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Pulling at the fabric of the exotic phase diagram for a simple 2D model[1] AHMAD ALMUDALLAL, IVAN SAIKA-VOIVOD, Memorial University of Newfoundland, SERGEY BULDYREV, Yeshiva University — We use computer simulation to study a simple, two-dimensional off-lattice model that was originally devised to understand the anomalous properties of water. The model comprises core-softened disks interacting through a repulsive square shoulder located inside a longer attractive square well. In calculating the phase diagram for the model we discover that the system exhibits the truly remarkable phenomenon of inverse melting, for which the system crystallizes upon isobaric heating, over a small range in pressure. Despite occurring in two dimensions, the melting transition is first order and to a liquid, rather than to a hexatic or quasicrystal phase. We find that by increasing the extent of the shoulder, we increase the pressure range over which inverse melting occurs. But as this range increases, the stability fields of other crystal phases must bend to accommodate the changing inverse melting line. This continues until the phase diagram breaks, with a triple point disappearing, new phases appearing, and a channel of liquid stability to low temperatures forming.

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