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IZEST

Drawing the Roadmap for Exawatt-Based High Energy and fundamental Physics

This is to let you know that we see an unprecedented opportunities emerging in accessing high energy physics and fundamental physics in novel ways by bridging between the intense laser and high energy physics communities. Promoting and stewarding this union will be IZEST main mission. It will be formed by the leading laser and high energy physicists supported the premieres world laboratories. Its experimental program will notably utilize the LIL, the European most powerful laser. IZEST's immediate objective will be to study and erect the first large scale Exawatt-Based High Energy and Fundamental Physics facilities like the XCELS in Russia and the 4th Pillar in EU.

Colliding high energy particle beams have been the lynchpin of high energy physics. However, the size and cost of colliders have reached a point where it becomes unaffordable even for large international consortia. Over the past 10 years we have seen a rapid and spectacular progress in laser peak power with planned intensity in the 100PW. These gargantuan powers that are delivered in femtosecond time scale can provide the highest electric field, the highest pressure that we can produce today and above all can offer new possibilities to high energy physics. They can complement existing paradigms in two ways. First, by providing extremely high gradients they open the route to more compact accelerators. If it is not a collider, we may be able to access extremely high energies to explore energy frontier along a path with less technical hurdles and shorter timeline. Secondly, if we consider that high energy particles probe a space defined by the momentum of its particles, laser field will explore a much larger volume of space defined by the laser wavelength and will be more appropriate for the search of low mass particles for dark energy and dark matter. We are also capable of accelerating ions to multi-TeV and laser-driven ion bunches inducing wakefields for multi-TeV electron acceleration in a compact fashion.

IZEST will be constructed around an exceptional experimental environment revolving around, the LIL laser (at CEA of France) with 10-100kJ. The CEA has given a support to utilize this for Exawatt-laser based fundamental physics. On the other hand, we have also advised and are obtaining a strong support - from Russia on the exawatt laser installation (Exawatt Center for Extreme Light Studies) (XCELS). Our primary mission is to establish an Exawatt laser-based center for High Energy and Fundamental Physics. It is our greatest pleasure to announce our effort in promoting the highest intensity frontier of lasers and high field science associated with such lasers and in forming an international team and network of scientists under the banner of the fledgling organization called International Center for Zettawatt-Exawatt Science and Technology (IZEST). IZEST will make a startegy and roadmap to utilize such lasers and promote the high field science derived from these. IZEST will focus on High Energy Physics at the TeV-and-Beyond level using laser plasma acceleration technology. In addition the laser extreme field will explore, low mass and weak coupling effects for dark matter and dark energy search, nonlinear QED and QCD effects, radiation physics, Unruh radiation, horizon physics at very large acceleration/gravity as examples.

Integration of intense laser physics and high energy and fundamental physics will rejuvenate the science. We believe that your participation in such an endeavor should lead to the creation of a new discipline of high field science by this integration. Our roadmap is to utilize the existing 10kJ LIL laser (by compression) to be deployed LIL lasers (immediately or in short period of time) to the applications of energy frontier (but not necessarily based on a collider mode) and of the high amplitude frontier mentioned above. Over several years we should have some class of first such demonstration experiments. While we cultivate the existing LIL lasers on laser based fundamental physics experiments, we will promote XCELS to install world's first dedicated to exawatt laser physic. Our project is underpinned by our recognized leading position in the area of extreme intensities, acquired over the past decade. Our demonstrated capability to produce world record laser peak power of 1PW with the intensity up to 10^{22} W/cm^2 gives us the confidence to go to the next level. The core of the planned infrastructure will be a novel and

unique source of light with 0.1 - 0.2 exawatt (1-2 10^{17} W) power with a possible upgrade to beyond the exawatt level.

High on this agenda, IZEST will facilitate XCELS training students and personnel at all levels. It will make its outmost efforts to create new technology and practice an aggressive technology transfer followed by companies spin-offs area of medical, energy, and industrial applications.

It is our greatest honor to ask your support of and/or participation in promoting the highest intensity frontier of lasers and high field science associated with such lasers and their fundamental physics applications and in forming an international team and network of scientists under the banner of the fledgling organization called International Center for Zettawatt-Exawatt Science and Technology (IZEST). We are looking forward to hearing from you.

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