# Novel Magnetic Order and Quantum Spin Fluctuations in d-Electron Magnetic Compounds of Hydroxyhalogenides $M_2(\mathrm{OH})_3X$ Series

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In recent years, we identified unconventional magnetic transitions in a transition-metal hydroxyhalogenide series of deformed pyrochlore compounds $M_2(\mathrm{OH})_3X$, where $M$ represents a d-electron magnetic ion such as $Cu^{2+}$, $Ni^{2+}$,$Co^{2+}$, $Fe^{2+}$, and $Mn^{2+}$ and $X$ represents the halogen ions. Many of them show unusal magnetic behaviours as we reported in related papers published in PRL and PRB. The hydroxyhalogenide compounds have many merits. First, dipolar interaction is negligible and the exchange interaction dominates, providing excellent reference systems for the rare-earth oxides. Secondly, this material category presents a complete series for spins $S = 1/2$ to $S = 5/2$. Thirdly, the lattice distortion can be controlled and adjusted using different halogen ions. Fourthly, the magnetic ions can be selectively replaced with a non magnetic ion to result in a two-dimensional kagome lattice. Fifthly, many of them have polymorphous triangular lattice compounds. Here we will report recent development in investigating the diversal magnetic states exhibited by this materials series.