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New Ground State of Dipolar Lattice of D2O@Beryl

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High quality beryl crystals with D2O molecules in nanocages are synthesized and carefully characterized. IR mapping of the crystals showed drastically different concentration distribution of water-I and water-II molecules. The effect of water concentration on the dielectric properties of D2O@Beryl was systematically studied. Two areas of the crystal with same water-I concentration and highly different water-II concentrations were studied by temperature-dependent terahertz and impedance spectroscopy. The experiments reveal a strong dependence of the dielectric properties of the crystal on water-II concentration. The sample with low water-II content showed an anomaly at T=2 K in the temperature behavior of radiofrequency permittivity; no saturation in the temperature-dependent behavior of terahertz soft mode is observed. These observations contrast with our previous results on incipient ferroelectricity in H2O@Beryl. We speculate about a possibility of new ground state developed in dipolar water lattice in beryl.