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Chirality and helicity in the frustrated langasite $Ba_3NbFe_3Si_2O_{14}^{-1}$ KAROL MARTY, Oak Ridge National Laboratory, VIRGINIE SIMONET, PIERRE BORDET, RAFIK BALLOU, Institut Neel, CNRS, UJF, Grenoble, France, ERIC RESSOUCHE, INAC, CEA Grenoble, France — Ba₃NbFe₃Si₂O₁₄ cristallizes in the trigonal non-centrosymmetric space group P321. The Fe^{3+} carry a spin 5/2 and form a triangular lattice of equilateral triangles. This compound orders magnetically at $T_N = 27$ K, well below the Curie-Weiss temperature of $\theta = -171$ K, which is a fingerprint of magnetic frustration. Neutron diffraction experiments allowed solving the magnetic structure. This consists in a ferro-chiral configuration of equal moments lying in the plane perpendicular to the 3- fold c axis, oriented at 120° from each other on each triangle of Fe³⁺ (due to the intra-plane geometrical frustration), with the same chirality for all the triangles, the whole helically modulated (due to the inter-plane frustration of interactions) along the 3-fold c axis with $a \approx 2\pi/7$ period. Additional neutron polarimetry experiments revealed that a single helicity is selected and that, in turn, this selects a single chirality, in agreement with group representation analysis. A mean field analysis shows that this unique feature is due to the twist in the spin-spin exchange path from plane to plane.

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