SXSDG 2019

Abstract Book

2nd International Workshop on Soft X-ray Single Order Diffraction Grating Development and Application

Physics Department, University of Coimbra, Portugal

16th to 20th October 2019

Thursday 17th October

E10A ROOM - PHYSICS DEPARTMENT, 2ND FLOOR

09:45 – 10:45 - X-ray Optics

Chair: Mingqi Cui

O1 - From Single-stage Diffraction Grating to Quantum Free Electron Laser

Leifeng Cao

Laboratory of Plasma Science and Technology, Laser Fusion Research Center, China Academy of Engineering Physics, Mianyang, Sichuan 621900

ABSTRACT: In the past twenty years from 1997 to 2019, the report and related research groups have focused on the application of ICF research, and carried out a series of studies on gratings and waveband plates, and obtained some meaningful results. The future will bring some new opportunities to the development of ICF research precision in China. Specific contents include: 1) X-ray single-order diffraction grating; 2) band plate coding imaging technology; 3) Quantitative measurement of X-ray single-order focusing zone plate and black cavity radiation spectrum; 4) arbitrary focal depth compact focusing zone plate and quantum free electron laser. X-ray single-stage diffraction grating rewrites the development history of diffraction grating, which may lead to a new revolution in X-ray spectral analysis technology and light source monochromization technology; band plate coding imaging technology makes three-dimensional imaging of inertial confinement fusion plasma possible; X-ray single-order focusing waveband plate provides a new technical way. A new energy spectrometer covering the soft X-ray/extreme ultraviolet omnipotent region and achieving uniform high energy resolution is developed. The advent of quantum free electron laser (QFEL) will make it possible to take sub-micron resolution holograms in the implosion compression region of inertial confinement fusion (ICF).

Keywords: Diffraction grating; Zone plate; Inertial confinement fusion; Quantum free electron laser

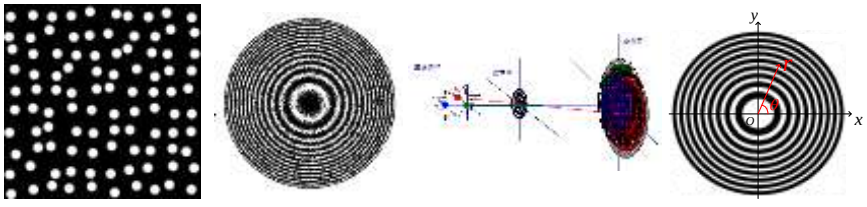

Fig. 1: a) single-stage diffraction grating; b) single-stage focusing zone plate; c) zone plate coding imaging schematic diagram; d) long-focal deep zone plate

O2 - Higher-order diffraction suppression of free-standing quasiperiodic nanohole arrays in the x-ray region

Hailiang Li, Yilei Hua, Changqing Xie

Key Laboratory of Microelectronic Devices & Integrated Technology, Institute of Microelectronics of Chinese Academy of Sciences, Beijing 100029, People's Republic of China

ABSTRACT: Nanohole array is particularly advantageous for light field manipulation. Here we report a strategy to mimic the function of x-ray transmission gratings with free-standing quasiperiodic nanohole array. An analytical description is developed to reveal the physical mechanism of the free-standing quasiperiodic nanohole array that reduces higher-order contamination, and is verified by rigorous numerical simulations. An x-ray free-standing quasiperiodic nanohole array consisting of 1.6 billion nanoholes over the area of 10mm×10mm was fabricated. Experimental results of near-complete suppression of higher-order diffractions were obtained in the x-ray region. The capability to separate multiple overlapping orders makes this kind of nanohole array attractive for future developments and applications of high-resolution spectroscopy.

