Stress-enhanced diffusion in Yukawa crystals

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Self-diffusion in deformed Yukawa crystals is analyzed using molecular-dynamics (MD) simulations. We show that deformation enhances diffusion and that this enhancement agrees well with a simple model: deformation lowers the barrier to Frenkel-pair formation, and this reduction is associated with the accumulation of elastic energy within the activation volume. The MD simulations allow us to estimate the size of this volume, which contains approximately $N \approx 30$. This allows us to suggest a simple approximate expression for self-diffusion in deformed Yukawa crystals, which can be used, in particular, in astrophysical applications to estimate diffusion in a stressed neutron-star crust or a white-dwarf core.