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**Convex Decompositions of Thermal Equilibrium for Non-interacting Non-relativistic Particles** AURELIA CHENU, Massachusetts Inst of Tech-MIT, AGATA BRANCZYK, Perimeter Institute, JOHN SIPE, University of Toronto — We provide convex decompositions of thermal equilibrium for non-interacting non-relativistic particles in terms of localized wave packets. These quantum representations offer a new tool and provide insights that can help relate to the classical picture. Considering that thermal states are ubiquitous in a wide diversity of fields, studying different convex decompositions of the canonical ensemble is an interesting problem by itself. The usual classical and quantum pictures of thermal equilibrium of $N$ non-interacting, non-relativistic particles in a box of volume $V$ are quite different. The picture in classical statistical mechanics is about (localized) particles with a range of positions and velocities; in quantum statistical mechanics, one considers the particles (bosons or fermions) associated with energy eigenstates that are delocalized through the whole box. Here we provide a representation of thermal equilibrium in quantum statistical mechanics involving wave packets with a localized coordinate representation and an expectation value of velocity. In addition to derive a formalism that may help simplify particular calculations, our results can be expected to provide insights into the transition from quantum to classical features of the fully quantum thermal state.

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