

Development of a laser-based airborne dust counter

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Rayleigh and Mie scattering of light from small particles strongly depends on the wavelength of light. Use of a high-power blue laser diode dramatically increases the scattering strength and allows to detect smaller size particles.

We have made an instrument for dust counting using a 1W blue diode laser at 445 nm. Scattered light from dust is detected with a photodiode at a right angle to the laser beam. Signal is amplified and sent to a small speaker where one can hear clicks similar to a Geiger counter. Amplitude of the pulses

is measured with *Arduino* microcontroller, binned into small, medium and large bins. Need to mention that particles of size below 10 μm are especially hazardous for health as they stay in the alveoli of the lungs and with time can cause asthma and lung cancer.

This dust detector was necessary for the laboratory dealing with high-finesse laser resonators that are very sensitive to pollution and require frequent cleaning. This laboratory is situated in the centre of the Riga city where outside air as well as inside air is quite polluted. With our home-made instrument we typically measure 25-50 particles per cm^3 (25-50 million in m^3). We have tested our dust sensor in a class 6 cleanroom box with a filter stopping 99.999% of dust larger than 0.3 μm and get about one count in a minute.

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References

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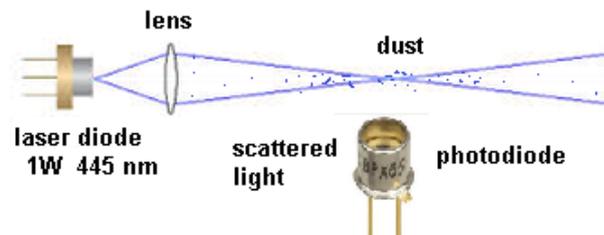


Fig. 1. Optical setup of the dust counter