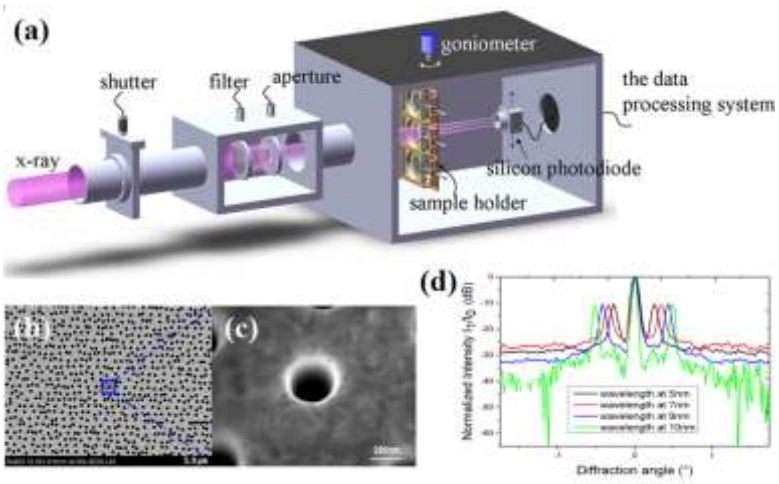

Fig. (a) The experimental geometry for the characterization of x-ray free-standing quasiperiodic nanohole array. (b)Scanning electron micrographs of the fabricated x-ray free-standing quasiperiodic nanohole array. (c) Low magnification image. (b)High resolution image enlarged from a selected area in (b). (d) The measured intensity profile of the diffraction patterns at different x-ray wavelengths.

11:00 – 12:00 - X-ray Optics

Chair: Mingqi Cui

O3 - Nanofabrication of free-standing spectroscopic photon sieves operating in soft X-ray region

Changqing Xie, Xiaoli Zhu, Hailiang Li, Yilei Hua

Key Laboratory of Microelectronic Devices & Integrated Technology, Institute of Microelectronics of Chinese Academy of Sciences, Beijing 100029, People's Republic of China

ABSTRACT: A novel design of X-ray spectroscopic photon sieves (SPS) was realized to eliminate the higher diffraction orders. SPS gratings consist of randomly distributed circular holes, forming an approximately sinusoidal transmission function. Due to the intensive absorption of soft X-rays in any known material, these gold nanoholes are free-standing without supporting membrane. For applications in soft X-ray region, a hybrid lithographic method was used to manufacture spectroscopic photon sieves (SPS) of 1000 lines/mm in high throughput. In the fabrication process, an electron beam was focused to write patterns on the membrane substrate to achieve a master mask. Using this mask XRL and gold electroplating were performed to efficiently replicate SPS structures. After that, UVL was used to define the supporting coarse frame. In the replication process of XRL, the deviation of circle patterns caused by overheating problem in exposure has been resolved by inserting appropriate filters in X-ray beam path. The spectrum of X-ray source for exposure can be restricted in the 1.0-2.0 keV energy band. Therefore, less heat are produced in exposure due to less absorption of higher energy X-rays in resist. After the SPS has been finished, the diffraction pattern was achieved at the soft X-ray beam line on Beijing Synchrotron Radiation Facility. The calibration results show that higher-order diffraction orders were efficiently suppressed along the axis of symmetry.

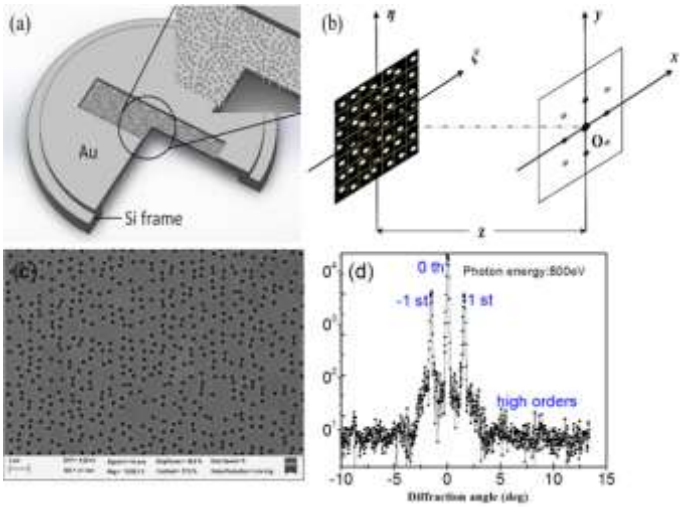

Fig. (a) Schematic geometry of free-standing SPS. (b) coordinate system for the geometry of the quasi-random nanoholes array. (c) Scanning electron micrographs of fabricated nanohole arrays. (d) angular distribution of different diffraction orders at 800 eV photon energy.

