**Magnetocaloric materials: Heusler/half-Heusler solid solutions**

The half-Heusler magnet MnNi3Sb is able to form a complete solid solution with the half-Heusler Mn3Si. The compounds are temperature-tunable magnetocalorics with applications ranging from refrigeration to waste heat recovery.

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**Mapping complex spin textures in topological magnets (skyrmions)**

Careful magnetization measurements allow the magnetic phase diagram of the prototypical skyrmion host crystal FeGe to be mapped out, through the transformation to a magnetic entropy map, shown on the right.

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**Conversion battery electrodes: The case of FeS2**

In a conversion (as opposed to intercalation) battery electrode, the crystalline structure of the electrode material is completely transformed in the process of charging and discharging. In operando synchrotron X-ray pair distribution studies of electrode cycling, judiciously coupled with density functional theory calculations of intermediate structure stability helps unravel the details of what happens when pyrite FeS2 is cycled.

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**Fundamentals of structure-property relations in halide perovskites**

Hybrid halide perovskites display complex structural changes as a function of temperature as a consequence of octahedral tilting, in conjunction with the dynamics of the organic cation on the A-site. We employ a combination of calorimetry, capacitance measurements, and high-resolution synchrotron X-ray scattering studies to unravel the details of these structural changes.

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**Topological materials: The nexus with energy materials**

Valence band and conduction bands of a slightly distorted (ssx off-centered Sr) rock salt SrTe, showing the distinct spin texture in this topologically non-trivial material. We are interested in the question of whether such spin textures can impact the use of these materials in energy conversion, i.e. as thermoelectrics and photocatalysts.