Supplemental Materials

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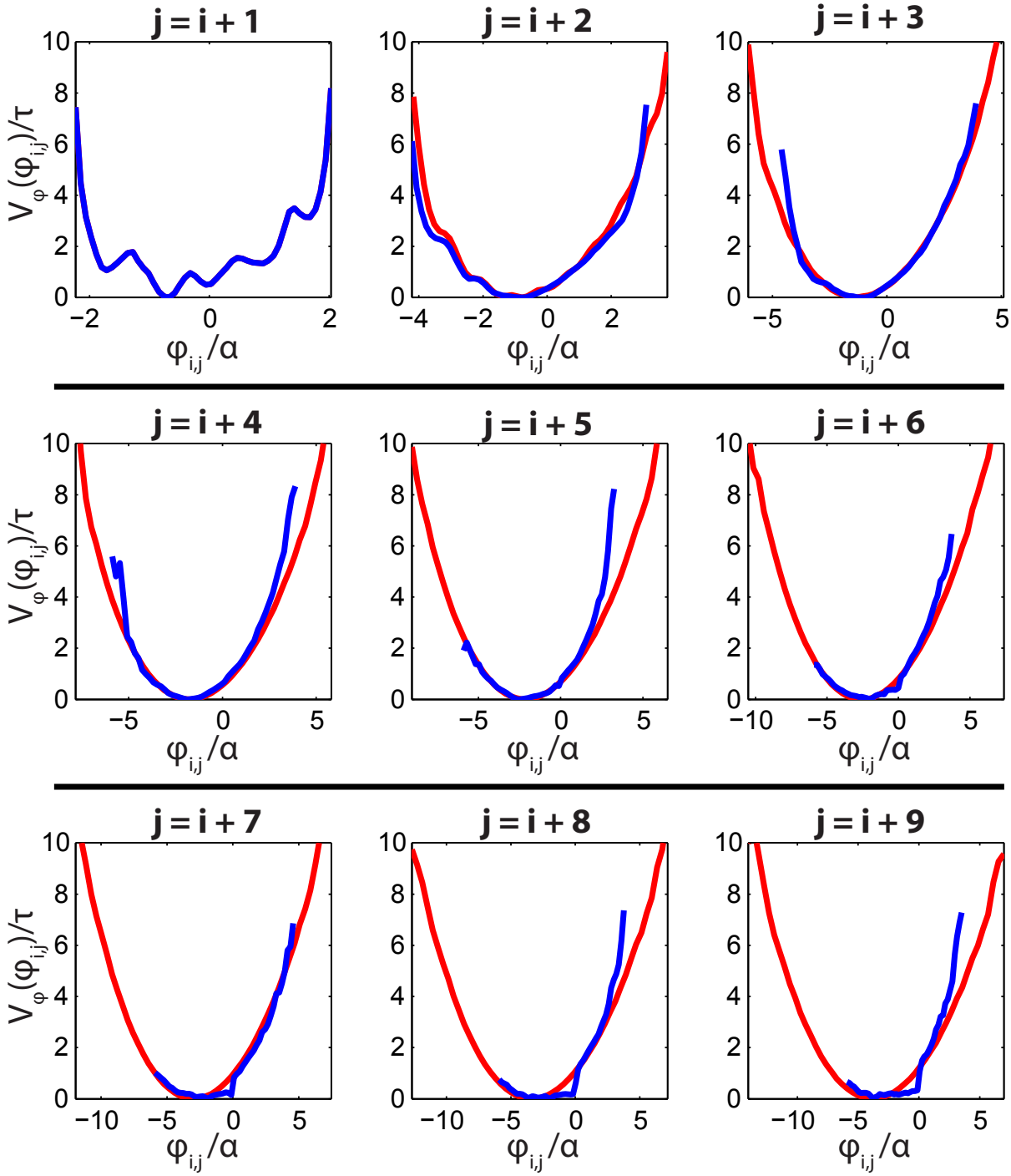

FIG. 1. Effective potentials for total bond winding angle $\phi_{i,j}$. Potentials are determined from distributions using equation 3. The blue curves are calculated directly from empirical data and the red curves are calculated using the distribution for $\phi_{i,i+1}$ to generate self-avoiding walks.

