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The physics of jamming: a journey from marble pebbles toward scaling invariant field theory

Jamming is a well known phenomenon that you have experienced when the traffic is very heavy. You cannot move because your neighbours block you and your neighbors cannot move because you block them. Jamming is a collective phenomenon. Marble pebbles on the beach are one example of jamming. However also for well-levigated pebbles, friction will play an important role. Statistical mechanics may be used to study the case of systems without friction. The most studied case is the hard sphere gas where the jamming point is reached in the limit of infinite pressure. In the case of frictionless jamming long-range correlations are present: we have a new kind of critical system. Recently the properties of the hard sphere gas have been analytically computed in the framework of the mean field approximation. Non-trivial critical exponents have been found. The behavior of the correlation functions at large distances has not yet computed (it is technically very challenging): at the end one should find a new scaling invariant (and quite likely conformal invariant) field theory.