O4 - Delta-like response soft x-ray energy spectrometer

Lai Wei, Lefeng Cao

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ABSTRACT: In the research of controlled nuclear fusion and solar physics, there is a striking contradiction between the application requirement of soft X-ray energy spectrum measurement and the existing technical means. Specifically, up to now, all the technical means developed and established by people cannot maintain a high enough spectral resolution level in a wide enough measurement range at the same time. We open up a new technical way to develop a kind of soft X-ray energy spectrometer with delta -like energy response corresponding to the dispersion distance and photon energy. The measurement range covers the whole energy range (10eV-10keV) of electromagnetic spectrum from extreme ultraviolet radiation to soft X-ray, while ensuring that the whole measurement range has a uniform high energy resolution level ($E/\triangle E>1000$). Considering the intense transient characteristics of fusion plasma, the new spectrometer will have a high time resolution level ($\triangle t < 150$ ps) besides its wide-range high resolution technical characteristics. To this end, this research will develop a soft X-ray single-order focusing zone plate with unprecedented superior dispersion characteristics, a broad-spectrum X-ray radiation field control system based on combined capillaries and a grazing incidence large-scale linear array ultrafast time-response X-ray photodetector. It will bring unprecedented technological opportunities for controlled nuclear fusion and solar physics research.

Keywords: X-ray diagnostics; Time resolution; Energy resolution

AD1 ROOM - PHYSICS DEPARTMENT, 1ST FLOOR

14:00 – 15:45 - X- and γ-ray Detectors and Applications

Chair: Fei Wei

O5 - AHEAD2020 project prospects for High-Energy Astrophysics

Rui Curado da Silva[1,2], Jorge Maia[1,3], Henrique Neves[1,2], Santos Filomena[1,2]

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ABSTRACT: High-Energy Astrophysics has entered a new era, with a number of operational and near-future instruments being deployed in space. AHEAD partner facilities play a fundamental role in the new venue of Multimessenger astronomy, as witnessed by the ground-breaking discovery of the electromagnetic counterparts to the gravitational wave event GW170817 observed by LIGO/Virgo or to the neutrino source TXS 0506+056. AHEAD brings together on European scale and open facilities for a) testing both ground and space-based technologies in an environment representative of space conditions, b) data exploitation and c) computational modelling, to all European researchers, from both academia and industry. On the framework of AHEAD Work Package on Space Experiments, a CubeSat-compatible prototype will be developed to

realise a compact Compton Telescope (`COMCUBE') design that offers game-changing GRB polarimetric capability in the few hundred keV range. Furthermore, it will allow the development of an extended CubeSat constellation for high-energy astrophysics.

O6 - Monte Carlo Simulation of X-ray Polarization Sensitivity in Noble Gas/Methane Mixtures

José Escada[1,2], Jorge Maia[1,3], Rui Curado Silva[1,2], Paulo Rachinhas[4], Teresa Teixeira Dias[1,2], Filomena Santos[1,2]

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[4]*Radiotherapy Department, University Hospital of Coimbra, Coimbra, Portugal*

