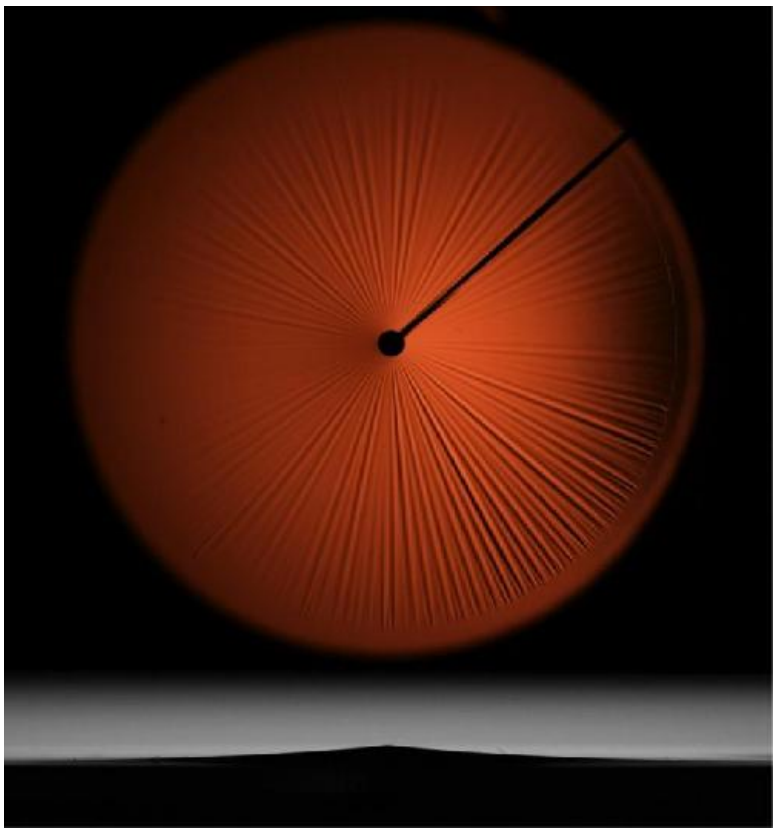
Professor Narayanan Menon



From:
http://www.sciencecodex.com/umass_amherst_team_offers_new_simpler_law_of_complex_wrinkle_patterns-176569

See:
https://www.physics.umass.edu/people/narayanan-menon
https://scholar.google.com/citations?user=lsu5A04AAAAJ&hl=en
http://people.umass.edu/nmenon/
http://www.sciencecodex.com/umass_amherst_team_offers_new_simpler_law_of_complex_wrinkle_patterns-176569

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What Professor Menon and his group do (from the website identified above):
In a new paper, researchers at the University of Massachusetts Amherst and Oxford University describe a new, more general law for predicting the wavelength of complex wrinkle patterns, including those found on curved surfaces, plus experimental results to support it.
The work is expected to help materials scientists to use wrinkles to sculpt surface topography, or to use the wrinkles on surfaces to infer the properties of the underlying materials such as textiles and biological tissues. Physicist Narayanan Menon points out that the work is crucial for understanding how wrinkle wavelength depends on properties of the sheet and the underlying liquid or solid. Findings appear this month in an early online issue of Proceedings of the National Academy of Sciences.

As he explains, "Wrinkles sometimes appear in nature in the form of regular, parallel corrugations such as the furrows on your forehead or the ripples formed when you blow on a cup of hot chocolate. Physicists understand the characteristic spacing between these wrinkles, known as the wrinkle wavelength, as a compromise between the thin skin, which resists being bent into a very fine pattern, and the underlying material, which resists bulging into a coarser pattern. But our understanding is limited to cases where the wrinkles are uniform, and laid out in parallel lines on a flat surface."

He adds that, of course, most naturally occurring wrinkles do not satisfy these ideal situations. Most wrinkles in nature are more complicated; they often bend and splay, or are carried on a curved surface such as the outside of a cell, on a lens, an elbow or the bark of a tree.

The new law developed by a team including physicists Menon and Benny Davidovitch, with polymer scientist Thomas Russell at UMass Amherst and mathematician Dominic Vella of Oxford University, offers a scheme to quantitatively explain the wrinkle wavelength in more realistic situations.

The authors explain, "We propose a local law that incorporates both mechanical and geometrical effects on the spatial variation of wrinkle wavelength. Our experiments on thin polymer films provide strong evidence for its validity." Menon adds, "A 'local' law explains the appearance of the wrinkles at a given location by the underlying properties of the materials at that location, without having to consider how these properties vary from place to place."

Selected Publications:

Huang, J., Juszkiewicz, M., de Jeu, W., Cerda, E., Emrick, T., Menon, N., Russell, T.P., 2007. Capillary wrinkling of floating thin polymer films. Science 317, 650–653.

Jiangshui Huang, Benny Davidovitch, Christian Santangelo, Thomas P. Russell, Narayanan Menon, “A smooth cascade of wrinkles at the edge of a floating elastic film”, Cornell University Library, arXiv:0901.2892 [cond-mat.soft], DOI: 10.1103/PhysRevLett.105.038302, 19 January, 2009, Physical Review Letters, Vol. 105, No. 3, 2010

King H, Schroll R D, Davidovitch B and Menon N 2012 P. Natl. Acad. Sci. USA 109 9716–9720

H. King, R. D. Schroll, B. Davidovitch, and N. Menon. Elastic sheet on a liquid drop reveals wrinkling and crumpling as distinct symmetry-breaking instabilities. Proc. Natl. Acad. Sci. USA, 109(25):9716–20, June 2012.

Vella, D., Huang, J., Menon, N., Russell, T. P. & Davidovitch, B. Indentation of ultrathin elastic films and the emergence of asymptotic isometry. Phys. Rev. Lett. 114, 014301 (2015).

Dominic Vella, Hamid Ebrahimi, Joseph Paulsen, Ashkan Vaziri, Narayanan Menon, and Benny Davidovitch, “Poking around: how indentation reveals wrinkly isometries”, Abstract ID BAPS.2016.MAR.P40.2, Paper given at American Physical Society (APS) meeting on March 16, 2016 in Baltimore, Maryland, in Session P40: More Geometry and Dynamics: Wrinkling, Folding, Snapping, etc.

Joseph D. Paulsen, Vincent Demery, K. Bugra Toga, Zhanlong Qiu, Benny Davidovitch, Thomas P Russell and Narayanan Menon, “Geometry-driven folding transitions in floating thin films”, Abstract ID BAPS.2016.MAR.P40.3, Paper given at American Physical Society (APS) meeting on March 16, 2016 in Baltimore, Maryland, in Session P40: More Geometry and Dynamics: Wrinkling, Folding, Snapping, etc.

Joseph D. Paulsen, Evan Hohifeld, Hunter King, Jiangshui Huang, Zhanlong Qiu, Thomas P. Russell, Narayanan Menon, Dominic Vella and Benny Davidovitch, “Curvature-induced stiffness and the spatial variation of wavelength in wrinkled sheets”, Proceedings of the National Academy of Sciences of the United States of America (PNAS), Vol. 113, No. 5, February 2016