Quantum phase transition in $S=1/2$ kagome-lattice antiferromagnet $(Rb_{1-x}Cs_x)_{2}Cu_{3}SnF_{12}$

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Spin-1/2 kagome-lattice antiferromagnets $Rb_{2}Cu_{3}SnF_{12}$ and $Cs_{2}Cu_{3}SnF_{12}$ were synthesized by Morita et al. [1] and Ono et al. [2] and their ground states were investigated by magnetic measurements. Their ground states are different. $Cs_{2}Cu_{3}SnF_{12}$ exhibits a structural phase transition at $T_{t}=185$ K and an antiferromagnetic long-range order at $T_{N}=20.2$ K. Down to $T_{N}$, the magnetic susceptibility is well described using the calculations obtained by exact diagonalization for 24 site kagome cluster with $J/k_{B}=240$ K. The crystal lattice of $Rb_{2}Cu_{3}SnF_{12}$ is enlarged to $2a \times 2a$ and is described as modified kagome lattice with four kinds of neighboring exchange interactions. $Rb_{2}Cu_{3}SnF_{12}$ has a pinwheel valence-bond-solid (VBS) ground state with a finite excitation gap [3].

We will present the ground state on $(Rb_{1-x}Cs_x)_{2}Cu_{3}SnF_{12}$ probed by the magnetic measurements. The ground states for $x<0.33$ and $0.5<x$ were found to be disordered and ordered, respectively. Thus, the quantum phase transition from the VBS to Néel ordered state is expected to occur between $x=0.33$ and 0.5. Exact diagonalization for 12-site kagome cluster was applied to analyze the magnetic susceptibilities of $(Rb_{1-x}Cs_x)_{2}Cu_{3}SnF_{12}$ and individual exchange interactions were evaluated. It was found that with increasing $x$, the exchange constants increase systematically with a tendency to be uniform. This behavior implies good homogeneity of the present $(Rb_{1-x}Cs_x)_{2}Cu_{3}SnF_{12}$ system.