High-entropy topological kagome magnet

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Topological kagome magnets such as RMn_6Sn_6 (where R is a rare-earth element) are materials of compelling interest due to their unusual band topology combined with room-temperature magnetism, which allows for forms of magnetism that are controlled by topology. A team of MRSEC researchers has synthesized a high-entropy version of a kagome magnet with four different rare-earth cations: $Gd_{0.38}Tb_{0.27}Dy_{0.20}Ho_{0.15}Mn_6Sn_6$. This high-entropy material exhibits multiple magnetic spin reorientation transitions that are not seen in any of the “parent” compounds that contain only one of the rare earths; these new competing magnetic interactions arise from the high entropy.

The material also shows an intrinsic anomalous Hall effect, which is a hallmark of topological systems and indicates that the high-entropy phase preserves the non-trivial band topology. These results suggest that high entropy can provide a route to engineer the magnetic structure and expand the material horizons of topological materials.