## QUANTUM TECHNOLOGIES, METAMATERIALS, AND THE FUTURE OF CB SENSING

# Ultra-low SWaP-C, Photonic Integrated Circuit Sensors For The Multiplexed Detection Of Organo-phosphate Simulants

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Chemical sensing is done at many levels from benchtop mass spectrometers, to colorimetric indicator paper assays and cost prohibitive handheld devices. It is currently a challenge to discriminate between like substances at low concentrations in a small sensor footprint. Size, weight, power and cost (SWaP-C) constraints are a large hurdle in miniaturizing chemical sensing components that are rapid, fieldable and highly sensitive. Thus, there is an urgency for sensors capable of balancing the need for sensitivity, selectivity, response time, cost and size. Here we show Photonic Integrated Circuit (PIC) chips with microring resonator (MRR) sensors coated in thin film sorbents for the detection of an organo-phosphate simulant below ppm concentrations. These chips are a low cost, mass-producible with shelf stability and the ability to multiplex dozens of MRR sensors within a few millimeters of space. This PIC chip design enables us to have continuous monitoring of many redundant backup sensors for an array of targets which decreases the chance of a false negative. Our PICs are fabricated in a DoD foundry and prepared with components that are mass producible. We utilize thin film sorbents [<400nm] to take advantage of the optical properties of microring resonators for sensitive and selective sensing of a particular target. Together these components create a sensor that is specific to a chemical target, low-cost, shelf-stable and heat-stable up to 70C.