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Status of hand-held, standoff analyzer for real-time detection of trace CBE materials on surfaces at 1 to 5 m.

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Reqd Short Abstract (250 words)

Real-time proximal situational awareness of potentially hazardous materials is an important capability needed by warfighters/first responders. It is also important to perform these assessments without contact or spreading of hazardous materials or use of reagents. We present work conducted under DHS funding to enhance the TRL level of a hand-held, 1 m to 5 m standoff, optical sensor which detects and classifies a wide range of CBE materials in real-time and full daylight with a fully integrated analyzer.

The sensor combines two complementary detection methods: identification of molecular bonds using Raman; and the electronic configuration information using fluorescence, with excitation below 250 nm. There are six main advantages of excitation below 250 nm compared to near-UV, visible or near-IR counterparts: 1) Solar blind detection enabling standoff operation in full daylight; 2) Fluorescence-free Raman and Raman-free fluorescence enabling enhanced detection and identification of target materials without mutual interference; 3) Resonance Raman signal enhancement for improved Raman sensitivity; 4) Simplification of Raman spectra due to resonance enhancement, 5) Short penetration depth, providing physical separation of surface contaminant materials from substrate; and 6) Retina eye safe. These detection capabilities are not possible with near UV, visible, or near IR sensors. A special feature of our sensor is the ability to detect trace biological materials at standoff distances in real time.

Photon Systems has developed these methods over many years, enabling instruments deployed to extreme environments on Earth and the SHERLOC instrument which has been successfully operating on Mars since it landed on Feb. 18, 2021.

Summary Abstract (100 words)

Real-time proximal situational awareness of potentially hazardous materials is an important capability needed by warfighters and first responders. It is also important to perform these assessments without contact or spreading of hazardous materials or use of reagents. We present work conducted under DHS funding to improve the TRL level of a hand-held, 1 m to 5 m standoff, deep UV Raman and fluorescence optical sensor which detects and classifies trace and bulk concentrations of a wide range of CBE materials in real-time and full daylight with a fully integrated analyzer.

Key Words: real-time, standoff, detection, classification, chemical detection, biological detection, explosives detection, hand-held, low SWAP/C

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