# Determination of Complex magnetic structures with neutron polarimetry

Determination of magnetic structure from measurement of the intensities of neutrons (or X-rays) scattered by magnetic Bragg reflections is in some ways a more difficult problem than determination of the crystal structure. This is because the magnetic structure factor is a vector quantity so that directional as well as phase information is lost in measuring just the intensity. Spherical neutron polarimetry provides a way of recovering some of this lost information.

SNP gives rather direct information about the orientation of the magnetic interaction vector and in favourable cases can determine it completely. This is in contrast to integrated intensity measurements which give the squared modulus of the vector. The additional information obtained from SNP is often crucial in determining the correct magnetic structure in cases where the moments are not collinear. The magnetic structures of $U_14Ai_{51}$ and $GdB_4$ may be cited as examples.

A special property of SNP is its ability to determine the transverse components of polarisation, those not parallel to the incident polarisation direction. This makes it possible to distinguish between rotation of the polarisation and depolarisation. True rotation, when it occurs, yields unique information about the scattering system. It has enabled distinction to be made between different types of modulated structure, and by revealing the phase relationship between nuclear and magnetic scattering, allows the absolute configurations of magneto-electric structures to be determined.