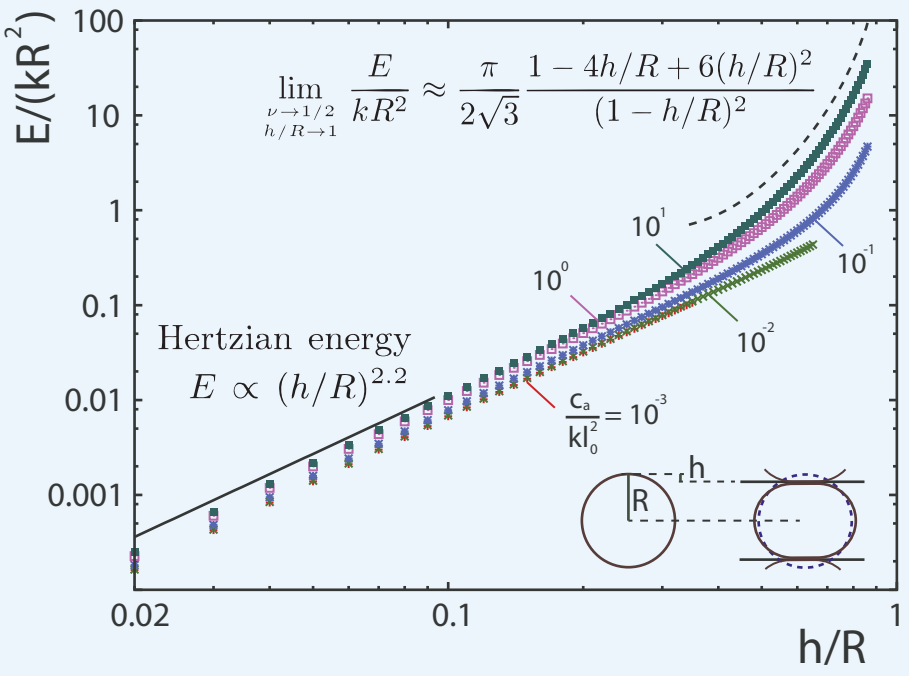
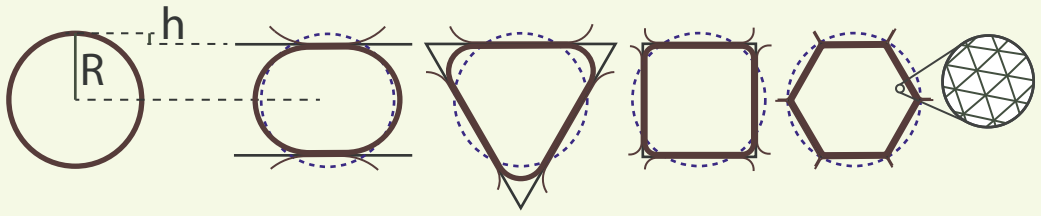
Many-body contact repulsion of deformable disks

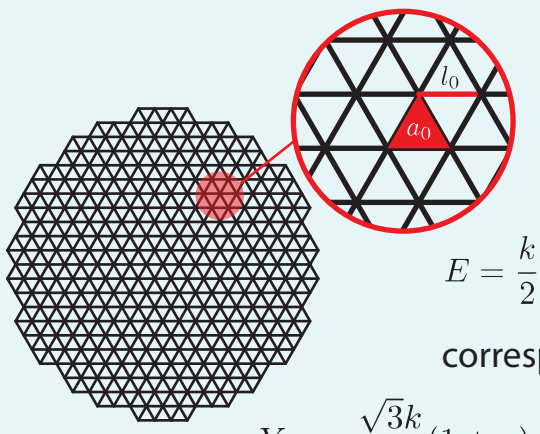
A. Šiber [1,2] and P. Ziherl [2,3]



By studying various 2D geometries, we find that as disks approach the incompressibility limit the many-body effects become dominant and the **disk-disk interaction is not pairwise additive**.



Upon compression, the disks undergo a **transition from the localized to the distributed deformation** regime accompanied by a steep increase of energy consistent with the **onset of a hard core**.



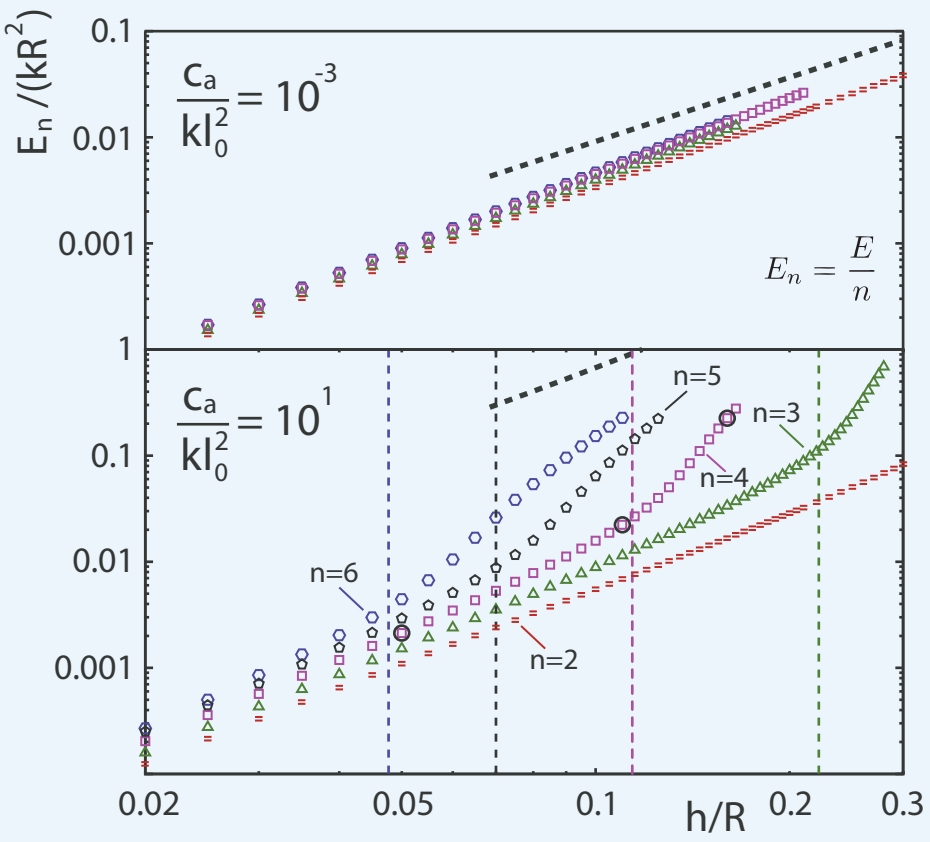
"microscopic" model:

