Harvard University Solid Earth Physics Seminar
1:15 p.m. Tuesday 4 February 2014
Dept. EPS Faculty Lounge, 4th Floor,
Hoffman Laboratory, 20 Oxford St.

Localised and distributed deformation in the crust and Lithosphere

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The Earth presents mechanical problems that differ from those that confront most other engineers and physicists. Richard Feynman was known to emphasise the importance of collecting data at the scale of the studied problem. This can be a problem for Earth Scientists. For example information about rheological properties commonly relies on data collected using small lab samples and short time scales that differ by many orders of magnitude from the processes occurring in the Earth. Few other physicists are as audacious in extrapolating as we are in Earth Science.

In this presentation I shall talk about what we can learn from studying Earth features on scales ranging from 100s of meters to 100s of kilometers and show that we can place constraints on the material properties of the Earth in this way. Two particular processes are discussed: the evolution by propagation of both small and large geological structures and the processes of localisation or distributed deformation in the continental lithosphere.

Examples come from the evolution of the Tibetan Plateau, the Gulf of Aden - Red Sea and the evolution of the Aegean and Anatolia. I then consider the origin of slip partitioning with examples covering a range of scales. This then leads to a discussion of the "Dead Sea". Why it is not a real Rift and how we should understand it mechanically. I use this as an example of the problem of modeling the deformation of slip-weakening elasto-plastic materials subject to complex displacement boundary conditions.