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FEL, A Super Laser for SuperB

May 21st, 2012

The SuperB accelerator project - to be realized within five years in the Tor Vergata area - is now

enhanced by a competitive FEL (Free Electron Laser). The peculiar features of the SuperB FEL light will permit to meet needs of material physics, biology and medicine, in synergy with SuperB's fundamental physics goals and without compromising the accelerator performances.

SuperB - which is the heart of Cabibbolab, the international center for fundamental and applied physics sponsored by the Italian National Institute for Nuclear Physics and by the University of Rome Tor Vergata - will be soon able to offer a very high level multidisciplinary infrastructure to the international scientific community.

"This idea is based on the desire to expand Cabibbolab's scientific offerings - says Roberto Petronzio, Cabibbolab Director - the SuperB Linac (LINear ACcelerator) is designed to inject electrons in the accelerator ring at an energy of 6.7 GeV and it is perfectly compatible with a high-performance FEL, able to produce monochromatic radiation in the region of "hard" X-rays, thus crossing the needs of biology and nanotechnology studies."

In addition to exploring the secrets of sub-nuclear matter, SuperB will allow the use of new research techniques based on X-ray images. It will be possible to take "radiography" of matter with a resolution higher than 1 million times the diameter of a single hair and to investigate the dynamics of ultra-high speed phenomena, impossible to photograph with traditional imaging tools. The extraordinary potentiality of this technology can be applied in the science of new materials, the development of nanotechnology, cellular biophysics and protein crystallography, also with great impact on the pharmacological and medical fields.

"The opportunity to create a FEL working in synergy with the SuperB accelerator is made possible by the very high level of Infn researchers," affirms Fernando Ferroni, president of the Italian National Institute for Nuclear Physics, "and thanks to the experience gained in building the Sparc complex (italian acronym for Auto- amplified Pulsed Coherent Radiation Source, ndr.) at the Infn Frascati Laboratories, where acceleration techniques at the front lines of technology are studied."

The FEL consists of a long magnetic "ondulator" formed by a large number of magnets with alternate polarities, which force the electron into a slalom-type path. A radiation emission follows the "deceleration" of the electrons occurring at each trajectory deflection. When properly received and amplified, this light has the valuable characteristics of mono-chromaticity and coherence, typical of laser light. The wavelength of the radiation released by the electrons depends on their energy value: this characteristic of the FEL allows tuning the type of light issued, from infrared to X-ray, by modifying the energy of the electrons bunches injected. A second characteristic makes FEL unique among synchrotron light sources: the possibility to produce ultra-short radiation pulses, on a scale of femto-seconds, useful to "filming" the dynamics of extremely fast processes.

The FEL will not in any way compromise the performance of the Linac, designed to accelerate and inject the electrons in the SuperB ring. Although occurring continuously, the electrons packets are injected in the FEL at a frequency rate that is very different from that of electrons injected in the SuperB ring, thus avoiding limitations on the performances of the accelerator.

Provided by INFN

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Raspberry Pi to add camera later this year

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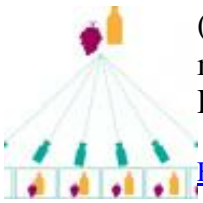

(Phys.org) -- NLT Technologies has announced its development of an autostereoscopic multiview display based on the success of its HxDP technology. HxDP stands for Horizontally x times Density Pixels. The company ...

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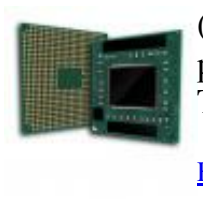
AMD's Trinity is out to rattle Intel's Ivy Bridge



(Phys.org) -- AMD has announced Trinity, its second-generation A-Series accelerated processing units (APUs), which are out to rival Intel's Ivy Bridge processors. AMD's Trinity is an update to its ...

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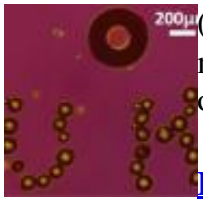

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