Origin of the ferromagnetic state in $SrRuO_3$

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Ru oxides are well known to exhibit surprising physical properties due to nontrivial correlation effects as well as appreciable spin-orbit coupling. Especially, $SrRuO_3$ has drawn much attention for its unique ferromagnetic transition. First and foremost, $SrRuO_3$ is the only Ru ferromagnetic material with Tc=160 K and a sizable moment of $\mu_{ord} \sim 1\ \mu_B$. Despite extensive studies spanning several decades, the origin of the ferromagnetic transition has still remained very much elusive.

In order to understand better the singular behavior of $SrRuO_3$, we have carried out extensive studies from bulk measurements to microscopic studies including neutron scattering. In particular, we used two state-of-art neutron instruments of its kind in order to probe much deeper into the structure and spin dynamics of $SrRuO_3$ than before. One is the high-resolution powder diffractometer (S-HRPD) built at J-PARC and the other is the time-of-flight Brillouin spectrometer (BRISP) at ILL. The extensive set of the data we have obtained shed new and important light on the origin of the puzzling ferromagnetic transition of $SrRuO_3$.