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**Diffusion and super-diffusion in strongly-coupled dusty plasmas**[1]

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Strongly-coupled plasma physics is easily studied using laboratory dusty plasmas. Micron-size polymer spheres are introduced into a low-temperature plasma, where they gain a large charge of typically $-8000e$. They represent a third plasma species, in addition to electrons and ions. Ambipolar electric fields of a gas-discharge plasma confine the microspheres, and frictional drag on neutral gas cools them to about 300 K. Due to their inter-particle potential energy that is large compared to $k_BT$, the microspheres arrange in a crystalline lattice. Using laser-light scattering and video cameras, we can track the motion of all the microspheres. To heat the lattice and melt it, we use random kicks applied to the microspheres by moving laser beam. We characterize random motion as diffusive or super-diffusive by using three diagnostic methods: mean-squared displacement (MSD) vs. time, velocity autocorrelation function, and probability distribution function. Doing this, we find indications of superdiffusion, where random particle motion results in larger displacements than for normal (Fickian) diffusion. Molecular-dynamics simulations show similar results.

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