The physics of the optical torque wrench

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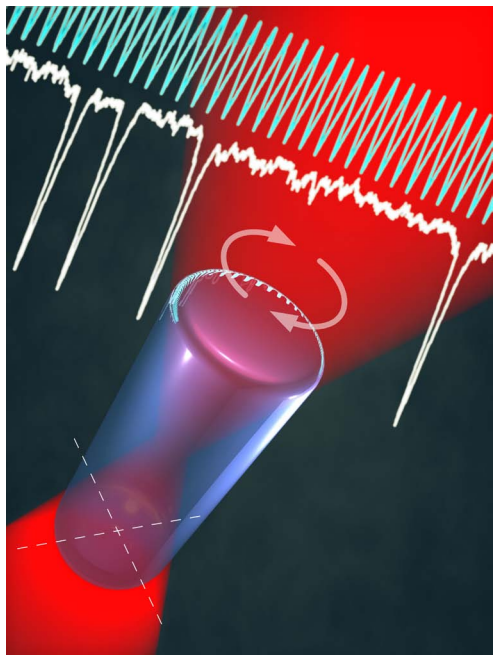
The optical torque wrench[1] is a laser trapping technique capable of applying and directly measuring torque on microscopic birefringent particles via spin momentum transfer. We have focused on the angular dynamics of the trapped birefringent particle[2], demonstrating its excitability in the vicinity of a critical point. This links the optical torque wrench to non-linear dynamical systems such as neuronal and cardiovascular tissues, non-linear optics and chemical reactions, which all display an excitable binary ('all-or-none') response to input perturbations. Based on this dynamical feature, we devise a conceptually novel technique capable of detecting single perturbation events with high signal-to-noise ratio and continuously adjustable sensitivity.



References:

1. A. La Porta and M. D. Wang, Phys. Rev. Lett. 92(19), 190801 (2004).
2. F. Pedaci, Z. Huang, M. van Oene, and N. H. Dekker, Nature Physics (2010).