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Bond orientational order in randomly-packed colloidal spheres[1] ELI SLOUTSKIN, ALEXANDER BUTENKO, Physics Department, Bar-Ilan University — Systems of jammed particles are abundant, yet poorly understood. These systems are often naively assumed to be disordered, such that only short-range correlations are present and all spatial directions are equivalent. Yet, the mechanical stability of these materials implies that a network of mechanical forces percolates through the sample, which may give rise to long-range correlations and symmetry breaking. We directly measure, by confocal microscopy, the positions of hard colloids, which are sedimented by centrifugation, to form a jammed matter. We follow the centrifugation process in motion, measuring the density profile of our particles along the sample. Strikingly, while only short-range positional order exists in our system, both in the fluid and in the jammed state, the orientations of the bonds between the nearest neighbors are correlated in the jammed state, throughout the system. This breaks the rotational symmetry of the jammed state. Moreover, the rotational symmetry is correlated with the direction of gravity, suggesting that the mechanical network of forces plays an important role in our system. This breaking of rotational symmetry, observed in our system, must have an impact on a wide range of properties in other, more complex, randomly packed systems.

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