Dielectric response of a vector-chiral magnetic ordering

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β-$TeVO_4$ is a zig-zag spin-1/2 quasi-one-dimensional system with a rich low-temperature phase diagram. Its vanadium spins interact through a nearest ferromagnetic (V-O-V) and next-nearest antiferromagnetic (V-O-Te-O-V) superexchange. The resulting frustration assisted by quantum fluctuations gives rise to three magnetic phase transitions [1]: paramagnetic to incommensurate spin density wave at T_{N1}=4.65 K, followed by the so-called stripe phase under T_{N2}=3.28 K, and lastly at T_{N3}=2.28 K the system enters the vector-chiral ground state [2]. These transitions have recently been explored by high-field magnetization, specific heat and neutron diffraction measurements [2,3,4].

Interestingly, the complex magnetic landscape makes β-$TeVO_4$ an ideal candidate for non-conventional magnetoelectric phases due to a symmetry which does not forbid the formation of electric dipoles [2,5]. We present the dynamic dielectric response of β-$TeVO_4$ single crystal samples in the presence of a magnetic field and discuss it in the context of low-temperature magnetic ordering as a potentially multiferroic phase.

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