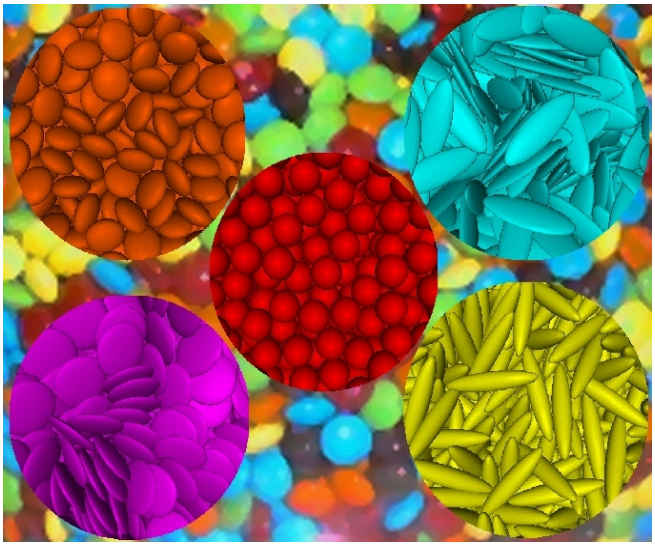
Jammed Packings of Hard Particles

Ph.D. Advisor: Salvatore Torquato
Career Path: Lawrence Fellow, Lawrence Livermore National Laboratory
Contact Information: aleks.donev@gmail.com

Aleksandar N. Donev

Research Program: Packings of hard particles are widely used as simple models for granular materials (like sand), glasses, dense liquids, and other random media, to mention a few examples. Furthermore, hard-particle packings have inspired mathematicians and been the source of numerous challenging (many still open) theoretical problems, such as the best way to pack certain shapes. Of particular interest are jammed hard-particle packings, where particles become trapped and the packing becomes mechanically rigid and resists flow. Better understanding of particle packings can have significant practical applications such as production of advanced ceramic materials (melts of aspherical particles) and rocket fuels (packings of polydisperse fuel grains), developing models for the mechanical behavior of powders and grains, understanding why eggs are not spherical, and a variety of other problems. My research focuses on developing computer algorithms to generate and analyze dense packings of particles in two and three dimensions, such as circles/spheres, ellipses/ellipsoids, and superellipses/superellipsoids. The results are used as guidance in developing theories that explain the observed properties.



Computer-generated packings of spheres and ellipsoids of various aspect ratios over a background showing a real-life packing of MMs (oblate ellipsoids).