

## Brief introduction of the NAPLIFE activity

### Nanoplazmonikus Lézeres Fúzió Kutatólaboratórium

Prof. em. Laszlo P. Csernai, Scientific Advisor, University of Bergen. (laszlo@csernai.no)

For more information see: <http://csernai.no/naplife/> and <https://wigner.hu/naplife/>

Nuclear fusion for massive energy supply for civilian use is studied for 80 years already. Two major directions: Magnetic Confinement Fusion (MCF) and Inertial Confinement Fusion (ICF). The MCF research activity aims for increasing size Tokamak devices, with ITER as its largest device presently under construction. This is a step in gradually increasing size of installations.

On the other hand, laser induced ICF is in revolutionary development in recent years due to the rapid advances of energetic laser technology. Its presently largest installation is the National Ignition Facility (NIF) at the US Lawrence Livermore National Laboratory (LLNL).

Both of these facilities, ITER and NIF, (i) have about 1g nuclear fuel, (ii) have intermittent energy production and (iii) hindered by Rayleigh-Taylor instabilities.

The ICF is in sudden rapid development, also at LLNL with the new NIF-ARC project.

New EU Labs: Szeged, Prague, Bucharest, all have laser driven ICF programs!

The ELI-ALPS, with parameters  $E=30\text{J}$ ,  $t=1\text{as}$ ,  $f=10\text{Hz}$ , is the most **unique for our project with the shortest laser pulse** of all!

- Ultra-relativistic nuclear physics  $\rightarrow$  time-like detonation (**TLD**)  $\rightarrow$  no RT instability
- Nanotechnology  $\rightarrow$  regulating laser absorption  $\rightarrow$  simultaneous ignition (**TLD**)

These two new features are unique! Patented in 2017.

Simple geometry: Two beams (instead of the 192 at NIF):

The NAPLIFE activity is international, including:

U. in Bergen, U. in Oslo, Norway;

Frankfurt Inst. of Advanced Studies / Univ. Frankfurt, / GSI/ GE;

Los Alamos National Laboratory, NM, & LBNL, CA, USA;

Purdue University, IN, USA;

Kurchatov Inst. Moscow, RU;

Wuhan Univ. of Technology, (Adj. Prof.) China. Several joint publications!

The Wigner Res. Cent. for Physics coordinates the Hungarian National Laboratory activity and in addition to ELI-ALPS, the Universities of Szeged, Debrecen, Budapest BME, and the Cent. for Energy Res. participate. The initial validation experiments are in progress at Wigner RCP. The increased and regulated laser light absorption by nano-antennas is already verified.

We would be interested in higher-level contacts, with the help of Tét delegates with the institutions:

- ENN Science and Technology Development Co., Langfang, Hebei province, China
- Jiaotong University, Xi'an, Shaanxi province, China
- Fudan University, Shanghai, China
- Laboratori Nazionali del Sud-INFN, Catania, Italy

