747st ASRC Seminar/J-PARC MLF Seminar

Date: Mar. 28 (Thu), 13:30~15:00

Location: J-PARC研究棟 4階会議室.

Speaker: Dr. Alexander J. Browne

(University of Edinburgh, UK, and University of Tokyo, Japan)

Title: Orbital molecules in vanadium oxide spinels

Abstract:

Orbital molecules are clusters of transition metal cations, formed by orbital ordering in systems with direct d-d interactions [1]. Their formation is particularly common in vanadium oxides, as illustrated by the V-V dimerisation that accompanies the metal-insulator transition in VO_2 [2], and the largest reported orbital molecules are V_7 'heptamers' that form in the spinel AlV_2O_4 below an ordering transition at 700 K [3]. X-ray total scattering was used to investigate the V-V bonding in AlV_2O_4 on the local scale and reveals that the heptamers are actually ordered pairs of V_3 trimers and V_4 tetramers [4]. Furthermore, these orbital molecules persist to at least 1100 K in a structurally-disordered high-temperature phase, implying that the electronic instability that forms them is of a different nature to the Peierls-type one normally considered for the dimerisation in VO_2. The involvement of ordered and disordered orbital molecules in the electronic states of other vanadium oxide spinels, such as the newly-synthesised material GaV_2O_4 [5], has also been explored.

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