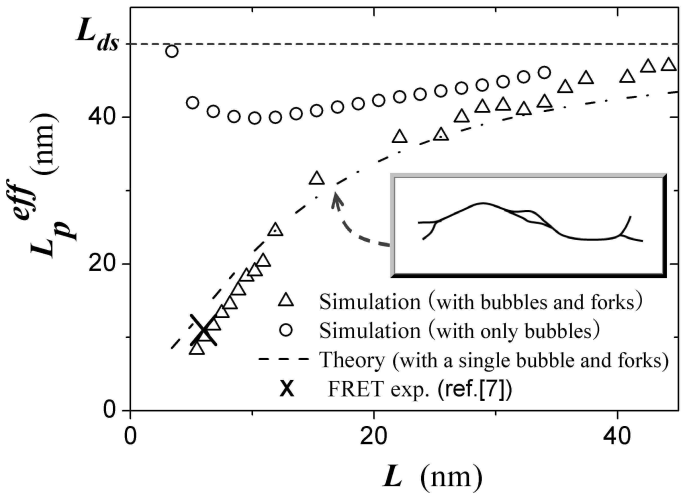


FIG. 6: Effective persistence length of the fragment of DNA with contour lengths $L$, where bubbles as well as forks exist (triangle). It is in a good agreement with the WLC theoretical curve with a bubble of the size given as its average, 1.7 bp and two forks of the size given as its average, 1.9 bp, and with the results of ref. [5] obtained by a fluorescence resonance energy transfer (FRET) experiment.

is shorter than that of the duplex of the same contour length without the free ends discussed before (indicated by circles). This can be ascribed to the additional form of local denaturation, i.e., the forks at the free ends. To support this quantitatively, we analytically calculated the effective persistence length of the duplex with a single bubble of the size 1.7 bp and two forks of the size 1.9 bp at the ends by integrating the correlation function and following the procedure as before. The close agreement of the theoretical curve with the simulation evidences additional influence of the forks; the two forks combines with and increasingly dominates over a bubble, to enhance flexibility, as the duplex gets shorter.

In ref. [5], the effective persistence length of dsDNAs of contour length $15 \sim 21$ bp (equivalently $5 \sim 7$ nm) was determined to be $11 \pm 2$ nm by a fluorescence resonance energy transfer (FRET) experiment, which is marked by a cross in Fig. 6. They considered the buffer conditions where the persistence lengths of non-interacting single stranded DNA have the range of the values 2.7-3 nm [11]. In a duplex, however, the two unpaired single strands are subject to steric and electrostatic repulsions, which may enhance this ss persistence