

# Ultrashort light pulse generation by an ideal marriage of laser physics and nonlinear optics

*Introduce*

**Prof. Gabriele FERRINI**

Università Cattolica del Sacro Cuore

*Interviene*

**Prof. Dr. Prasanta Kumar DATTA**

Department of Physics, Indian Institute Technology Kharagpur

## Abstract

The growth of nonlinear optics and laser technology has been inter-dependent. Introduction of nonlinear optical element inside a laser cavity facilitates mode-locking, whereas ultrashort laser pulse enables excitation of higher and higher orders of optical nonlinearity in a medium. Solid state lasers are passively mode-locked for ultrashort pulse generation by incorporation of a saturable loss mechanism inside the laser cavity. Kerr-lens mode-locking (KLM) which exploits self focusing effect due to positive nonlinear phase distortion in the gain medium itself due to intrinsic third order nonlinear susceptibility ( $\chi^{(3)}$ ), has been found to be very efficient and reliable in femtosecond regime. Although there is only few reports on Kerr-lens mode-locked Nd:YAG laser, however, in picosecond regime KLM has not been popular because the lower intra-cavity peak power is generally inadequate to drive the required nonlinear loss modulation due to weak intrinsic  $\chi^{(3)}$  of the medium. Cascading of two second order nonlinear processes can induce large equivalent third order susceptibility ( $\chi^{(3)}$ )<sub>eff</sub> and thus can mimic the effects of third order nonlinear optical processes in a second order nonlinear optical crystal even at comparatively much lower power. The talk will present application of cascaded nonlinearity for the availability of saturation of loss required for passive mode-locking of Nd:YVO<sub>4</sub> laser. Results of the stability of mode-locking using the real and imaginary part of effective third order nonlinearity are compared. It is shown that the real part of effective third order nonlinearity has better stability in mode-locking than the imaginary part due to its inherent inverse saturation behavior.

## Seminario

**Venerdì 10 giugno 2016**

**Sala Riunioni, ore 12.00**

Via dei Musei 41 - Brescia



UNIVERSITÀ  
CATTOLICA  
del Sacro Cuore

**1965 2015**  
CINQUANT'ANNI  
di presenza a **Brescia**

