

# Laboratory for Advanced High Density PHYSICS (LAHDP)

Lotfia El Nadi

*Physics Dept., Faculty of Science, Cairo, Egypt, Giza, Egypt*

*International Center of Scientific and Applied Sciences of High Density Lasers*

*NILES, Cairo University*

[lotfianadi@gmail.com](mailto:lotfianadi@gmail.com)

LAHDP is meant to create facilities and programs for performing systematic studies at Cairo University, relevant to High Energy Density Physics in general, Energy Production, National Industrialization and other applications. The plan is to establish a laboratory highly equipped with high density ultra short pulse Lasers and experimental system that do not exist in Egypt up to the moment. The goal of the facility is to initiate unprecedented experiments provided by high technological measuring equipments that are widely used in international laboratories.

The study of the interaction of high density laser fields with matter is an important rapidly expanding branch of physics since the last five years. The potential applications of this research are numerous, not only in physics, but also in new energy resources, chemistry, biology, material science, in the fast ignition approach to fusion, in accelerators, for relativistic electrons and for Nuclear effects and charged ion acceleration.

When such photon densities are properly focused on a target, creation of simultaneous exotic conditions within an extremely short time are developed, which have never been achieved before in labs, namely:

Intensities  $\sim 10^{20}$  Watts/cm<sup>2</sup>

Electric field  $\sim 10^{11}$  Volts/cm

Magnetic field  $\sim 10^9$  gauss

Temperature  $\sim 10^{10}$  K (10 eV)

Pressure  $\sim 10^9$  bars

Acceleration  $\sim 10^{26}$  cm/s<sup>2</sup>

These conditions would definitely initiate severe nonlinearities. Matter exposed to these extreme conditions behaves in ways that produce new insight into the fundamental energy phenomena from condensed matter studies to nuclear physics, high energy physics, astrophysics, etc...and their applications.

I will discuss experimental efforts and High Energy Density Laser facility planning and development at NILES, Egypt.