Exotic magnetization plateau in the S=1/2 kagome candidate $Y_3Cu_9(OH)_{19}Cl_8$

J. Willwater,[1] D. Menzel,[1] P. Puphal,[2] E. Kermarrec,[3] C. Krellner,[4] D. Gorbunov,[5] Y. Skourski,[5] and S. Süllow[1]

[1] *IPKM, TU Braunschweig, Mendelssohnstraße 3, 38104 Braunschweig, Germany*
[2] *Max-Planck Institute for Solid State Research, Heisenbergstr. 1, 70569 Stuttgart, Germany*
[3] *LPS, Université Paris Sud, 1 rue Nicolas Appert, Bâtiment 510, 91405 Orsay Cedex, France*
[4] *Goethe-Universität Frankfurt, Max-von-Laue-Straße 1, 60438 Frankfurt am Main, Germany*
[5] *HLD-EMFL, Helmholtz-Zentrum Dresden-Rossendorf, Bautzner Landstraße 400, 01328 Dresden, Germany*

In the field of quantum magnetism, obtaining insight into the nature of the quantum spin liquid state is one of the central issues. Largely, this is triggered by the discovery of the Heisenberg kagome antiferromagnet candidate Herbertsmithite [1]. Correspondingly, significant efforts have been made to find new materials with antiferromagnetically coupled kagome layers and to investigate the exotic quantum liquid state, $Y_3Cu_9(OH)_{19}Cl_8$ has been synthesized recently [2]. No magnetic order was found in muon spin relaxation measurements and elastic neutron scattering on the powder [3]. However, recent measurements indicate that there are important differences in the structure and the magnetic behavior at low temperatures between the powder and the hydrothermally grown single crystals (powder samples showing signs of hydrogen deficiency), triggered by different procedures for sample preparation. Indeed, in contrast to the powder samples, the single crystals undergo a long-range magnetic ordering transition, as seen in bulk thermodynamics, muon spin relaxation [4] and inelastic neutron diffraction experiments below a temperature of 2.1 K.

To extensively characterize the magnetic behaviour of single crystalline $Y_3Cu_9(OH)_{19}Cl_8$, we carried out magnetization measurements parallel and perpendicular to the Kagome planes in pulsed magnetic fields. Surprisingly, at low temperatures a magnetization plateau is visible in a field range from 19 T to 25 T for both field configurations. The plateau sets in at a comparatively small magnetization value of $\sim$0.2 μB/Cu and is thus slightly less than the 1/3 plateaus previously observed in other kagome systems. We discuss possible mechanism for this exotic magnetization plateau.

References:

[1] T.-H. Han et al., Nature **492**, 406 (2012).
[2] P. Puphal et al., J. Mater. Chem. C **5**, 2629 (2017).
[3] Q. Barthélemy et al., Phys. Rev. Mat. **3**, 074401 (2019).
[4] F. Bert et al., private communication.