

# Crystal and magnetic structures and magnetic excitations spin-trimer system $\text{Ca}_3\text{Cu}_{3-x}\text{Ni}_x(\text{PO}_4)_4$ ( $x=0,1,2$ )

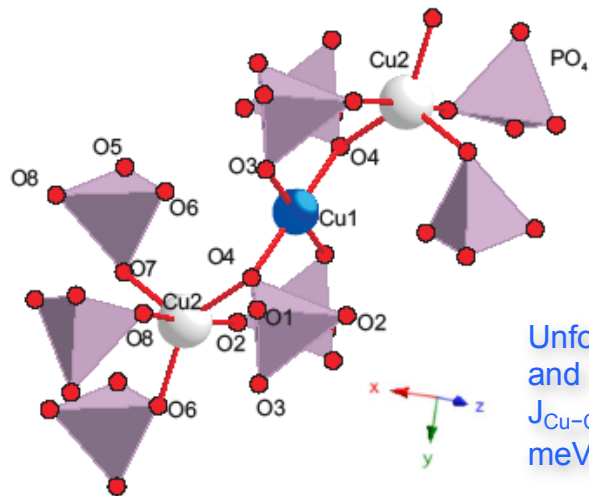
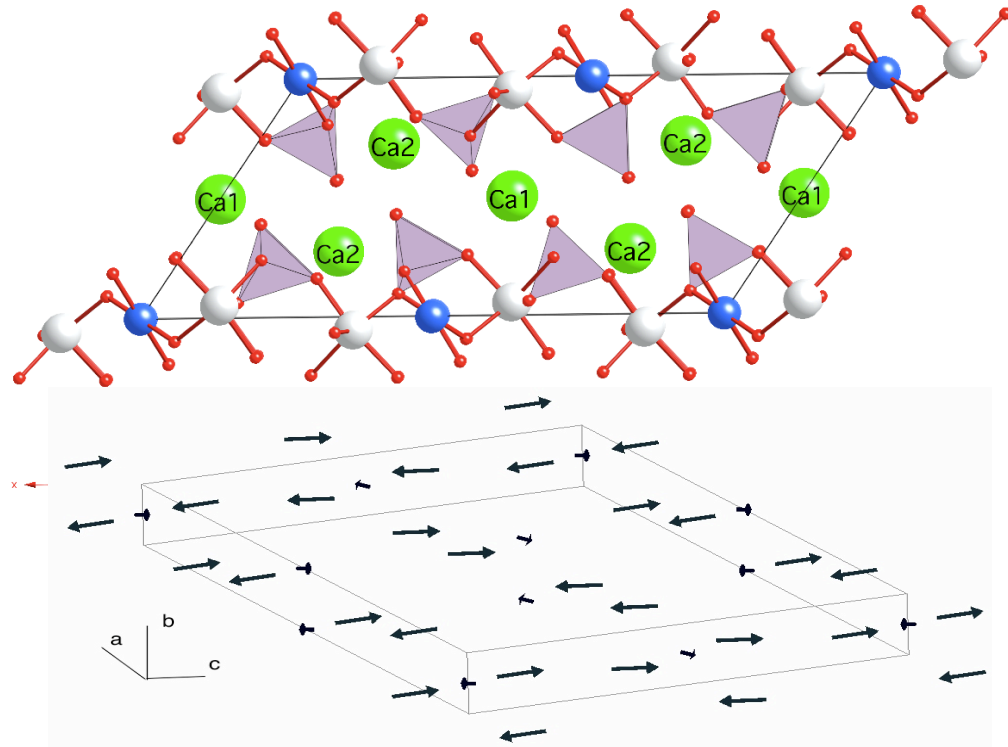
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## Motivation

$\text{Ca}_3\text{Cu}_3(\text{PO}_4)_4$  is a novel quantum spin trimer system in which the three  $\text{Cu}^{2+}$  ( $S = 1/2$ ) spins are antiferromagnetically coupled giving rise to a doublet ground state. By substituting a  $\text{Cu}^{2+}$  spin in the trimer by  $\text{Ni}^{2+}$  ( $S = 1$ ) a singlet ground state could be in principle realized offering the observation of the Bose-Einstein condensation in a quantum spin trimer system.



Unfortunately the ground state was found to be doublet, triplet and quintet in the Cu-Cu-Cu, Cu-Cu-Ni and Ni-Cu-Ni trimers with  $J_{\text{Cu-Cu}} = -4.92(6)$  meV,  $J_{\text{Cu-Ni}} = -0.85(10)$  meV and  $D_{\text{Ni}} = -0.7(1)$  meV in the ( $x=1.2$ ) compounds.