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COLLECTIVE EFFECTS IN A RANDOM-SITE ELECTRIC DIPOLE SYSTEM: $KTaO_3$:Li

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Data sets taken by nuclear magnetic-resonance, dielectric-relaxation, pyroelectricity, birefringence and ultrasound methods are presented for $KTaO_3$ doped with various amounts of Li and, in part, codoped with Nb. Various anomalies in the response functions point out the occurrence of collective effects among the Li dipoles. The data are compared with data taken by other experimenters, and reviewed in the light of theories. Among these, the mean-random-field approximation for interacting dipoles and computer-simulated interacting spin systems come closest to accounting for the picture which emerges: Upon increasing the interaction, i.e., experimentally, increasing the impurity concentration, collective effects arise, in particular a peak of the susceptibility near T_g. Its frequency dependence, the concomitant ultrasonic attenuation, and nuclear magnetic relaxation in this critical temperature range fail to show any true critical behavior. It is concluded that the dynamics of Li dipolar becomes precipitously slow near T_g and an apparent condensation takes place into a system of metastable clusters devoid of ergodicity and long-range order.