Raman and Fluorescence Imaging LIDAR (RFI-LIDAR) for sea mine detection

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BAE Ocean LIDAR (532 nm)
(ONR, 6.2 program)

**Issues:**
* No detection in the top 1-2 m surface layer
* Glint problem
* Signal from fishes, plants
Single Shot Detection of AN inside HDPE plastic bottle at 2 m Seawater Depth with 532 nm Laser

*3 as-measured spectra shown

Single pulse excitation
100 ns detection

* Can detect explosives in plastic bags underwater
* Raman signal ~ No. of Molecules
* Metals have no Raman signal
Raman Detection of Ammonium Nitrate through Seawater and 3 Plastic Bags

* Easy to tell if something is on the surface or how deep.

* 5 as-measured spectra shown

From water Raman signal one can tell
(1) Some thing is in the way
(2) And at what depth
(3) No glint issue
Detection of both opaque metal object and also the transparent plastic dish using the image contrast.

**Issue:**
- There are many things in the ocean… fishes, plants
- Solution: Real time image of the object (fish vs. mine)

**Raman Image**
Single pulse detection, detection time 300 ns
Detection in presence of bio-fluorescence

Detection of oil spill

One drop (0.1 ml) of crude oil in 2000 ml of water (50 ppm)

• Oil film is few micron thick