ABSTRACT: The identification of the state of polarization of X-rays is a very useful tool in the investigation of the physics and geometry of astrophysical compact sources (active galactic nuclei, neutron stars, supermassive black holes, etc), as it adds two new parameters – polarization degree and polarization direction – to the three normally considered – time, energy and position. The polarimetry is based on the preferential alignment of the direction of emission of photoelectrons with that of the polarization of incident X-rays. The mission/observatory IXPE/NASA (Imaging X-ray Polarimetry Explorer) will investigate the polarimetry of X-rays in the 2-8 keV range. In this mission, the polarimeter's main element is a gas multipixel detector, in which the gas filling is the key factor for the polarimetric sensitivity, which is expressed by the intrinsic modulation factor (for 100% polarized X-rays) of the photoelectrons' direction emission. The ratio between the modulation measured and the intrinsic value provides the degree of polarization of the incident radiation.
The purpose of this work is to study the polarimetric potential of a few gaseous media, calculating by Monte Carlo simulation their intrinsic modulation factors: noble gas based mixtures (preferentially with low atomic number) with a molecular gas (CH4, CF4, CO2, iso-C4H10 or DME). A Monte Carlo simulation model has been developed, considering angular differential diffusion in photoionization of the gas medium, which includes dipolar (β) and non-dipolar (γ and δ) first order terms (X-ray energy and photoionized subshell dependent). The primary electron cloud formation is reproduced considering the cascade decay process of the ions produced (envolving Auger, shake-off electron emission as well as fluorescence photon). When, along their drift under the weak electric field, electrons reach subionization energies, their position is assessed and the azimuthal distribution of the cloud is calculated. From this distribution, the modulation factor is determined.

We present preliminary results for incident X-ray energies in the 2-15 keV range in noble gas mixtures (Xe, Ar, Ne, He) with CH4.

O7 – Coimbra Gas Radiation Detectors Heritage

A.F.V. Cortez

LIBPhys, Physics Department, University of Coimbra, Rua Larga, Coimbra, 3004-516, Portugal

ABSTRACT: The use of electroluminescence as the amplification mechanism in gas detectors has the advantage of introducing much smaller fluctuations than the charge amplification mechanisms, allowing to obtain very competitive solutions. Some of the most relevant contributions of Coimbra in the development of gas radiation detectors based on electroluminescence and possible applications are reviewed.

Keywords: Electroluminescence, Gas radiation detectors, Large Volume Detectors, High Pressure, Secondary Scintillation

AD1 - PHYSICS DEPARTMENT, 1ST FLOOR

16:00 – 17:00 – X-ray Sources

Chair: Rui Silva

O8 - Proposals of soft X-ray instrument for Chinese future space missions

Fei Wei[1,2], Yihong Guo[1,2], Songwu Peng[1, 2]

[1]*Key Laboratory of Space Environment Exploration, National Space Science Center, Chinese Academy of Sciences, Beijing, China*
[2]*Environmental Space Situation Awareness, E-SSA, Beijing, China*

ABSTRACT: Soft X-ray emission provides a powerful tool for monitoring solar flares, diagnosing solar activities and the conditions of geospace under the solar wind. In the past variety of X-ray spectrometers and imagers have been developed for the purposes of monitoring and diagnosing solar activities and the geospace phenomena. But the very important section of soft X-ray in the keV range extending to extreme ultraviolet wavelength is far from being fully used for diagnosing solar activity because of tough technical challenges, although theoretically it is the most closely linked to the fast heating mechanisms of solar flares and the extreme high-temperature processes. The interaction between the solar wind and Earth's magnetosphere, and the geospace dynamics that result, comprise a fundamental driver of space weather. The newly technical improvement in deep-suppression of spectral resonance and development of X-ray optics give us the unprecedented capability to deepen our knowledge on the driving and evolution of violent solar storms, and give novel approach to study the nature of geospace system by the soft X-ray spectral analysis and wide FOV imaging. Here in the report we introduce some of the proposals based on the newly technical innovations for the Chinese future space missions. The Soft X-ray Imager on board SMILE (Solar Wind Magnetosphere Ionosphere Link Explorer, a joint collaborative mission by the European Space Agency and Chinese Academy of Sciences) will break new ground, and a larger class mission with improved spatial, temporal and sensitivity will be proposed to be

placed on the moon surface, which allows us to observe from a distance of 60 R_E from Earth, hence offers the opportunity of expanding very substantially the coverage of geospace available at any time to an X-ray imager. It will provide extended continuous monitoring of the response and evolution of geospace conditions under the buffeting of the solar wind, providing direct scientific input to the studies of space weather and to the validation of global models of solar-terrestrial interactions.

