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Magnetic wire trap arrays for biomarker-based molecular detection GREGORY VIEIRA, The Ohio State University Department of Physics, KALPESH MAHAJAN, GANG RUAN, JESSICA WINTER, The Ohio State University William G. Lowrie Department of Chemical and Biomolecular Engineering, R. SOORYAKUMAR, The Ohio State University Department of Physics — Submicrometer-scale magnetic devices built on chip-based platforms have recently been shown to present opportunities for new particle trapping and manipulation technologies. Meanwhile, advances in nanoparticle fabrication allow for the building of custom-made particles with precise control of their size, composition, and other properties such as magnetism, fluorescence, and surface biomarker characteristics. In particular, carefully tailored surface biomarkers facilitate precise binding to targeted molecules, self-actuated construction of hybrid structures, and fluorescence-based detection schemes. Based on these progresses, we present an on-chip detection mechanism for molecules with known surface markers. Hybrid nanostructures consisting of micelle nanoparticles, fluorescent quantum dots, and superparamagnetic iron oxide nanoparticles are used to detect proteins or DNA molecules. The target is detected by the magnetic and fluorescent functionalities of the composite nanostructure, whereas in the absence of the target these signals are not present. Underlying this approach is the simultaneous manipulation via ferromagnetic zigzag nanowire arrays and imaging via quantum dot excitation. This chip-based detection technique could provide a powerful, low cost tool for ultrasensitive molecule detection with ramifications in healthcare diagnostics and small-scale chemical synthesis.

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