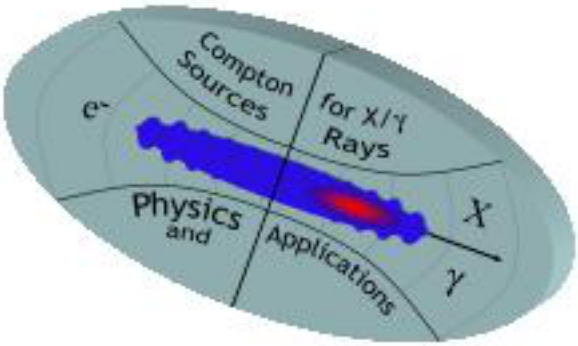
Compton Sources for X/gamma Rays: Physics and Applications

Sunday, 7 September 2008 - Friday, 12 September 2008

Hotel Porto Conte



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High Finesse Fabry Perot cavity R&D at Orsay

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Afternoon / 1

Tsinghua Thomson Scattering X-ray Light Source

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Upgrade of X-band Thermionic Cathode RF-gun for Compton Scattering X-ray Source

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Afternoon / 3

Design study of compact Compton X-ray sources for material and life sciences applications

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Clinical mammography with synchrotron radiation and the new digital development

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Morning / **5**

Development of advanced quantum-beam sources and their applications as sophisticated imaging tools

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Study of a bunch in an undulator with the Maxwell Equations solver RETAR

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Morning / **7**

Detection of radioactive isotopes by laser Compton gamma-ray beams

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Characterization Results of the BNL ATF Compton X-ray Source Using K-edge Absorbing Foils

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Morning / **10**

Phase contrast medical imaging with compact X-ray sources: towards clinical applications

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Recent Progress in Generation and Application of AIST Laser-Compton Photon Beam

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Advantages of quasi-monochromatic X-ray sources in absorption mammography

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Morning / 14

X-Ray spectra reconstruction from analysis of attenuation data: a Back Scattering Thomson Source application.

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Emittance measurements of electron beam from photocathode RF Gun in Tsinghua University

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Afternoon / **16**

Polarization effects of electron and photons in the Thomson scattering X-ray source

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Morning / **17**

Compton Scattering Monochromatic Tunable X-ray Source based on X-band Multi-bunch linac at the University of Tokyo

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Morning / **18**

Application of monochromatic keV X-ray source to X-ray drug delivery system development

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Summary:

X-ray drug delivery system is the most advanced radiation therapy coming after IMRT (Intensity Modulated Radiation Therapy) and IGRT (Image Guided). DDS uses advanced nano-scaled polymers which contain and deliver drug or contrast agent to cancers without side effects. Several X-ray DDS poses high-Z atoms like Pt and Au to absorb X-rays effectively and used as contrast agent for inspection. Moreover, they have radiation enhancement effect by emission of Auger electron and successive characteristic X-rays. The enhancement factor of Pt and Au is more than five. This can be used for therapy. This new modality must be very important for inspection and therapy of deep cancers. We are making use of our Compton scattering monochromatic keV X-ray source for the purpose. Studies to evaluate the biological effect of the gold colloids have been carried out. The combinational effect of X-rays and colloidal gold has been evaluated from several points of view. DNA double- and single- strand breaks were measured with the gamma-H2AX focus assay and the alkaline comet assay, respectively; the cell toxicity was evaluated using the colony assay. Results obtained so far indicate that the combinational use of X-rays and colloidal gold does not enhance the toxicity. This implies that colloidal gold would be beneficial as contrast agent rather than a sensitizer during radiotherapy, which is also supported by numerical simulations showing that colloidal gold accumulated inside a tumor with a practical mass percentage provides contrast on the X-ray image as clear as bones. It should be noted, however, that this should depend on various other parameters such as the size of colloidal gold and the energy of irradiated X-rays. Further studies are in progress. Particle Induced X-ray Emission (PIXE) has been employed to measure the time transient of uptake of cisplatin micelle, which is the practical anti-cancer DDS containing Pt and shell-shaped polymer, into cells. The results showed that it is very likely that not cisplatin micelle itself but cisplatin released from the micelle is uptaken by the cells. Presently experiments using microbeam PIXE system have been carried out to evaluate the behavior of platinum-incorporated DDS drugs inside cells/organs.
In addition to the above fundamental in-vitro experiments, numerical simulation of the imaging by the gold colloids by using our X-band Compton source is presented for coming experiments.

