ESRF **Beamline:** ID22 **Shifts:** 9	**Experiment title:** Structural disorder in the quantum spin liquid candidate $Na_2BaCo(PO_4)_2$ **Date of experiment:** from 22.09.2021 to 26.09.2021 **Local contact(s):** Ola Grendal	**Experiment number:** HC-4369 **Date of report:** 13.08.2022

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This experiment was focused on the structural study of the triangular quantum spin-liquid candidate $Na_2BaCo(PO_4)_2$ and its chemical analogs. In the case of $Na_2BaCo(PO_4)_2$, we confirmed trigonal symmetry but revised the space group as $P\bar{3}$ contrary to $P\bar{3}m1$ reported previously [PNAS **116**, 14505 (2019)]. We have also observed a subtle disorder effect reflected by the unusually high displacement parameter of Na atoms. We are currently investigating this effect using NMR as the local probe.

In the second part of the experiment, we studied temperature-dependent crystal structure of the new compound $Na_2SrCo(PO_4)_2$ that proved to be even more interesting for the high-resolution setup of ID22. Here, reflection splitting was clearly observed at room temperature, indicative of the monoclinic symmetry. We then found two phase transitions upon heating, from $P2_1/a$ to $C2/m$ around 650 K and from $C2/m$ to $P\bar{3}m1$ around 1025 K. The results on $Na_2SrCo(PO_4)_2$ have been **published** in [Phys. Rev. B **106**, 054415 (2022)].

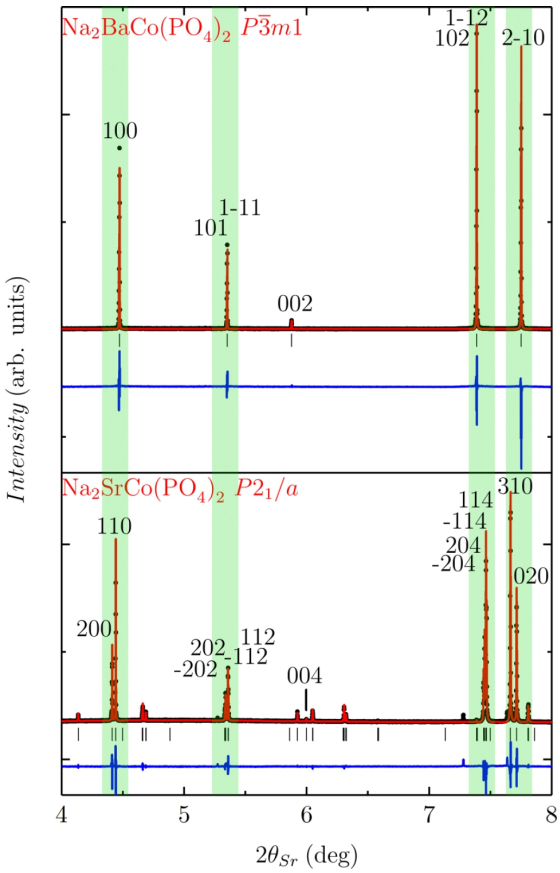

Figure 1: Comparison of room-temperature XRD data for $Na_2BaCo(PO_4)_2$ (trigonal, $P\bar{3}$) and $Na_2SrCo(PO_4)_2$ (monoclinic, $P2_1/a$). The 2θ values for the Ba compound were adjusted in order to match peak positions of the Sr phase.