Primitive paths and tubes in strained "Olympic gels"

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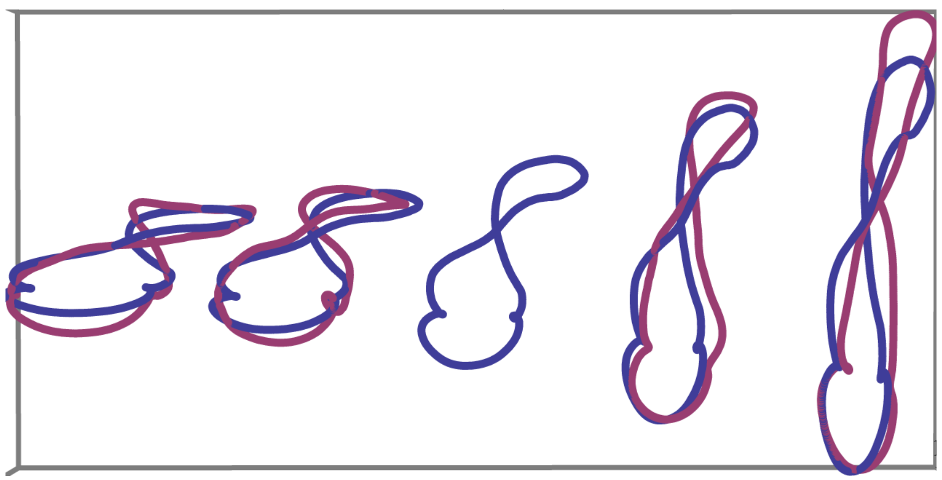
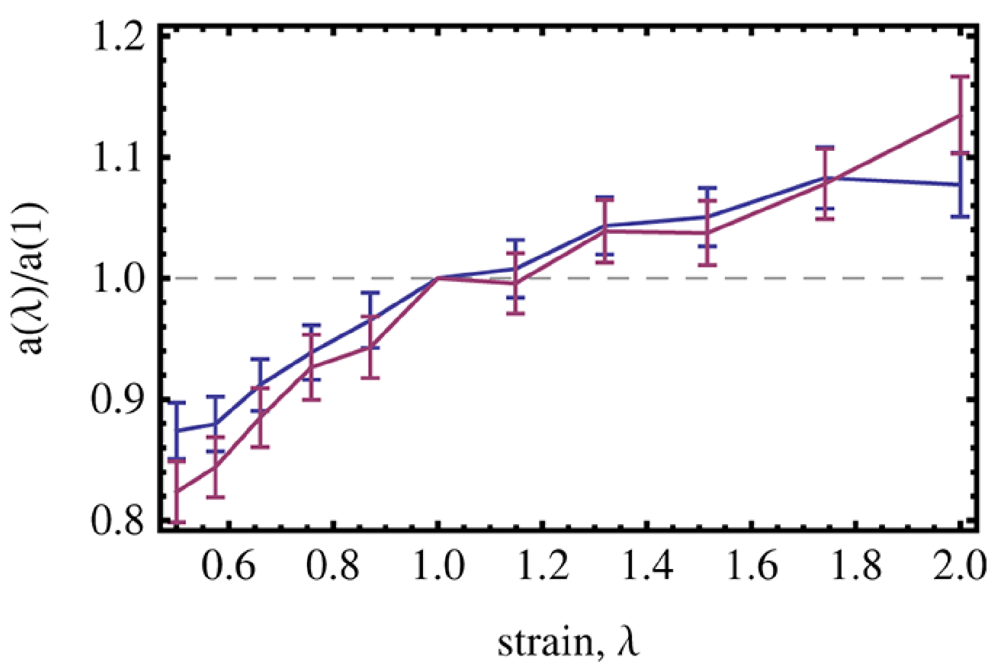


Primitive path after strain (blue; undeformed at center), vs. affinely deformed path (red)



Tube diameter vs. strain (blue and red results for different isoconfigurational averaging times)

Problem:

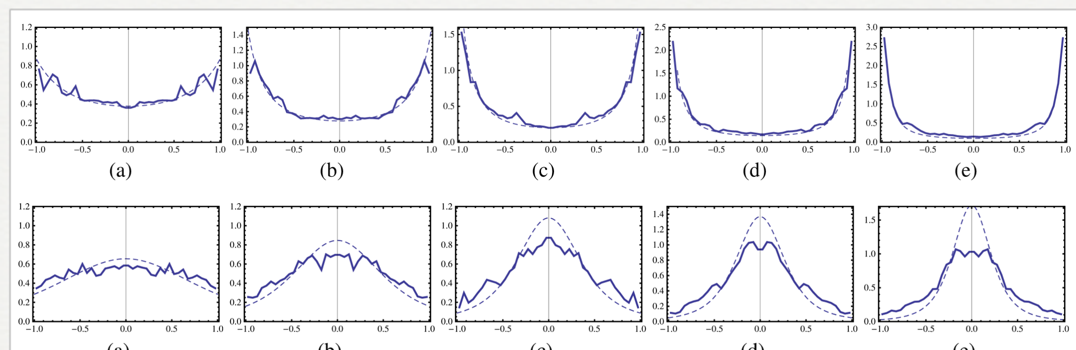
- Theories of nonlinear elasticity for gels make assumptions about how the primitive path and tube deform
- No prior direct observations of tube in deformed gels

Approach:

- Melt of linked "Olympic rings" as proxy for gel
- "Isoconfigurational average" method to observe primitive path and tube in simulation of bead-spring chains
- Progressively apply compressional or extensional strain, observe how primitive path and tube respond

Results:

- Primitive path and tube deform nearly affinely, for modest strains
- Tube diameter varies smoothly with strain
- Our results provide useful input for gel elasticity models



Tube tangent distribution P(cos(θ)) for increasing extension (top) and compression (bottom), vs. affine prediction (dashed)

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