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Mapping the Discontinuous Shear Thickening Transition to an Equilibrium Phase Transition[1] JETIN E THOMAS, KABIR RAMOLA, Martin A School of Physics, Brandeis Unv, ABHINENDRA SINGH, JEFF MORRIS, Levich Institute and Department of Chemical Engineering, CCNY, BULBUL CHAKRABORTY, Martin A School of Physics, Brandeis Unv — Discontinuous Shear Thickening, the abrupt change in viscosity of a dense suspension as the rate of shear is increased, appears to arise, at least for certain systems, because the interparticle contacts change from lubricated to frictional in nature. This change also manifests at the microscopic level as clustering of vertices in a dual space representation of forces (the force-tiling representation), opening the door for microscopic theories to describe DST. We model this collective reorganization of vertices as an equilibrium phase transition between an isotropic and a clustered phase of particles interacting via an ultra-soft potential of the form of step function [1]. We find signatures of a new phase transition at low densities: a regime that had not been investigated earlier but is relevant to DST. We use a cluster-based analysis scheme to compare the predictions of this model with numerical simulations of dense non-Brownian suspensions. We find that near DST, several properties of the point pattern of vertices bear a remarkable similarity to those arising in this simple model. We discuss generalizations to other potentials and examine the mapping for conditions of shear jamming. [1] W. Klein, et. al., Physica A 205, 738 (1994)

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