The glass transition as a mixture of random organization and athermal jamming

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By choosing appropriate protocols, both the random organization and the athermal jamming transition can be studied within a unifying model system [1]. We explore the model system for a mixture of the protocols and argue that the result is compareable to a glassy system of soft spheres at small but non-zero temperatures. In our model system, we start with a random configuration of spheres. While athermal jamming is realized by heading for the local minimum of overlap energy without crossing energy barriers, random organization is obtained if we displace overlapping particles randomly in each step. When mixing these protocols, we discover that the limit of a small but nonzero probability of random step differs from the case without random steps. The case of mainly deterministic but also a few random displacements corresponds to a system of soft spheres at small but non-zero temperatures. Therefore, our model shows that the glass transition at small but non-zero temperatures differs from the jamming transition at zero temperature.

Finally, we determine the critical exponents of the transitions and explore the relation to other transitions that occur in similar packing models.