high pressure and temperature laboratory experiments to extract useful information that help us to thermodynamically model the Earth's interior. Thermodynamic and elastic properties of minerals and melts provide a crucial link that permit the seismic tomographic images of the Earth's interior to be translated into information of geophysical significance: mineralogy, composition, and temperature. State-of-the-art high pressure experimental techniques and quantum mechanical first-principles atomistic simulations complement each other and help us obtain robust estimates of various physical and chemical parameters needed for seismic and geodynamical study of Earth interiors. The Mineral Physics group here at IISER Kolkata performs first principles density functional theory (DFT) based studies to investigate the thermodynamic and elastic properties of probable phases inside the Earth at pressure and temperature conditions up to the Earth's inner core.

2. Geochemistry – Prof. Prasanta Sanyal is looking for a PhD student to work in the field of Organic Geochemistry/Stable Isotope Geochemistry.

3. Tectonic Geomorphology- The *Earth Surface Dynamics* group led by Dr. Sanjay Kumar Mandal studies the diverse processes that operate together to create the surface geology of the Earth. The focus of the group is on tectonic processes that deform the near-surface of the

Earth and erosional processes that sculpt the surface, thereby forming the topography and creating sediment. Himalaya is the best example of this linked system, with orogenic processes occurring due to the ongoing collision between the two continental plates, raising the high mountains that erode rapidly under the influence of monsoon climate. This produces sediments that are deposited in the river valleys, intermontane basins, Indo-Gangetic foreland basin, and ultimately in the Bengal and Indus fans. These sedimentary records chronicle the orogenic evolution of the Himalayas.

The processes of continental collision, tectonic mountain building, erosion, sediment production, and transport in the Himalayan system are all of interest to the Earth Surface Dynamics group. The researchers employ a variety of techniques to study this system. These include fieldwork, geochemical, and isotopic analysis, cosmogenic nuclide analysis, GIS, remote sensing, and computer modeling. Fieldwork is an important component of our research.

The Ph.D. students will have the opportunity to design and conduct research in one or more of the following broad areas: (1) deciphering the geomorphic sensitivity of Himalaya to climate change and associated hazards on natural and human systems; (2) orogen-scale climate-erosion-tectonics coupling; (3) decoding tectonics from landforms and sedimentological archives with key emphasis on the foreland basin and terrace-fill sedimentary records of the



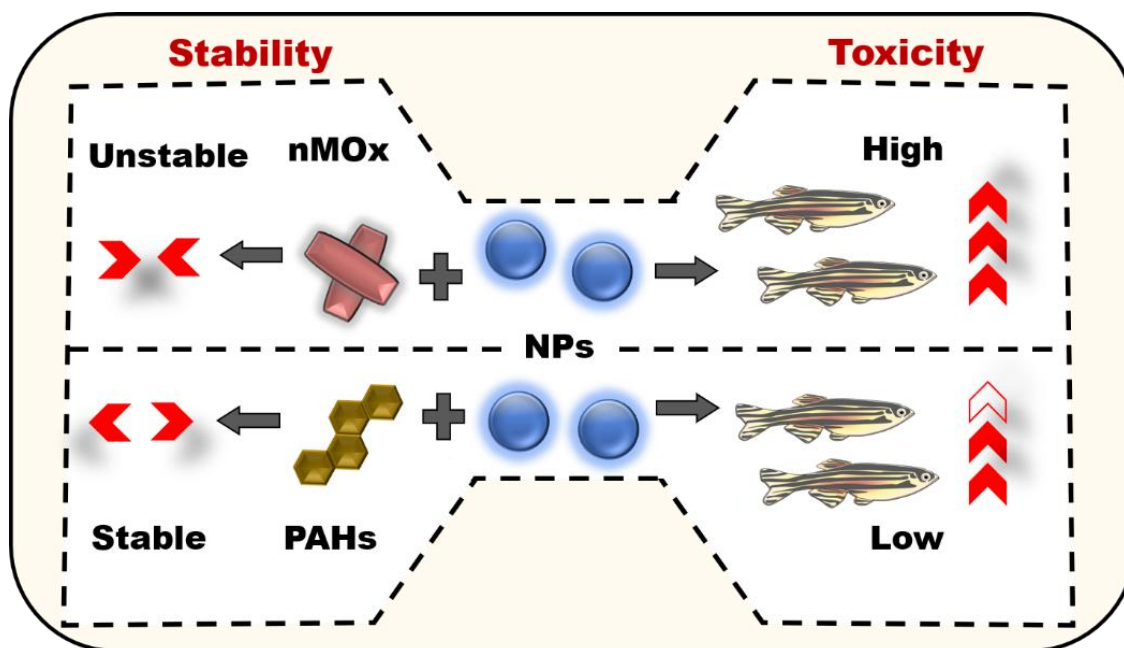
Himalaya.

