

## “Chemistry on a background - new orders in simple solids”

**Professor J Paul Attfield**

**Centre for Science at Extreme Conditions and the School of Chemistry,  
University of Edinburgh**

**Date : Thursday 18th April**

**Time : 11:00 am-12:00 pm**

**Venue : C209, Center Building, OIST Campus**

**Abstract:**

Control of the electronic and magnetic properties of materials often involves the formation of additional orders within simple structure types such as perovskite, spinel, rocksalt, etc. These orders may be of atoms, vacancies, charges, and orbital or spin states. This talk will illustrate the progression from long range motifs to molecule-like objects driven by the d-states within ordered superstructures of transition metal compounds. Long range superstructures will be illustrated by the discovery of large-period vacancy ordered planes in SrCrO<sub>3-x</sub> materials - these are synthesised through 'hard-soft' chemistry starting from the high pressure perovskite SrCrO<sub>3</sub>. More unconventional, polymer-like, correlated orders of O and N atoms have recently been discovered in oxynitride perovskites such as SrTaO<sub>2</sub>N. These have an unusual sub-extensive scaling of entropy with particle size. The low temperature phase of magnetite, Fe<sub>3</sub>O<sub>4</sub>, has been an enduring mystery since it was first reported by Verwey in 1939. Our recent determination of the superstructure shows that it is charge and orbitally ordered to a good approximation, but with an additional molecule-like order of 3-site 'trimeron' units.

**Short Bio of Prof. Attfield:**

Professor Paul Attfield obtained B.A.( Hons.) and D.Phil. degrees in Chemistry and a Junior Research Fellowship at Oxford University during 1980-91. He was a Lecturer, then Reader in Materials Chemistry, and a Co-Director of the IRC in Superconductivity at the University of Cambridge from 1991 until 2003, when he moved to the University of Edinburgh to take the Chair in Materials Science at Extreme Conditions. This is held jointly in the School of Chemistry and the Centre for Science at Extreme Conditions (C SEC). He has recently become the Director of CSEC. Research on the synthesis, structures and electronic properties of transition metal oxides is currently supported by five grants from EPSRC, STFC and the Leverhulme Trust. He was awarded the 1991 Meldola and 1998 Corday-Morgan RSC Medals and he was elected a Fellow of the Royal Society of Edinburgh in 2006. He is the author of more than 200 publications in peer-reviewed scientific journals.

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