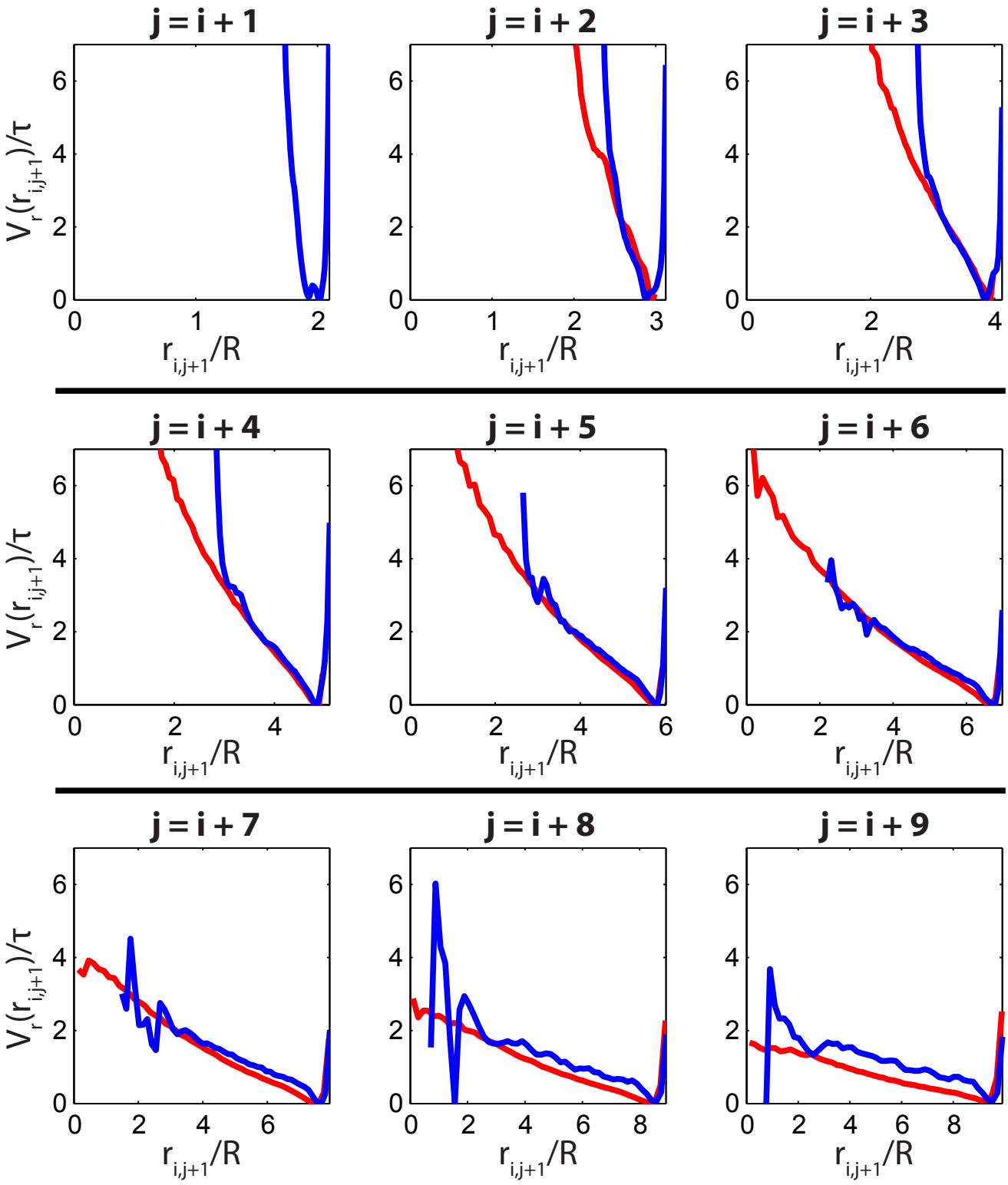

FIG. 2. Effective potentials for interparticle distance $r_{i,j+1}$. Potentials are determined from distributions using equation 4. The blue curves are calculated directly from empirical data and the red curves are calculated using the distribution for $\phi_{i,i+1}$ to generate self-avoiding walks.