Figures (left) Researchers are mapping the Siwalik section at the foothills of Himachal Himalaya. **(right)** Researchers are collecting samples from the fill terrace deposits for Luminescence dating and cosmogenic nuclide analysis.

4. Environmental Sciences- Dr. Gopala Krishna Darbha is leading the environmental nanoscience and hydrogeochemistry group at the Department of Earth Sciences, IISER Kolkata. The group's research focus is in water and soil pollution. Their work involves understanding the factors responsible for the fate (stability and transport) of pollutants (such as plastics, pesticides, metals, persistent organic compounds) in the riverine and soil environments and further their sorption onto rock and mineral surfaces under the prevailing environmental conditions. They are currently working on i) the impact of hydrogeochemistry on the transport of metal pollutants along the freshwater bodies ii) understanding the distribution and fate of micro- to nano- plastics along coastal zones and rivers of India iii) bio- and phytoaccumulation of the toxic metals and persistent organic compounds in the presence of plastics iv) the transport of pollutants in porous (soil) media: column experiments & modelling v) application of eco-friendly materials derived from agricultural waste to remediate the potentially toxic metals such as chromium, lead, arsenic, as well the organic contaminants such as dyes,

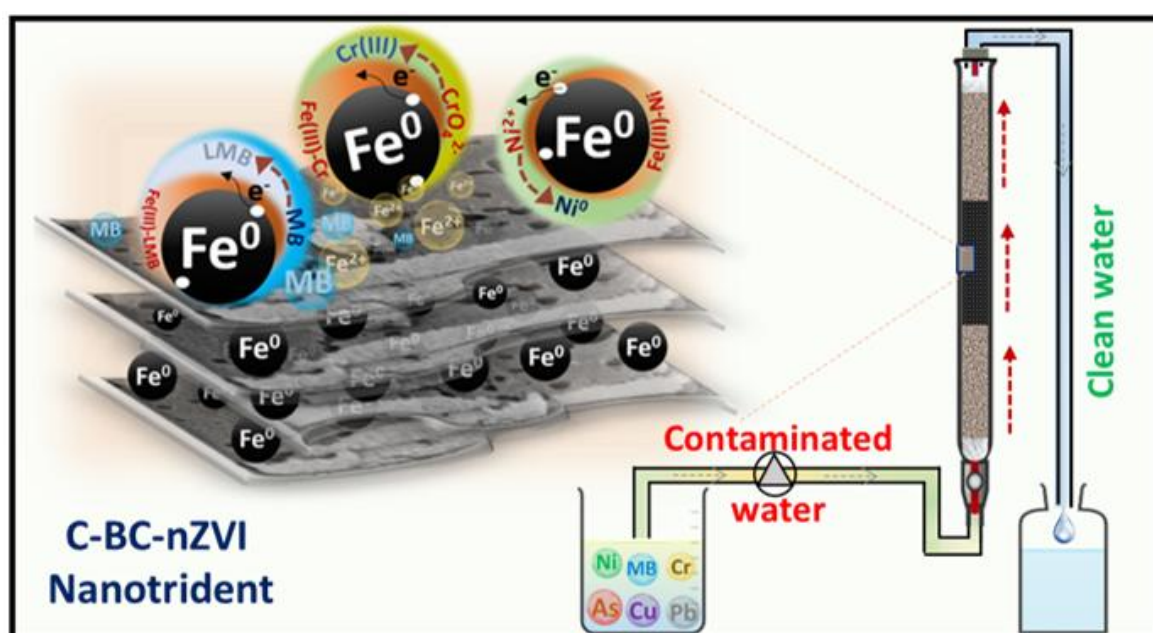
perfluoroalkyl compounds. For more details on recent publications, achievements etc., please visit our website: <https://gkdarbha.wixsite.com/gopaladarbha>. The recent publications include:

- i) Metal oxide nanoparticles and polycyclic aromatic hydrocarbons alter nanoplastic's stability and toxicity to zebrafish, Nisha Singh, Jacky Bhagat, Ekta Tiwari, Nitin Khandelwal, **Gopala Krishna Darbha*** and S K Shyama, **Journal of Hazardous Materials**, 2021, 124382 (IF=9.038)
- ii) Characteristics and spatial distribution of microplastics in the lower Ganga River water and sediment, Nisha Singh, Arijit Mondal, Amarjeet Bagri, Ekta Tiwari, Nitin Khandelwal, Fazel Abdolapur Monikh and **Gopala Krishna Darbha***, **Marine Pollution Bulletin**, 163, 111960, 2021 (IF=4.049)
- iii) Interaction of metal oxide nanoparticles with microplastics: impact of weathering under riverine conditions, Nisha Singh, Nitin Khandelwal, Ekta Tiwari, Nabanita Naskar, Susanta Lahiri, Johannes Luetzenkirchen and **Gopala Krishna Darbha***, **Water Research Journal**, 2020, 189, 116622 (IF=9.130) (*Nature Indexed Journal*)

