Extreme spontaneous deformations of active crystals

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We demonstrate that two-dimensional crystals made of active particles can experience extremely large spontaneous deformations without melting[1]. Using particles mostly interacting via pairwise repulsive forces, we show that such active crystals maintain long-range bond order and algebraically decaying positional order, but with a decay exponent whose value is not limited by the 1/3 bound given by the (equilibrium) KTHNY theory.

We rationalize our findings using linear elastic theory and show the existence of two well-defined effective temperatures quantifying respectively large-scale deformations and bond-order fluctuations. We argue that the root of these phenomena lies in the sole time-persistence of the effective noise felt by particles. They should thus be observed in many different situations, a few of which we discuss.

References

[1] Shi, X., Cheng, F. & Chaté, H. Phys. Rev. Lett. 131, 108301 (2023).