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

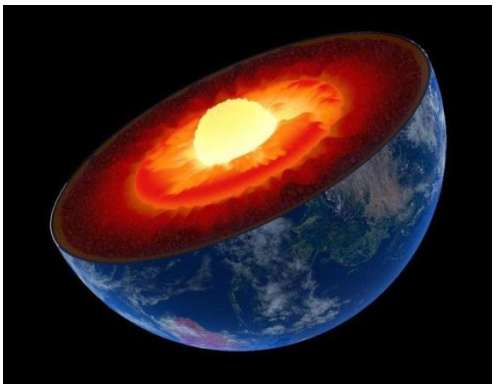
2) Physics/Chemistry/Mathematics/Biological Sciences/Computational Seismology/interested to pursue research with the DES faculty member in the matching specialization.

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.

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

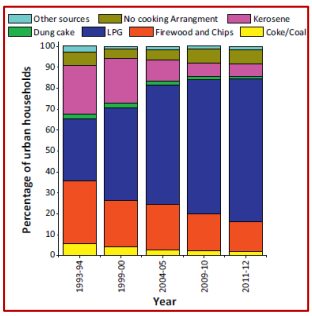
- Candidates must have **physics, chemistry and mathematics at 10+2 level**, and at least one of these subjects at their bachelor level.
- They can work with any faculty member in DES based on mutual research interest. The research areas are listed below.

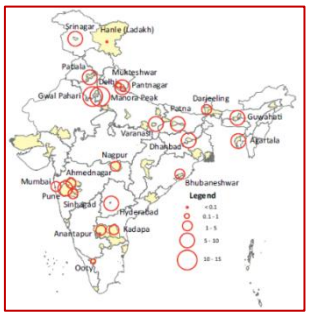
(i) Computational Mineral Physics : The Earth's interior is inaccessible to mankind. However, the evolution of the Earth and the other planets, as well as their present structure and dynamics, depends on processes that take place in their deep interiors. There are several ways in which the Earth's interior 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.

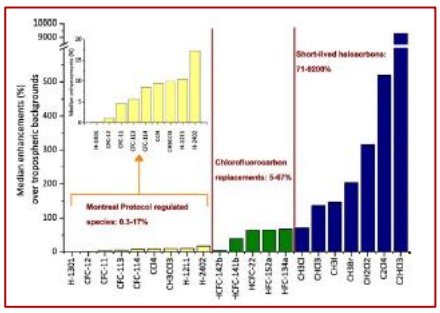


The Mineral Physics group here at IISER Kolkata performs first principles density functional theory (DFT) based studies to investigate the dynamical stability and thermoelastic properties of probable phases inside the Earth at pressure and temperature conditions up to the Earth's inner core. Thermoelastic properties of minerals and melts are the 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 students are supposed to be working with Dr. Swastika Chatterjee or Dr. Gaurav Shukla in this group. Please see the faculty profile on the institute webpage for further detail. Students willing to work in this field must have physics or chemistry in bachelor's level.

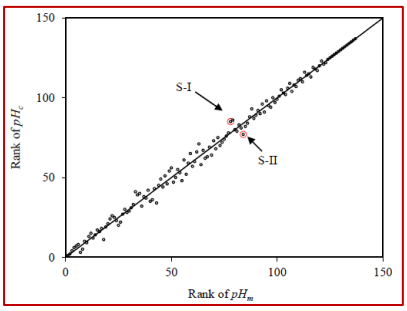
(ii) The **Atmospheric Chemistry and Climate Change (AC3) Research Group**led by Dr. Sayantan Sarkarat IISER-Kolkata is involved in studying fine mode aerosol characteristics in urban, rural and remote areas to understand source emissions and their impacts on tropospheric chemistry, climate and human health. At present, our major research interests include: i) chemical characterization, mass balance, atmospheric transportand source apportionment of fine mode aerosol; ii) measurement of atmospheric black carbon and other light absorbing species using chemical and optical approaches, and to estimate their impacts on regional climate change; iii) reconstruction of historical atmospheric black carbon deposition profiles in remote environments; and iv) human exposure to aerosols in various microenvironments. **Recent publications from our group are:**

