# Repulsive interactions

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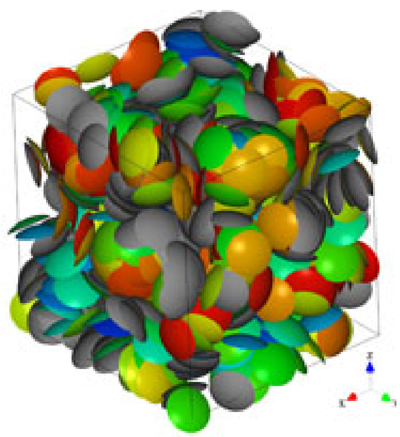

Contact lens-shaped particles form irregular clusters. Photo by Giorgio Cinacchi

(PhysOrg.com) -- The recent state of the roads is a clear illustration of what happens when water freezes into crystals of ice. But despite its frequent occurrence, the crystallisation of water is remarkably difficult to understand in detail.

Nevertheless, many features of the process can be modelled by imagining that the fluid consists of hard spheres which take on a regular, ordered structure when they are pushed together by applying pressure.

Some solutions, however, do not form these regular structures when they are cooled or concentrated, but instead spontaneously form irregular, localised clusters of the dissolved material. For example, the clustering of proteins dissolved in liquids plays a role in Alzheimer's disease and in the formation of eye cataracts.

Scientists trying to understand such clustering phenomena have so far examined models in which particles (or molecules) experience both repulsive and attractive interactions. In work published this week in the Journal of Physical Chemistry *Letters*, chemists from the University of Bristol report the chance discovery of spontaneous cluster formation in a very simple model which has only repulsive interactions.

Previous work has shown that the repulsive interaction of thin discs results in the discs forming an aligned state - like when CDs are thrown on a table, they all lie flat. However, when contact lens-shaped particles were examined, the team found they formed irregular clusters and did not align as CDs would.

As well as perhaps being the simplest model to demonstrate clustering, the repulsive interaction of contact lens-shaped particles may also offer insight into the clustering of particles and the structures they form in real life.

Dr Jeroen van Duijneveldt, an author on the study, said: "We hope this work will provide a basis for a better understanding of a wide range of fluids, such as clay suspensions, liquid crystals for new solar cell applications, and perhaps, in the long term, even certain diseases".

**More information:** Phase Behavior of Contact Lens-Like Particles: Entropy-Driven Competition between Isotropic-Nematic Phase Separation and Clustering by Giorgio Cinacchi and Jeroen S. van Duijneveldt. The *Journal of Physical Chemistry Letters* published online 27 January 2010. dx.doi.org/10.1021/jz900448e

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