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Buckling in a particle film ANDREW CROLL, Department of Physics, North Dakota State University — When a thin rigid plate is adhered to a soft substrate and compressed, the plate will buckle out of plane to accommodate the applied stress. The out of plane bending is resisted by the substrate and the result is a sinusoidal topography (wrinkles). When the plate is replaced by a collection of closely packed particles similar phenomena results – the positions of the particles move out of plane and follow a roughly sinusoidal curve. Due to the similarity of the end state of each system, the same continuum theory is often applied to model the behaviour. Here, we use a carefully constructed experimental system consisting of micron-scale polymer and silica spheres on a PDMS elastomer substrate to demonstrate the physical differences between a continuum plate and a discrete set of particles. In particular, because we can easily track the position of each particle in three dimensions with confocal microscopy, we have access to all of the particle motion. We note that the wrinkling is independent of particle modulus, and highly dependent on particle packing. This leads us to suggest that the underlying physics is granular (and not continuum) in nature. This result may have implications in biology, where elastic continua are often made of discrete building blocks (e.g. cells).

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