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**Ultra-high resolution optical trap with single fluorophore sensitivity**

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We present a new single-molecule instrument that combines ultra- high resolution optical tweezers with single-fluorophore fluorescence microscopy. The new instrument will enable the simultaneous measurement of angstrom-scale mechanical motion of individual DNA-binding proteins (e.g., single base-pair stepping of DNA translocases) along with the detection of fluorescently labeled protein properties (e.g., internal configuration). The optical tweezers portion of the instrument is based on a timeshared dual optical trap design and is interlaced with a confocal fluorescence microscope. In a demonstration experiment, individual single-fluorophore labeled DNA oligonucleotides can be observed to bind and unbind to complementary DNA suspended between two trapped beads. Simultaneous with the single-fluorophore detection, coincident angstrom-scale changes in tether extension can be clearly observed.