# Magnetic and transport studies of the parent and Fe doped Hexagonal-$Mn_3Ge$ Weyl semimetal

**Venus Rai**

*Jülich Centre for Neutron Science JCNS-2, Forschungszentrum Jülich GmbH, D-52425 Jülich, Germany*

$Mn_3Ge$ displays large anomalous Hall effects (AHE) below the Néel temperature (365 K) that can be switched in a small magnetic field (20 Oe) [1], which makes it a strong candidate for room-temperature spintronic applications. The chiral anomaly effect, which is prominent in Weyl semimetal, has not been explored in $Mn_3Ge$. We have performed detailed transport studies of hexagonal-$Mn_3Ge$, and observed a few signatures of a chiral anomaly effect in this compound. In addition to this, we also observed that the sample goes through a topological electronic transition near 200 K, driven by the in-plane lattice parameter of the sample. Moreover, the AHE observed in Weyl semimetals has its origins in the topological Weyl nodes, which can be tuned by suitable dopants of the parent phase. Therefore, we have also explored the electrical transport and magnetic properties of the $(Mn_{1-\alpha}Fe_{\alpha})_3Ge$ ($\alpha = 0 – 0.3$) compounds to study the change in the strength of AHE and the chiral anomaly effect of the doped samples. Signatures of the AHE and chiral anomaly were observed in low Fe doped compounds as well. To predict the origin of AHE in doped samples, the ground state magnetic structures of Fe doped $Mn_3Ge$ compounds were determined using neutron diffraction techniques. We observed that the magnetic structure of the doped sample remains the same as that of the parent compound in the temperature regime where AHE was observed. These observations led us to two main conclusions: (i) the Weyl points are very likely to be present in the doped samples as long as the magnetic structure of the doped compound remains the same as $Mn_3Ge$. (ii) the characteristics of the Weyl points can be tuned by suitable doping of the Weyl semimetals.

Reference:

[1] A. K. Nayak, J. E. Fischer, Y. Sun, B. Yan, J. Karel, A. C. Komarek, C. Shekhar, N. Kumar, W. Schnelle, J. Kübler, C. Felser, and S. S. P. Parkin, Sci. Adv. **2**, e1501870 (2016).