Antiferromagnetic Transitions in Botallackite-Structure 
$\text{Cu}_2(\text{OH})_3\text{Cl}$ and $\text{Cu}_2(\text{OH})_3\text{Br}$

T. Yamashita$^1$, X. G. Zheng$^{1,2}$*, M. Hagihala$^1$, M. Fujihala$^1$, and T. Kawae$^3$

1 Department of Physics, School of Engineering, Saga University, Saga 840-8502, Japan
2 Department of Physics, Faculty of Science and Engineering, Saga University, Saga 840-8502, Japan
3 Department of Applied Quantum Physics, Faculty of Engineering, Kyushu University, Fukuoka 812-8581, Japan

In recent years, we found unconventional magnetic transitions in a mineral compound clinoatacamite $\text{Cu}_2(\text{OH})_3\text{Cl}$ and the coexistence of long-range antiferromagnetic order and spin fluctuation in clinoatacamite $\text{Cu}_2(\text{OH})_3\text{Cl}$ [1]. It is the first example of the $S = 1/2$ ($\text{Cu}^{2+}$) Heisenberg quantum spin on a pyrochlore lattice and the mother compound for the “perfect kagome lattice” $\text{ZnCu}_3\text{Cl}_2(\text{OH})_6$ exhibiting spin liquid behavior [2]. $\text{Cu}_2(\text{OH})_3\text{Cl}$ has four polymorphous structures of atacamite, clinoatacamite, paratacamite and botallackite. Among them, botallackite is the only two-dimensional structure with the spins on a triangular lattice showing long-range antiferromagnetic transition below $T_N = 7.2$ K [3]. The present work further investigates the magnetic transitions in botallackite-structure $\text{Cu}_2(\text{OH})_3\text{Br}$ and $\text{Cu}_2(\text{OH})_3\text{I}$. We hope the obtained information should help us to understand the magnetic structure as well as the role of super exchange interaction and dimensionality in these triangular lattices.

* corresponding author, zheng@cc.saga-u.ac.jp