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A "Hamiltonian" for Jammed Granular Matter CHAOMING SONG, PING WANG, HERNAN A. MAKSE, Levich Institute and Department of Physics, City College of New York — We introduce a "Hamiltonian"-like function, called the volume function, to describe the microstates of jammed matter such as granular materials and emulsions from a geometrical point of view. We present a theory of volume fluctuations and derive the volume function defined in terms of the available free volume of the particles in the jammed systems. At the microscopic level the volume function provides an analytical formula for the calculation of the Voronoi volume associated with a single particle in terms of field variables. We then coarse-grain the volume function over a scale of a few particle diameters and provide a mesoscopic volume function which is now solely a function of the coordination number. We predict an exponential tail in the distribution of volumes in general agreement with experiments. Our analysis allows the calculation of macroscopic obervables using the statistical mechanics of jammed states when it is supplemented by the condition of mechanical equilibrium of jamming.

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