Nanoelectromechanical Systems for Proteomics

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Mechanical resonators realized on the nano-scale by now offer applications in mass-sensing of biomolecules with extraordinary sensitivity. The general idea is that perfect mechanical biosensors should be of extremely small size to achieve zepto-gram sensitivity in *weighing* single molecules similar to a balance. However, the small scale and long response time of weighing biomolecules with a cantilever restricts their usefulness as a high-throughput method. Commercial mass spectrometry (MS), such as electro-spray ionization (ESI)-MS and matrix-assisted laser desorption/ionization (MALDI)-time of flight (TOF)-MS are the gold standards to which nanomechanical resonators have to live up. These two methods rely on the ionization and acceleration of biomolecules and the following ion detection after a mass selection step, such as time-of-flight (TOF). Hence, the spectrum is typically represented in *m/z*, i.e. the mass to ionization charge ratio. In this presentation I will describe the feasibility and mass range of detection of a new mechanical approach for ion detection in time-of-flight mass spectrometry. The principle of which is that the impinging ion packets excite mechanical oscillations in a semiconductor nanomembrane. Ion detection is demonstrated in MALDI-TOF analysis over a broad range with angiotensin, bovine serum albumin (BSA), equimolar protein mixtures of insulin, BSA, Immunoglobulin G (IgG), and IgM. We find an unprecedented mass range of operation of the nanomembrane detector.