Rugged microscope for aqueous applications

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In the United States, significant socio-economic impacts result from changing water conditions such as eutrophication of freshwater with an estimated annual cost of 91 million dollars for ocean fisheries, 79 million dollars for the aquaculture industry, and over 1 billion dollars in losses for the tourism/recreation sector. Remote water monitoring platforms measure chemical (pH, pCO2, Nitrate, ...), physical (temperature, pressure, ...) and biological (cell count, N2 fixation) changes of the water body which gain a high scientific importance considering early detection of harmful changes can be studied in real-time and allow authorities to react in a timely manner. Harmful Algal Bloom (HAB) is one of the changes which can occur in every water side such as oceans or lakes. The dynamics of HAB growth is scientifically not completely understood due the lack of enough real-time data. Remote platforms are often too expensive for a wide integration.

The work in this Cap-Stone will investigate one part of a low cost remote water monitoring platform for HAB observations. An optical microscope system needs to be developed which is compatible to the aqueous environment and can observe the presence of microorganisms in real-time. Some challenges of the apparatus are:

- ‘Stable’ microscope even at rough sea (focus optimization during measurements)
- Material compatibility to harsh aqueous media such as seawater
- Electronic protection against moisture/water
- Mechanical infrastructure to bring seawater to the microscope (pumps, filter, ...)
- Low cost
- (Data management of the captured pictures)
- ...