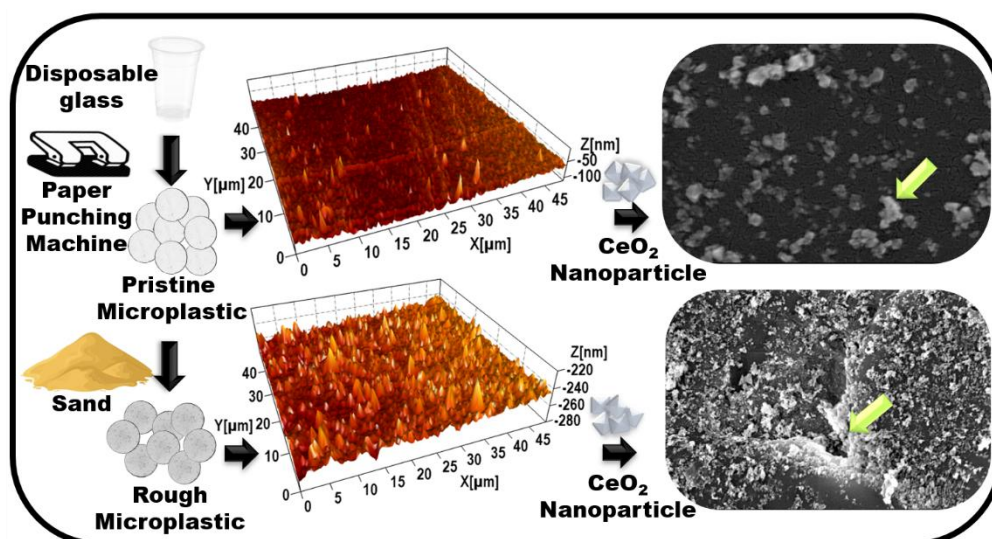


*NP- Nanoplastic, nMOx- Metal-oxide nanoparticle, PAH- Polycyclic aromatic hydrocarbon

Toxicity of plastics in fish showed high levels in the presence of metal oxides over polyaromatic hydrocarbons (published in HazMat, 2021)



Modified biochar (derived from agricultural waste) for continuous water filtration
(Published in ES&T Water, 2011)



Weathered plastics can act as contaminant carriers in the riverine environment over the pristine plastics

Department of Earth Sciences is also looking for few Institute Funded PhD students to work in following areas with qualifying eligibility criteria as discussed below-

Eligibility for institute funded students:

- Candidates must have qualified in one of the following examinations, **GATE, SLET, UGC/CSIR NET-LS or other equivalent examination without scholarship**. Candidates must have **physics, chemistry and mathematics at 10+2 level**, and at least one of these subjects at their bachelor level.

The institute will fund student interested to work in the following areas of research-

1. Paleobiology - Dr. Subhronil Mondal is leading this group. A distinctive characteristic of life's evolutionary history is the increase in taxonomical and ecological diversity during the Phanerozoic (Bambach et al., 2007; Alroy et al., 2008). For marine invertebrates, numerous studies have analysed these diversification patterns and identified several potential causal mechanisms 'driving' these changes. However, a few issues require additional attention, and a candidate will have the opportunity to work on this general research theme: analyzing the biogeographic patterns of taxonomical and ecological diversifications of marine invertebrates through space and time. Basic knowledge in the 'R' Programming language is required.

References: (i) Alroy, J, et al. 2008. Phanerozoic trends in the global diversity of marine invertebrates. *Science* 321.5885: 97-100. (ii) Bambach, R.K., et al. 2007. Autecology and the filling of ecospace: key metazoan radiations. *Palaeontology* 50:1-22.

2. Computational Mineral Physics- same as for externally funded students but do not have their own fellowship. The student is supposed to work with Dr. Gaurav Shukla.

Please note that fulfilling the minimum essential criteria does not ensure that a candidate will be called for the interview. Additional criteria for shortlisting might be set by the department based on academic records, experience and research interest of the candidates. Reservations of candidates will be as per government norms. The departmental faculty profiles can be found at the URL: <http://www.iiserkol.ac.in>