O9 - Quantum Free Electron Lasers: Current situations and prospects

Quanping Fan, Leifeng Cao

Science and Technology on Plasma Physics Laboratory, Research Center of Laser Fusion, Chinese Academy of Engineering Physics, Mianyang, China

ABSTRACT: Quantum free electron lasers (Q-FELs) provide the opportunities to realize high-gain x-ray devices on the scale of a university laboratory with unprecedented small bandwidths at both transverse and longitudinal coherence. Compactness of Q-FELs arises from the use of laser pulses as optical undulators, which reduce undulator period to sub-micrometers and electron energy to a few ten MeV for the production of coherent x-ray pulses. Several academic teams are carrying out relevant research work in the world. Since two years ago, we also start to focus on Q-FELs and form a joint research team. Here, we briefly introduce the development history and current situation of Q-FELs, as well as the experimental challenges it faces. The main members of our joint team and the important progresses our team made are also introduced briefly. We hope more teams will join in our work and further promote the development of Q-FEL.

Keywords: Quantum free electron laser; optical undulator

Friday 18th October

CONFERENCE ROOM - PHYSICS DEPARTMENT, 3RD FLOOR

09:45 – 10:15 – Beam Monochromatic and Applications

Chair: Leifeng Cao

O10 - Reflectance measurements and analysis of EUV multilayers on the SDG beamline of BSRF

Bin Ji[1], Mingqi Cui[2], Jingtao Zhu[1]

[1]*School of Physics Science and Engineering, Tongji University, Shanghai, China*
[2]*Institute of High Energy Physics, Chinese Academy of Sciences, Beijing 100049, China*

ABSTRACT: The 3B1 beamline of BSRF is a novel monochromatic beamline equipped with single-order diffraction gratings (SDG) which can significantly suppress high-order diffractions [1-2]. The beamline can be focused on a spot less than 0.5 by 0.1 centimeters, with an energy range that is continuously tunable from 10eV to 20eV, 20eV to 30eV, 30eV to 50eV and 50eV to 120eV depending on the grating configuration. In this work, a laterally graded Mo/Si multilayer was made by magnetron sputtering and it was measured at BSRF and NSRL. The d-spacing of the laterally graded Mo/Si multilayers vary from 6nm to 10nm with an average gradient of 0.075 nm/mm. Reflectance measurements of the multilayers were performed in the energy range of 70eV-110eV with a grazing incidence angle of 10° at both BSRF and NSRL, the reflectance measurements were performed at every 5mm interval along both two gradient directions of the multilayers. The results show that the reflectance measured at NSRL is higher than that at BRSF, especially in the lower energy bands. Without the high order harmonics, the lower measured reflectance may be caused by the scattered light introduced by the randomly distributed mutually disjointed dots on the surface of the gratings [3]. This is the problems with the single-order diffraction gratings that have to be addressed.

Keywords: synchrotron radiation; single-order diffraction gratings; multi-layer thin film

References

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O11 - Polarization Measurement of the SDG Beamline of BSRF Based on Multilayer in VUV and EUV Range

Mingqi Cui[2], Bin Ji[1], Jingtao Zhu[1]

[1]*School of Physics Science and Engineering, Tongji University, Shanghai, China*
[2]*Institute of High Energy Physics, Chinese Academy of Sciences, Beijing 100049, China*

