## Course 1: Optical Interferometry

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The laser based optical interferometry is a very active field of research and utilization including applications in gravitational wave detection. The present tutorial Course will cover, Basics of Interferometry, Light sources for precision Optical Interferometry, Interferometry for Optical Metrology and Physical Characterization, Fundamental Physics with Interferometry and Interferometry beyond the Standard Quantum Limit. The two-day course will cover lectures and hands on demonstration of some advanced experimental techniques in the field

**Course content**

**1. Basics of Interferometry:** Two beam, multi beam, white-light, Michelson, Mach-Zehnder, Sagnac, Fizeau, Phase Shifting Interferometry. Measurement errors, noise ,limited measurements.

**2. Light sources for Optical Interferometry:** Narrow line width lasers, He-Ne, diode lasers, NPRO, VCSELs, superluminent LEDs, supercontinuum, swept sources.

**3. Interferometry for Optical Metrology:** Precision measurements of position, form, displacement, distance, velocity, acceleration, rotation, wavelength, wavefront, etc., with interferometer. Applications of Fizeau, PSI, VISAR, Sagnac interferometers.

**4. Interferometry for Physical Characterisation:** Precision characterisation of materials; measurement of refractive index, stress-strain, poison ration, coefficient of thermal expansion, piezoelectric coefficient, etc. with interferometers.

**5. Fundamental Physics with Interferometry:** Michelson-Morley experiment, Holometer, LIGO, polarisability of vacuum, isotropy of space.

**6. Interferometry beyond the Standard Quantum Limit (SQL):** Introduction to SQL, vacuum noise, squeezed light sources, Quantum Non-Demolition measurements using interferometers, Quantum-metrology.

**Hands-on demonstration / experiments:** Fizeau interferometer for flatness measurement, Phase shifting interferometry for optical components testing, scanning Fabry-Perot for laser line-width measurement, displacement measurement with a Michelson interferometer, rotation measurement with Sagnac interferometer.