



**CALIFORNIA STATE SCIENCE FAIR
2010 PROJECT SUMMARY**

Name(s) Andrew C. Ng	Project Number S0828
Project Title Simple Field-Assembled Laser Spectrometer for the Detection of Air Pollutant Nitrogen Dioxide	
<p style="text-align: center;">Abstract</p> <p>Objectives/Goals The objectives of the project are to design and construct a simple, field-assembled laser spectrometer for the detection of nitrogen dioxide pollutants in air.</p> <p>Methods/Materials Nitrogen dioxide gas absorbs light optimally at 400 nanometer wavelength. The theory of molecular absorption spectrometry forms the basis of the instrument being constructed. The key components used are a blue (405 nm) laser pointer, a laser power meter, and an optical rail. The laser pointer and the laser power meter are aligned and mounted securely at the two ends of the optical rail, detecting the presence of nitrogen dioxide gas in air.</p> <p>Results The absorption of the 405 nm laser radiation by nitrogen dioxide gas was verified by passing the laser beam through an atmosphere containing concentrated nitric acid. The portable spectrometer could be assembled and aligned for use within ten minutes. The engagement of a 405 nm band-pass optical filter on the power meter allowed daytime, outdoor operation with negligible background readings. The spectrometer was applied in detecting potential nitrogen dioxide gas presence near an operating vehicle and in school parking lots. The readings suggested nitrogen dioxide gas pass in-and-out of the laser path at different times.</p> <p>Conclusions/Discussion The current measurements are relative. When the spectrometer is calibrated with known concentrations of NO₂ in air, quantitative measurements can proceed with Beer's Law, that is, the linear relationship between Absorbance and concentration. Light scattering by molecules and aerosol particles will reduce the laser radiation being detected and, beneficially, this spectrometer may also measure these trace substances in air.</p>	
Summary Statement A portable laser spectrometer is designed and constructed for the detection of nitrogen dioxide gas in air.	
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