Insights into fundamental states of matter through packing problems in hard spheres, sticky spheres, and M&Ms

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Hard spheres are used as model systems to study age-old and new packing problems. I will discuss packing of hard spheres in crystalline solids, and rich phase behaviour in terms of the entropy-driven disorder-order transition that even hard spheres exhibit. Some simple as well as sophisticated experiments are providing surprising new insights about packing in disordered solids when one deviates from spheres in shape. Deviations from hard sphere interactions, realized in experiments with colloidal systems, combined with theoretical predictions, are leading to deeper understanding of the glass and gel states of matter.