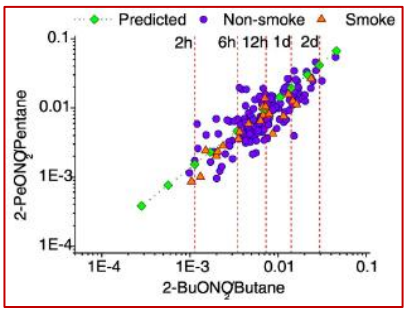


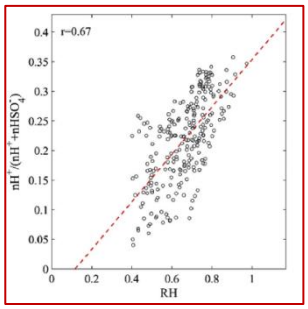




1) Review on black carbon aerosol in India from 2002-2018 **(Rana et al., 2019, Atmos. Res.,**







218, 207-230). Source apportionment of tropospheric halocarbons in SE Asia and evaluation of the effectiveness of Montreal Protocol regulations **(Sarkar et al., 2018, Sci. Total Environ., 619-620, 528-544)**. Theoretical and experimental studies on fine mode aerosol pH **(Jia et al., 2018, Atmos. Chem. Phys., 18, 11125-11133; Jia et al., 2018, Chemosphere, 202, 677-685).**

(iii) Surficial geochemistry: Cycling of trace element and isotopes in rivers and estuaries, and its impact on ocean composition, determination of sources and speciation of heavy metals in rivers/estuaries. The student will be working with Dr. Tarun Kumar Dalai.

(iv) Precambrian crustal Evolution- (a) Archean crustal evolution in central India: A granitoid perspective- The actual mechanism of Archaean crust formation remains a major research interest globally. Granitoids are the dominant rock type in Archaean cratons. They provide vital clues to the mechanism and geodynamic setting of continental crust formation. Archaean granitoids of diverse types are well exposed in the central India. This study the field and age relationship, and geochemistry of these granitoids to understand their petrogenesis, role in crust formation and crust-mantle interaction, and to suggest geodynamic model for Archaean crustal evolution. (b) An investigation into the detrital zircon archive to unravel Hadean to Archaean crust formation in central India- Crustal evolution study through detrital zircon record is still in nascent stage in India. Central India has a protracted (Palaeoarchaean to Palaeoproterozoic) crustal evolutionary history. The proposed research aims to determine U-


Pb age and Hf isotope composition of detrital zircons from sandstones and conglomerates of Palaeoarchaean to Palaeoproterozoic successions. Interpretation of the newly acquired data is expected to contribute a better understanding of several unresolved issues regarding evolution of central India, including different stages of juvenile crustal addition and crustal reworking, processes operated within the mantle, and the mechanism of formation of continental crust with relation to the possible tectonic settings. Students will be working with Dr. Sukanta Dey. (Hariharan, R., Mukhopadhyay, J., Beukes, N.J., Gutzmer, J., Belyanin, G.A., Armstrong, R.A., 2009. Evidence for an early Archaean granite from Bastar craton, India. Journal of the Geological Society, 166, 193–196; Roberts, N.M.W., Spencer, C.J., 2015. The zircon archive of continent formation through time. Geological Society London Special Publications 389, 197–225)

(v) Environmental Chemistry: (a) Application of eco-friendly nanoparticles for the remediation of contaminants in the environment (b) Understanding the stability and transport properties of nanoparticles in the subsurface environment. Students willing to work in this field must have studied chemistry as a subject at bachelor's level.

Eligibility for institute funded students:

- Candidates must have qualified in one of the following examinations, **GATE, SLET, UGC/CSIR NET-LS, INSPIRE, other equivalent examination**.
- The institute will fund student interested to work in the-
  - **i)** Computational Mineral Physics- same as for externally funded students but do not have their own fellowship.
  - **ii)** Precambrian crustal evolution- same as for exernally funded students but do not have their own fellowship.

Eligibility for Project Funded:

Candidates must have qualified in one of the following examinations, **GATE, SLET, UGC/CSIR NET-LS, INSPIRE, other equivalent examination**. The project will fund student interested to work in the Geomorphic evolution of alluvial fans and terraces in eastern India Himalayas and the role of climate and tectonics in shaping them. The work is focussed on quantitative approach on lansdcape evolution using remote sensing and geochronology of the study area. The project is for 2 years and 6 months. The students will get a fellowship for the period of that and later will have to apply for outsource funding for further fellowship in order to continue. The student will be working with Dr. Manoj K. Jaiswal.

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*