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Low temperature magnetodielectric coupling in the spin-liquid candidate κ-(BEDT-TTF)$_2$Cu$_2$(CN)$_3$ MARIO POIRIER, SAMUEL PARENT, ALEX COTE, Universite de Sherbrooke, KAZUYA MIYAGAWA, Tokyo University, YASUHIRO SHIMIZU, Nagoya University, KAZUSHI KANODA, Tokyo University — In the context of geometrical frustration of exchange coupling between spins on dimer orbitals, the possibility of a quantum spin-liquid state has been inferred for the quasi-2D organic Mott insulator κ-(BEDT-TTF)$_2$ Cu$_2$ (CN)$_3$. However, because the geometrical frustration effect is not strong, it has been proposed that the suppression of magnetic order could result from fluctuating quantum electric dipoles. Indeed, non-trivial charge degrees of freedom survive in this dimer Mott insulator as observed in dielectric measurements. Here, we report in-plane microwave dielectric measurements that reveal a coupling of the electric dipoles to the spins at low temperatures. Anomalies in the complex dielectric permittivity are observed at 6 K and around 3-4 K. The one at 6 K is in clear correlation with the thermal expansion measurements for which a second-order phase transition was inferred. The second dielectric anomaly is frequency dependent and cannot be associated to a phase transition; however, it is rapidly modified and ultimately suppressed by a magnetic field which effects are highly anisotropic. These results could be consistent with the scenario of a dipolar-spin liquid phase where spins couple to the dipoles through the interdimer charge fluctuation. Such a phase appears inhomogeneous since the dielectric anomalies are sensitive to thermal cycling and small pressures.

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