**PhD Physics course at Bari University ( XXXIV Cycle)**

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| **Title** | Optical sensors and gas spectroscopic techniques |
| **Proponent** | Dr. Pietro Patimisco |
| **# CFU**  **(1 CFU = 8 hours)** | 2 CFU |
| **Schedule** | From 17th July to 26th July 2018 |
| **Brief Summary of the course** | The course introduces the physical principles of sensing and describes various physical effects that can be used for a direct conversion of stimuli into electric signals. Then, the course will provide about knowledge on components employed in an optical sensing system, followed by an introduction of the most advanced spectroscopic techniques. Students will complete the class through a laboratory experience on quartz-enhanced photoacoustic spectroscopy. |
| **Programme** | **Physical principles of sensing**. Capacitance. Magnetism. Induction. Piezoelectric effect. Pyroelectric effect. Hall effect. Thermoelectric effect. Sound waves. Light absorption in a gas.  **Optical components of a sensor.** Spectral broadband sources. Laser sources. Semiconductor laser. Quantum cascade laser. Detector. Figures of merit.  **Laser absorption spectroscopy.** Direct absorption. Lambert-Beer law. Amplitude modulation. Lock-in amplifier. Wavelength modulation.  **Spectroscopic techniques.** Fourier-Transform Spectroscopy. Multipass cell. White cell. Herriott cell. Optical cavities. Cavity-enhanced absorption spectroscopy. Cavity ring down absorption spectroscopy. Photoacoustic spectroscopy. Acoustic resonators. |
| **Recommended texts** | * Jacob Fraden – Handbook of Modern Sensors: Physics, Designs and Applications, Springer. * Gianluca Gagliardini and Hans-Peter Looks – Cavity-Enhanced Spectroscopy and Sensing, Spinger Series in Optical Sciences. * Lessons Slide |
| **Assessment methods** | Oral examination |