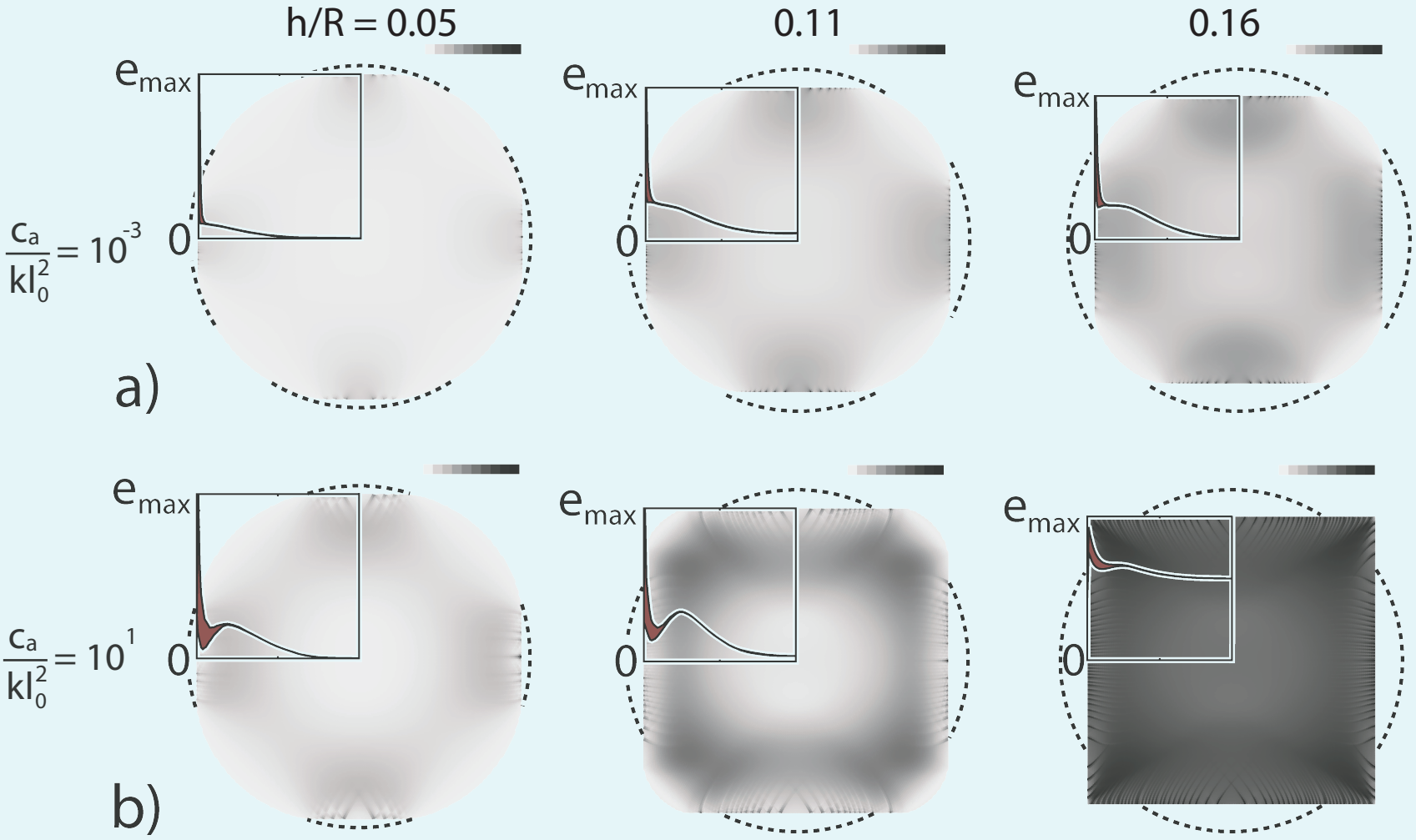
$$E = \frac{k}{2}\sum_j (l_j - l_0)^2 + c_a \sum_J \left(1 - \frac{a_0}{a_J}\right)^2$$

correspondence with linear elasticity:

$$Y = \frac{\sqrt{3}k}{2}(1+\nu) \qquad \nu = \frac{1}{2} - \frac{1}{4\left[1 + 16c_a/(3kl_0^2)\right]}$$

We use a **spring-and-plaquette network** model to analyze the repulsion between **elastic disks in contact.**





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1 Institute of Physics, Bijenička cesta 46, 10000 Zagreb, **Croatia**
2 Jožef Stefan Institute, Jamova 39, SI-1000 Ljubljana, **Slovenia**
3 Faculty of Mathematics and Physics, University of Ljubljana, Jadranska 19, SI-1000 Ljubljana, Slovenia