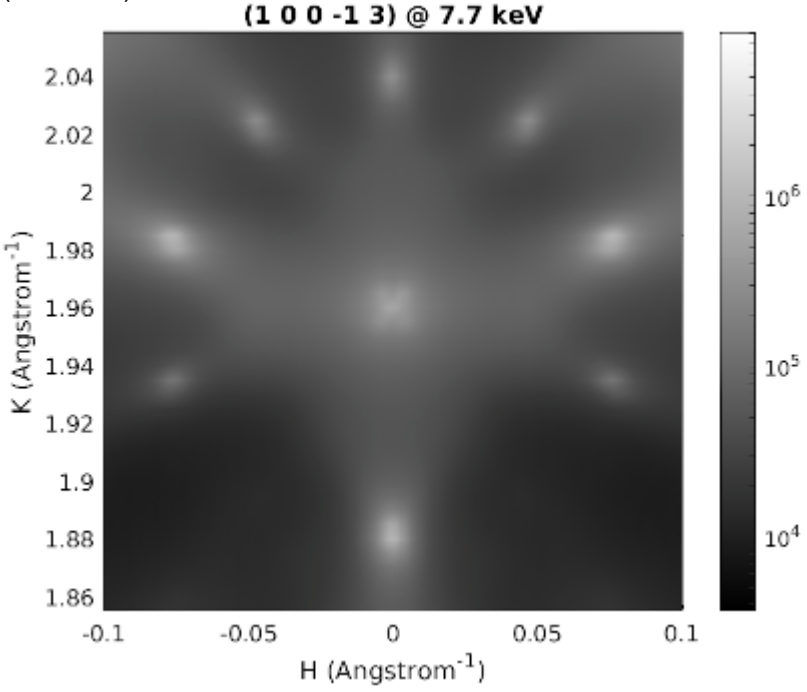
MS21-1-4 Resonant 'forbidden' reflections in aperiodic crystals
#MS21-1-4

G. Beutier [1], M. De Boissieu [1], G. De Laitre [1], G. Chahine [1], N. Blanc [2], S.P. Collins [3], G. Nisbet [3], S.R. Kotla [4], S. Van Smaalen [4], P. Gille [5], E.N. Ovchinnikova [6], V.E. Dmitrienko [7]
[1]Univ Grenoble Alpes - CNRS - SIMaP - Grenoble (France), [2]CNRS - Institut Néel - Grenoble (France), [3]Diamond Light Source - Grenoble (United Kingdom), [4]Universität Bayreuth - Bayreuth (Germany), [5]Universität München - München (Germany), [6]Moscow State University - Moscow (Russian Federation), [7]Shubniov Institute of Crystallography - Moscow (Russian Federation)

Abstract
Some symmetries in crystal structures are responsible for systematic extinctions of reflections (for instance, in crystals with face-centred lattice, it is well known that reflections are allowed only if h, k and l are of the same parity). Nevertheless, in the case of glide plane and screw axes symmetries, the forbidden reflections can be observed at an X-ray absorption edge of the material, thanks to the anisotropy of the tensor of scattering, which encodes the local electronic anisotropy of the resonant atoms [1,2]. Such resonant "forbidden" reflections are well known for periodic crystals.
In this contribution, we present the first experimental demonstration (to our knowledge) of such reflections in aperiodic crystals. We present results on crystals from two classes of aperiodic crystals: d-AlCoNi, a decagonal quasicrystal (Figure 1), and Rb2ZnCl4, an incommensurately modulated crystal (Figure 2). In the former case, the forbidden reflections are mostly due to the intrinsic symmetry of the quasicrystal. In the latter case, however, the intensity of forbidden reflections can be related to atomic displacements with respect to the symmetric (commensurate) structure [3], similarly to the case of a few periodic crystals [4–9].

References
[1] Dmitrienko, Acta Cryst. A 39, 29–35 (1983).
[2] Templeton & Templeton, Acta Cryst. A 41, 133-142 (1985).
[3] Dmitrienko & Ovchinnikova, Acta Cryst. A 56, 340-347 (2000).
[4] Kokubun et al, Phys. Rev. B 64, 073203 (2001).
[5] Kirfel et al, Phys. Rev. B 66, 165202 (2002).
[6] Collins et al, Phys. Rev. B 68, 064110 (2003).
[7] Beutier et al, Eur. Phys. J. Special Topics 208, 53–66 (2012).
[8] Richter et al, Phys. Rev. B 89, 094110 (2014).
[9] Beutier et al, Phys. Rev. B 92, 214116 (2015).

(1 0 0 -1 3) forbidden reflection in Al-Co-Ni



Spectrum of the 700 reflection of Rb2ZnCl4.