DEPARTMENT LECTURE SERIES | SPRING 2019

CONSTRAINTS ON THE TIMESCALES AND DISTANCES OF SOLID MIGRATION IN THE SOLAR NEBULA FROM METEORITE PALAEOMAGNETISM

Solid objects ranging in size from the oldest mm-scale grains to km-scale asteroids and even the terrestrial planets are thought to have migrated throughout the early solar system. Although these migrations have been proposed to have played key roles in generating the present day architecture of the solar system and forming planetary bodies, their timescales and distances are poorly constrained. One reason for this limited understanding stems from difficulties in recovering the formation distances of meteorite components and parent bodies from laboratory measurements. Models of our protoplanetary disk indicate that the magnetic field it supported decreased in intensity by orders of magnitude over distances of tens of AU from the Sun. Hence, the intensity of ancient magnetic fields recovered from magnetic measurements of material old enough to have recorded a magnetic remanence of this field could be used as a novel method of constraining its formation distance. I will present paleomagnetic results from two ancient meteorites that indicate the distal formation (>10 AU) of their parent bodies. I will use the distances I recover to support at least one major planetary migration event during the history of our solar system, the efficient outward transport of mm-sized solids from the innermost solar system to >10 AU within ~3 Myr, and propose an explanation for a key trend in the oxygen isotope composition of carbonaceous chondrites that indicates the inward migration of distal ice to the carbonaceous chondrite reservoir within the first ~3 - 4 Myr of the solar system. Finally, I will use all of these observations to place new constraints on the timescale of the formation of Saturn's core and the accumulation of its gaseous envelope.

James Bryson

Junior Research Fellow
University of Cambridge

4 PM WEDNESDAY

February 6, 2019
Room 54-915

Pre-Lecture Reception, 3:45 PM
All are welcome to attend.

FOR MORE DETAILS ON THIS AND OTHER LECTURES: *http://eapsweb.mit.edu/events/all*