Magnetic structure and phase diagram of the quasi-1D Ising-like antiferromagnet PbCo2V2O8

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The study of quantum phase transitions (QPTs) has become increasingly popular, as it offers valuable insights into the fundamentals of magnetism. Unlike classical phase transitions, which are driven by thermal fluctuations, QPTs occur at zero temperature when a non-thermal external parameter, such as pressure, magnetic field, or chemical doping, is adjusted. One of the classic examples of a system with a QPT is the Heisenberg-Ising model in a transverse magnetic field. Recently, experimental studies have focused on quasi-1D Heisenberg-Ising antiferromagnetic AM_2V_2 materials. I will present findings from various measurements performed on the $PbCo_2V_2O_8$ material, which is almost isostructural to $SrCo_2V_2O_8$ and $BaCo_2V_2O_8$ compounds and is considered as a quasi one-dimensional Ising-like antiferromagnet [1,2,3]. The measurements include: heat capacity, low and high field magnetization and neutron powder diffraction (NPD) conducted below the Néel temperature $T_N = 3.8$ K. The magnetic susceptibility parallel to the c-axis exhibits a broad maximum near 40 K, characteristic of a low dimensional antiferromagnet. The study also establishes the phase diagram for $H\|c$, $H\|a$, and $H\|[110]$, through magnetic and heat capacity measurements. Additionally, the magnetic structure of the material at 0 T is determined using NPD results. It has been found that the phase diagrams of $PbCo_2V_2O_8$, similar to that of $SrCo_2V_2O_8$ and $BaCo_2V_2O_8$, reveals a new magnetic phase, which has not been reported yet, most likely due to lower energy scale of the studied system.

References:

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