

Allgemeines Physikalisches Kolloquium

Donnerstag, 10.06.2021 um 16 Uhr c.t.
Online-Kolloquium

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The classical condensed phases of matter: Hard spheres and other simple model systems

In standard lectures on condensed matter physics for undergraduate students, solids at finite temperatures are introduced through a simple harmonic picture: atoms are trapped in an energetic minimum which mainly arises owing to the potential energy with their neighbors, and they perform small vibrations eventually leading to the picture of a free phonon gas. The liquid state is usually neglected altogether. Here I show that our current understanding of correlations in liquids and solids has come through the study of hard spheres (billiard balls) and that entropy is a major factor in understanding these. A successful analytic theory is classical density functional theory which for hard spheres is built on mainly geometric insights. Based on this, I discuss a novel strategy to improve classical density functional theory for other systems using methods of machine learning.