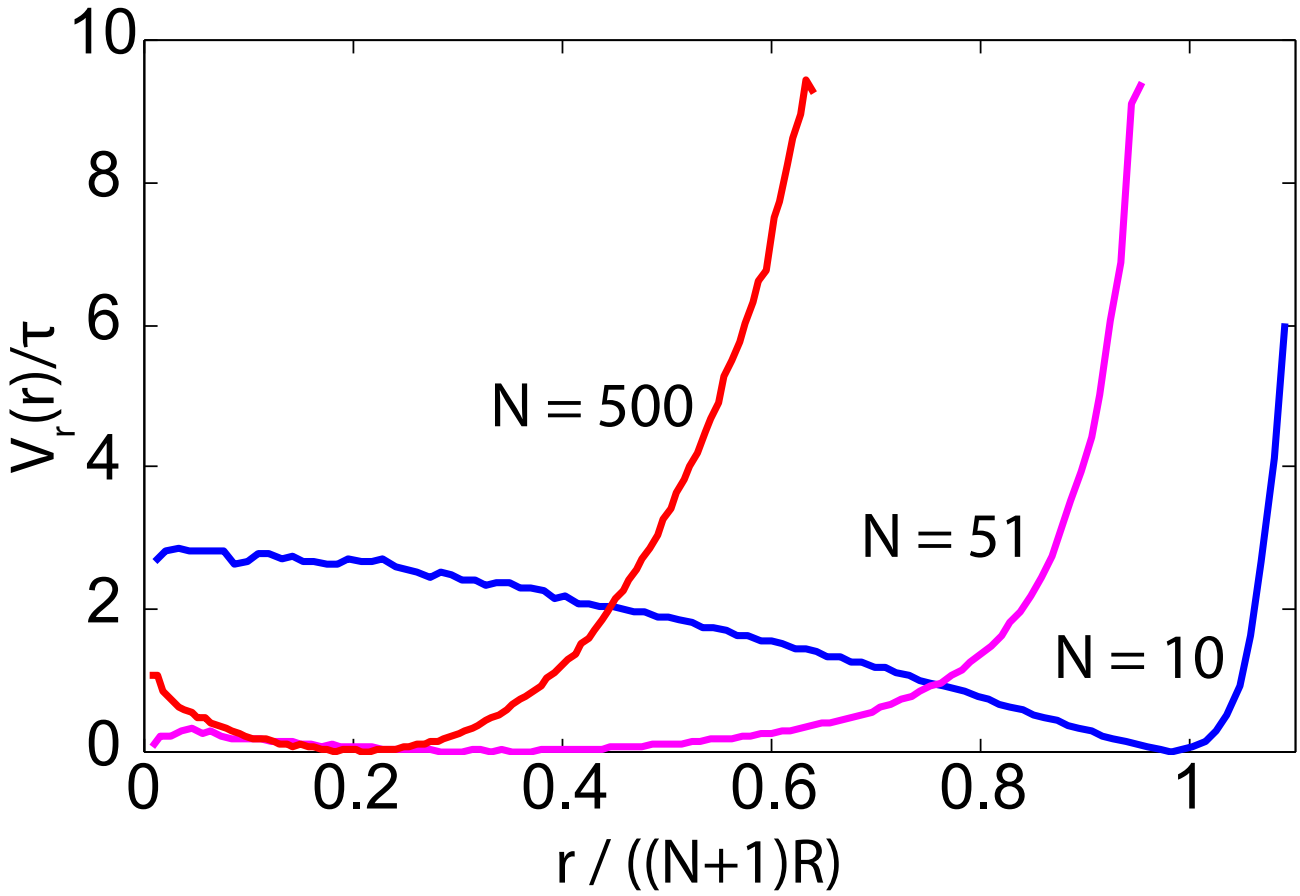

FIG. 3. Effective potentials for end-to-end distance for long chains showing the crossover from anharmonic to harmonic.

SELF AVOIDING WALK SIMULATION ALGORITHM

We create self avoiding random walks with fixed bond length 22m, particle diameter 15mm and bond angles $\phi_{i,i+1}$ drawn from a given predefined distribution $P(\phi_{i,i+1})$. In order to build a chain with N bond angles we employ the following algorithm

```
Begin
  Draw N bond angles from the distribution
  For each particle
    Calculate the (x,y) value
    Test for intersection with all previous particles and links
  EndFor
Repeat until a chain of N non-intersecting links is found
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