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Deswelling and buckling of a temperature-sensitive hydrogel toroid MICHAEL DIMITRIYEV, YA-WEN CHANG, ANTON SOUSLOV, ALBERTO FERNANDEZ-NIEVES, PAUL GOLDBART, Georgia Institute of Technology — Temperature-sensitive hydrogels lose volume with increasing temperature by expelling water from their polymer matrix, which becomes effectively hydrophobic above a certain critical temperature. Whilst the temperature response of a *spherically shaped* sample of hydrogel has been well studied, less is known about the response of a *toroidal* sample. We present a model for the behavior of a hydrogel toroid for two cases of heating protocol: (i) the quasistatic limit, in which the sample loses volume but is found to maintain its toroidal shape; and (ii) the rapid quench limit, after which the sample is found to have maintained its volume but may have undergone a macroscopic, qualitative change of shape to a buckled toroid. For the quench-limit case, we develop a criterion for the stability of the rotationally symmetric state of the toroid, by utilizing an effective elastic ring model. When this criterion is no longer met, a long-wavelength deformation leads to a buckling instability of the toroid in a manner analogous to the buckling of an Euler rod.

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