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Application of Edwards' statistical mechanics to polydisperse and high-dimensional jammed sphere packings MAXIMILIEN DANISCH, Ecole Normale Superieure de Cachan, YULIANG JIN, HERNAN MAKSE, The City College of New York, PATRICK CHARBONNEAU, Duke University, SAM MEYER, Université de Lyon, CHAOMING SONG, Northeastern University, FRANCESCO ZAMPONI, Ecole Normale Supérieure — The Edward's statistical mechanics of jammed sphere packings [Song et al., Nature (London) 453, 629 (2008)] is generalized to different systems: polydisperse sphere packings in three dimensions, and high-dimensional monodisperse sphere packings. The theory predicts the density of random close packing and random loose packing of polydisperse systems for a given distribution of particle size and describes packings for any interparticle friction coefficient. In the high-dimensional limit, an asymptotic solution of the self-consistent relation is obtained by saddle-point evaluation and checked numerically. The resulting random close packing density scaling is consistent with that of other approaches, such as replica theory and density-functional theory. The theory could serve as a starting point to solve more difficult problems: such as predicting the optimal density of non-spherical packings, and understanding the higher-order correlations present in amorphous jammed packings.

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