Relationship between crystallographic and magnetic chiralities in chiral heilmagnet $CsCuCl_3$

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In recent years, chiral helimagnets, where antisymmetric Dzyaloshinskii-Moriya interactions induce long-range modulations of magnetic order, became a subject of active experimental and theoretical investigations. Because they provide an opportunity to observe stable magnetic topological structures, i.e., whirls of magnetization called skyrmions and a spiral helimagnetic order. One of the interesting issues in the chiral helimagnets is the relationship of the chirality between crystallographic and magnetic structures. For example, MnSi is known that its crystal structure takes only left-handed chirality and its magnetic structure also takes left-handed. However, there is little information about the relationship between crystallographic and magnetic structures because it is difficult to make a crystal with single helical domain.

$CsCuCl_3$ have a chiral crystallographic structure with space groups of right (*R*)-handed $P6_122$ or *L*-handed $P6_522$. Magnetization shows an antiferromagnetic response at T_N = 10.5 K. Recently, our group has succeeded in obtaining the mm-ordered single crystals. According to X-ray diffraction measurements, each crystal forms only the *R*- or *L*-handed crystallographic chirality. In order to clarify the relationship between crystallographic and magnetic structures, we performed muon spin rotation measurements at J-PARC and at PSI. We observed muon spin precession signals in both *R*- and *L*-handed crystals under a zero field below T_N, indicating the presence of a long-range magnetic order. Temperature dependence of the precession frequencies observed in both crystals behaves the same way, suggesting that the *R*- and the *L*-handed samples are a pair of complete isomers in terms of both crystallographic and magnetic structures.