**Within the framework of INFN-Gr. IV seminars and in collaboration with INFN-Gr.V**

**Friday 13 June 2014, Room 0M04, 14:30**
**seminar activity on:**

# FAST, STRONG, NONLINEAR LASER-PLASMA INTERACTIONS FOR FUTURE ACCELERATORS

## 14:30 - Laser-wakefield acceleration: scientific and technological challenges (40 min)

**Leonida A. Gizzi**
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**ABSTRACT**
*The recent progress of high power laser technology initiated by the introduction of the Chirped Pulse Amplification (CPA) concept is now leading to the realization of new large laser systems within the framework of the Extreme Light Infrastructure (ELI) that, by the end of this decade, will start paving the way to the exploration of new physical domains, approaching the regime of electron-positron pair creation and the possibility to reach the critical field of quantum electrodynamics. Meanwhile, laser-plasma accelerating schemes are being developed and used for novel radiation sources. Laser-wakefield with self-injection in mm-sized high density plasmas using multi-TW laser systems is now established for the generation of multi MeV up to several GeV energy electron bunches. In the seminar, the basic mechanisms and the experimental challenges will be discussed and a description of the latest experimental results obtained using the ILIL and Flame laser facilities will be given, along with an overview of numerical simulations developed, for the optimization and control of the laser-plasma acceleration process.*

## 15:10 - The "slingshot effect": a possible new acceleration mechanism for electrons derived from the microscopic plasma equations (40 min)

**Gaetano Fiore**
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**ABSTRACT**
*We give a rather detailed description of the impact of a very intense and short laser pulse normally onto the surface of a plasma by a new resolution approach to the exact microscopic equations ruling a relativistic cold plasma after the plane-wave Ansatz. We argue that under appropriate conditions the interplay among the strong ponderomotive force, the excited restoring electric field (originated by charge separation) and the finite size of the laser spot may cause the expulsion of a thin layer of electrons from the plasma surface with high energy in the direction opposite to that of the pulse propagation ("slingshot effect"). The effect should arise also from impact onto gases or other states of matter, provided that the pulse is sufficiently intense to cause locally their complete ionization. Its experimental verification seems to be feasible and, if confirmed, would provide a new laser-driven acceleration mechanism for electrons.*