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Dependence of edge-enhancement-index on experimental parameters in phase contrast imaging using quasi-monochromatic sources

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Morning / 20

Laser-plasma electron accelerator for all optical inverse-Compton x-ray source

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Experimental characterization of in-line phase contrast x-ray imaging

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Afternoon / **22**

Theoretical considerations for x-ray phase contrast mammography by Compton source

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ULTRA-HIGH BRIGHTNESS ELECTRON BEAMS BY PLASMA BASED INJECTORS FOR ALL OPTICAL FREE ELECTRON LASERS

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APPLICATION OF THE THOMSON SOURCE RADIATION IN THE PHASE CONTRAST IMAGING

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Multi-disciplinary experiments with hundred TW class Ti:Sa lasers

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Guiding of X-rays from Inverse Compton Scattering as a Means to Enhance Flux and Brightness

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Approaches to High Average Flux, High Brightness X-ray Sources Based on Inverse Compton Scattering

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Morning / **29**

Stand-off Detection of Nuclear Materials Using Inverse Compton Scattering Generated Gamma-Rays

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Morning / **30**

The Thomson Source at INFN-LNF and its foreseen applications, as part of the SPARC&PLASMONX National Projects

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Status of Thomson Source at SPARC/PLASMONX

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Morning / **32**

3D Nanoscale Imaging Using Coherent X-Rays

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Morning / **33**

HARP(High-gain Avalanche Rushing amorphous Photoconductor) detector

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Morning / **34**

Laser Super-cavity

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Afternoon / **35**

Experience with synchrotron light source and comparison

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Morning / **36**

Compact Systems and Application for Water-Window X-rays

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Summary:

We have succeeded in geneataion of low energy quasi-monochromatic X-arys via inverse Compton scattering between high quality electron beam and high intensity laser. Further we have started the improvements for higher number of photons using high quantum efficiengy photo-cathode RF-gun with multi-bunch beam.

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PIC simulations of the production of high-quality electron beams via laser-plasma interaction

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Morning / **38**

Simulations for linear and fully nonlinear Thomson Scattering with TSST code

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Morning / **39**

THe LAL Compton Program

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Nonlinear Compton scattering

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Afternoon / **41**

An overview of emerging scientific applications of synchrotron radiation: biomedical imaging, radiation therapy, paleontology and cultural heritage

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Summary:

An overview of imaging and radiotherapy programs with synchrotron radiation is here given. These scientific programs could also be carried out at compact sources when available.

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Implementation of a Compton source for X-rays in the ELSA facility

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Afternoon / **43**

Imaging in Radiotherapy

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Summary:

The correlation between the progress of the diagnostic modalities and the radiotherapy methods and results will be discussed and the main concepts for the treatment optimization based on diagnostic will be presented

Morning / **44**

Compton Ring/ERL Polarized Positron Source for ILC/CLIC

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Summary:

A concept of the laser-Compton polarized positron source for ILC/CLIC is presented. In the concept, the super cavity to stack laser pulse is employed to achieve high efficiency. For the electron beam, usage of an electron storage ring or an ERL is considered.

Morning / **45**

The Compact Light Source: A Miniature Synchrotron producing x-rays with Inverse Compton Scattering.

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Morning / **46**

Introductory tutorial

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Morning / **47**

Compton source and nuclear photo-science application

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Morning / **48**

Linac e+ source for ILC, CLIC

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Afternoon / **50**

Integrating Laser and Linac Technology for Next Generation X-ray Sources

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Introduction and Workshop overview