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Multiple magnetic transitions on the pentagonal Cairo lattice in $Bi_4Fe_5O_{13}F$ ALEXANDER TSIRLIN, Experimental Physics VI, EKM, University of Augsburg, Germany, IOANNIS ROUSOCHATZAKIS, University of Minnesota, DMITRY BATUK, EMAT, University of Antwerp, Belgium, ARTEM ABAKUMOV, Skolkovo Institute of Technology, Moscow, Russia — Pentagonal Cairo lattice gives rise to an unusual frustrated scenario that was actively studied theoretically but still lacks experimental manifestation in real materials. In this talk, I will present a novel Cairo-lattice antiferromagnet $Bi_4Fe_5O_{13}F$ that features a sequence of three magnetic transitions at $T_1 = 62\,\mathrm{K}$, $T_2 = 71\,\mathrm{K}$, and $T_N = 178\,\mathrm{K}$. Using a combination of neutron diffraction and Mössbauer spectroscopy, we show that the magnetic structure below T_1 is consistent with orthogonal spin order anticipated by theory. The collinear magnetic structure observed between T_1 and T_2 is also anticipated by theory, but only for the quantum version of the model, whereas $Bi_4Fe_5O_{13}F$ with its spin-$\frac{5}{2}$ Fe^{3+} should be close to the classical limit. Finally, the magnetic structure between T_2 and T_N is again orthogonal, but individual spin directions are different from those below T_1. A microscopic magnetic model of $Bi_4Fe_5O_{13}F$ will be presented, and possible origins of the spin-reorientation transitions in this material will be discussed.

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