Title: Free nergy landscape design of origami nanostructures: deploy, store, and compute on the edge

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This research focuses on developing “intelligent” origami nanostructures by engineering their free energy landscapes to enable autonomous information storage and logic operations at the nanoscale. By combining statistical mechanics with nonlinear geometry, the project establishes a framework to harness nanoscale effects, such as van der Waals interactions and thermal fluctuations, to program reliable thermomechanical state transitions. These nanostructures are designed for “computing on the edge”, providing the ability to sense and respond to environmental stimuli like thermal gradients or electromagnetic fields independently of conventional electronics – establishing a foundation for resilient, autonomous materials capable of operating in extremely harsh conditions, such as space or high-radiation environments.