The electric slide dance of DNA knots

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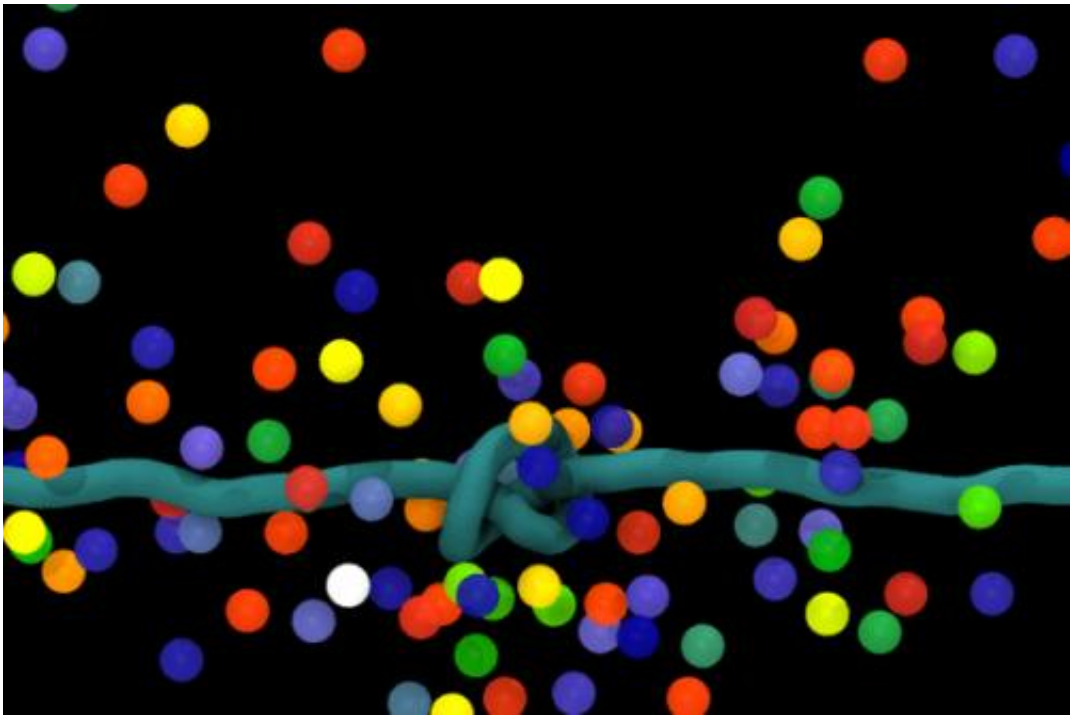

Simulation of a knotted DNA chain under mechanical tension.

DNA has the nasty habit of getting tangled and forming knots. Scientists study these knots to understand their function and learn how to disentangle them (e.g. useful for gene sequencing techniques). Cristian Micheletti, professor at the International School for Advanced Studies (SISSA) in Trieste and his team have been carrying out research in which they simulate these knots and their dynamics. In their latest paper, just published in the journal *Soft Matter*, Micheletti together with Marco Di Stefano, first author and PhD student at SISSA, and colleagues from

Ljubljana and San Diego devised and tested a method based on the application of electric fields and "optical tweezers".

DNA is in fact an electrically charged molecule which reacts to the presence of opposing charges. "In our theoretical-computational study we took into account a "stretched-out" strand of DNA, with its ends secured by two optical tweezers that serve as anchors to keep them apart. We succeeded in moving the knot, inserted into the configuration, by applying an electric field", explains Micheletti. "Try to imagine holding one end of a knotted rope so that the rope is suspended above the ground: by shaking it gently you can make the knot slide down with the help of gravity. Something like that takes place in our experiments".

"Our work", concludes Micheletti, "provides useful information for setting up new experiments where the movement of the DNA knots can be controlled from the outside". In fact, in studies of this kind carried out to date the movement of the knot was "stochastic", that is, produced by thermal noise, the random movement of atoms caused by the rise in temperature of the system, and never directly controlled by the investigator.

More information: "Driving knots on DNA with AC/DC electric fields: topological friction and memory effects",
Marco Di Stefano, Luca Tubiana, Massimiliano Di Ventrac and Cristian Michelettia. '*Soft Matter*', 2014, Advance Article. DOI: 10.1039/C4SM00160E. Received 20 Jan 2014, Accepted 05 Jun 2014. First published online 12 Jun 2014

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https://phys.org/news/2014-07-electric-dna.html