Resonant X-ray Scattering as a Tool to Detect Parity-Odd Magnetic Multipoles in Globally Centro-Symmetric Crystals

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A brief outlook is given of the physical quantities detectable by means of resonant x-ray scattering, focusing on the ordinary multipole expansion of the (static) electric and magnetic fields. On this basis I propose a way to identify the parity-odd multipoles, related to the vector potential part of such an expansion, in many centro-symmetric classes of materials with a local inversion-breaking. I put forward two specific examples: Li_2VOSiO_4 and V_2O_3. The first system fulfills all the requirements to individuate magnetic, parity-odd multipoles (i.e., magnetic quadrupoles, toroidal moments, etc.). The second allows the identification of a time-reversal even, parity-odd physical quantity, related to the toroidal moment, through a subtle interference effect.

Notice that such observations would not be possible without the use of a diffraction technique, where the local transition amplitudes are added with a phase factor that can compensate the vanishing 'bulk' effect due to the global symmetry.