

# Contemporary problems in experiments, theory and application of interest in ecology with lasers in laboratory and remote detection

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Multiple sensor systems and applications in ecology deserve multidisciplinary approach. Concerning laser implementation in monitoring, main parameters and processes have to be chosen in description of object of interest. The purpose of this paper is to underline the links and usability of scattering matrices in the description of biological objects (cells, nuclei, bacteria, etc). Light scattering processes are unavoidable in application and measurements, based on laser systems. Depending on the measurement systems, angular scattering and differential cross sections carry valuable information, and measurements should confirm chosen simplifications from theory. Shape recognition, size and chemical content could be certainly of interest in one part of ecological monitoring (water). Thermal imaging of objects depends on emissivity (water, ground, etc.) and some simplifications of derived cases are added to the previous.

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## 1. Introduction

Contemporary life pace, trends in industry and traffic have been causing considerable pollution of air and hydro sphere. Different events are organized in order to define environment on global scale. Theoretical and experimental issues that could arise during application of lasers and optical methods in control of human environment (atmosphere, water surfaces, soil, plant covered areas - lower levels and canopy) are analyzed in this paper. In order to apply different types of monitoring, based on scattering, fluorescence, absorption and other processes of interest in control, considerable amount of laboratory measurements of optical and other properties have to be done, which will be indirectly controlled by various physical processes, including acoustic. Lasers implementation in measuring technique brings forward, not only linear but nonlinear optical properties where nonlinear processes based methods are in some cases used from the start. Spotlights are on analytical approaches of important constants related to water and all water surfaces, existing software tools in the area and on consequences arising from irregular use of existing data.

For chosen cases, some areas' properties related to conditions of water and its pollution will be rated, as well as monitoring of air pollution using software packages, and considering theories of scattering on organic and inorganic scattering centers, angular distribution for specific micro organisms (bacteria) will be evaluated.

Among a huge number of data and parameters defined for fire description (as well as fire products, some of them could be treated with same methods, in industrial and real day to day conditions utilizing optical methods). Optical and acoustic methods coupling and other relations with material constants will point out possible indirect measurements i.e. products detection of interest in ecology and other areas of interest for humans [1-3].

## 2. Theory, experiment and simulations

**Multiple sensor systems and applications in ecology** - From almost half a century ago, the uses of lidar are growing as do main decisions in solving a detection problem (or monitoring). Monitoring is related to comparisons of a few of techniques which coupled achieve their full importance in ecology, although primarily they are derived for other areas [4-8]. The comparison must include multidisciplinary approach and independent from the chosen technique and devices, application of certain sensor system must include meticulous preliminary study for correct description of monitored objects with characteristic parameters, which must be correctly measured. The influence of atmosphere must be taken into account, depending on geographical location, meteorological situation as well as season during the year. Comparisons could be done on various levels. Besides differences in devices based on millimeter waves,

















