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Ultrasensitive Plasmonic Biosensors for Direct Detection of Biomarker Proteins with The Naked Eye AHMET ALI YANIK, Harvard University Medical Schoold and Massachusetts General Hospital, JOHN CONNOR, Boston University Medical School, GENNADY SHVETS, University of Texas, Austin, HATICE ALTUG, Boston University Electrical and Computer Engineering — We introduce an ultrasensitive label free biodetection technique based on asymmetric plasmonic Fano resonances. Our sensors bring a number of advantages: (i) ultrasensitive detection limits surpassing gold standard Kretschmann configuration plasmon sensors, (ii) detection of biomarker molecules with "the naked eye", (iii) massive multiplexing capabilities. By exploiting extraordinary light transmission phenomena through high quality factor sub-radiant dark modes, we experimentally demonstrate record high figures of merits for intrinsic detection limits surpassing the gold standard BiaCore devices. Our experiments show an order of magnitude improved device performances over the state of art metamaterial and other plasmonic biosensors. Steep dispersion of the plasmonic Fano resonance profiles in engineered plasmonic sensors exhibit dramatic light intensity changes to the slightest perturbations within their local environment. As a spectacular demonstration, we show direct detection of a single monolayer of biomolecules with naked eye using these Fano resonances and the associated Wood's anomalies. The demonstrated sensing platform offers point-of-care diagnostics in resource poor settings by eliminating the need for fluorescent labeling and optical detection instrumentation (such camera, spectrometer, etc.).

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