Tensional twist-folding and scrolling of elastic sheets

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Twisting sheets has been used widely by humanity in making catgut bow strings and surgical sutures going back thousands of years and has been more recently proposed as a strategy to make structured yarns from ultra-thin materials. Yet, a formal description of the underlying shape transformations has been neither reported nor even recognised.
Enabled by nondestructive x-ray reconstruction, we show that twisted elastic sheets under tension follow ordered paths to form multilayered self-scrolled yarns through recursive folding and twist localisation.
I will present a tensional twist-folding framework combining elasticity and origami to explain the energetics before self-contact and morphologies observed until the formation of a yarn. Quite surprisingly, our study reveals that origami can be harnessed to understand the transformation of stretchable sheets into self-assembled architectures with a simple twist.