

## Dr. Jorge Tredicce



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Curso Programa de Profesores Visitantes 2011 DF, FCEyN, UBA.: **Óptica Cuántica**

### Program

#### 1.- Introduction

Fundamental processes in radiation matter interaction: remarks on absorption, spontaneous and stimulated emission. A simple model of lasers: rate equations. Laser threshold. Relaxation oscillations. Brief description of most common lasers: He-Ne, Ar+, dye, CO<sub>2</sub>, Nd-YAG, Semiconductor lasers; their properties and technical issues.

#### 2.- Quantum and semiclassical model

Field quantification. The field, atom and interaction Hamiltonian. The rotating wave approximation. Fluctuations and dissipation. The semiclassical model of radiation matter interaction. Atomic susceptibility: gain and index of refraction. Homogeneous and inhomogeneous broadening.

#### 3.- Multimode lasers

Optical resonators: the ring and Fabry-Perot cavities. The boundary conditions. Steady-state solutions and their stability. Mode pulling. Mode-mode coupling. Active and passive mode-locking. Dynamical behavior of multimode lasers. Homogeneous versus inhomogeneous broadening. Lamb dip - Mode-hopping. Anti-phase oscillations.

#### 4.- Single-mode lasers

The first and second laser thresholds. The exact solutions of Maxwell-Bloch model. The uniform field limit. Classification of lasers. Q-switch.

#### 5.- Some interesting laser systems

Laser with injected signal. Laser with optical feedback. Bidirectional ring laser. Multi-transverse mode laser. Random lasers and more?..