ABSTRACT: Studies of polarization-sensitive, such as circular dichroism spectroscopy, spin-polarized photoelectron spectroscopy and spectroscopic ellipsometry are hot points nowadays. For these studies, it is very crucial to accurate evaluation of the polarization state of the radiation, which requires evaluate the actual polarization state of the light. The measurements and investigation of polarization with used of multilayers [1] have been developed at 3B1 beam line of BSRF using a homemade polarimeter [2]. The results shows that the degree of linear polarization of the beamline is around 0.6 at 18eV to 26eV, and around 0.9 at 90eV to 120eV which include the optical elements of the beamline. The degree of linear polarization is up to around 0.85 at 18-26eV, and 0.97 at 96.5eV when the beamline is polarized by multilayer optical elements. The lower degree of linear polarization in 18eV-26eV may be caused by the reflection mirror which change the light path in the horizontal direction, and the scattered light which not within the design working energy range of the multilayers polarizing elements. The results showed that the

polarimeter with polarizing elements of multilayer can be satisfied with measurements polarization of the beamline. And using the polarizing elements multilayer the linear degree polarization of beam has been improved remarkably.

Keywords: synchrotron radiation; multi-layer polarizing element; polarization measurement

References

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Multilayer Interference Mirrors for Astronomical Observation and Synchrotron Radiation

Jingtao Zhu[1], Miqing Cui[2], Qiushi Huang, Haochuan Li, Yuchun Tu, Jiayi Zhang, Bin Ji[1], Miao Li, Shengming Zhu, Lei Pan

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ABSTRACT: Multilayer mirrors were successfully used in EUV astronomical observation and Synchrotron radiation applications. Basing aperiodical and laterally graded multilayer design, wide-spectral width mirrors will simplify the experiment alignment for SR and ICF. Multilayer Laue Lens can focus hard X-ray into ~20nm successfully at SR.

10:30 – 11:30 - X- and γ-ray Detectors and Applications

Chair: Changqing Xie

O12 - Negative ion mobility measurement with a Dual-Polarity Ion Drift Chamber

D. Marques[1,2], A.F.V. Cortez[3], J. Escada[1,2], F.P. Santos[1,2], C.A.N. Conde[1,2] and F.I.G.M. Borges[1,2]

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ABSTRACT: The knowledge of the ion transport parameters in their parent gases, namely their mobility and diffusion, are important issues in many scientific areas from physics to medical sciences and with special relevance in large volume high pressure gas detectors, an example of which are the Time Projection Chambers (TPC)[1,2], used in several particle physics experiments. In these type of detectors, with a high charge density per detected event, the information on the drift of the resulting ions is of upmost

importance in the optimization of the detector modeling. Also, the possibility of using the negative ions as the charge carriers instead of the electrons, to reduce the diffusion of the charge, as in the Negative Ion TPC (NITPC), has been recently proposed [3].

The LIP-Coimbra group has been performing positive ion mobility measurements with an experimental system, described in [3], for about a decade. The experimental system uses a UV flash lamp which emits photons that hit a CsI film deposited on the top of a GEM that is inside a gas chamber. The photoelectrons released from the CsI film drift through the GEM holes, ionizing some of the gas molecules encountered along their paths. While the electrons are collected at the bottom of the GEM electrode, the originated cations drift through a uniform electric field region towards a double grid, a Frisch grid and a collecting grid, at ground voltage, that collects the ions. Using a charge pre-amplifier, the charge collected originates a voltage signal that is recorded in a digital oscilloscope, originating a time spectrum. After the background noise is subtracted from the signal, a gaussian curve is fitted to these spectra and the respective peak centroid corresponds to the average drift time of the ions along a known drift distance of 4.273 cm. From these values, the drift velocity and mobility can then be calculated.

Recently a new experimental system, the Dual-Polarity Ion Drift Chamber (DP-IDC) was developed to allow the measurement of negative ions, also originated in the GEM holes by electron attachment to molecules from an electronegative gas, like SF_6, O_2, among others. This electronegative gas can either be the main one or an additive to it. In this new experimental chamber, the negative ions are collected in a double grid, located below the GEM, symmetrical to the collecting grid for the positive ions.

In this work, we present this new experimental system and the first measurements obtained with it, comparing the ion mobility with previous ones obtained with the original system [4]. The steps to be taken to improve the system will also be discussed.

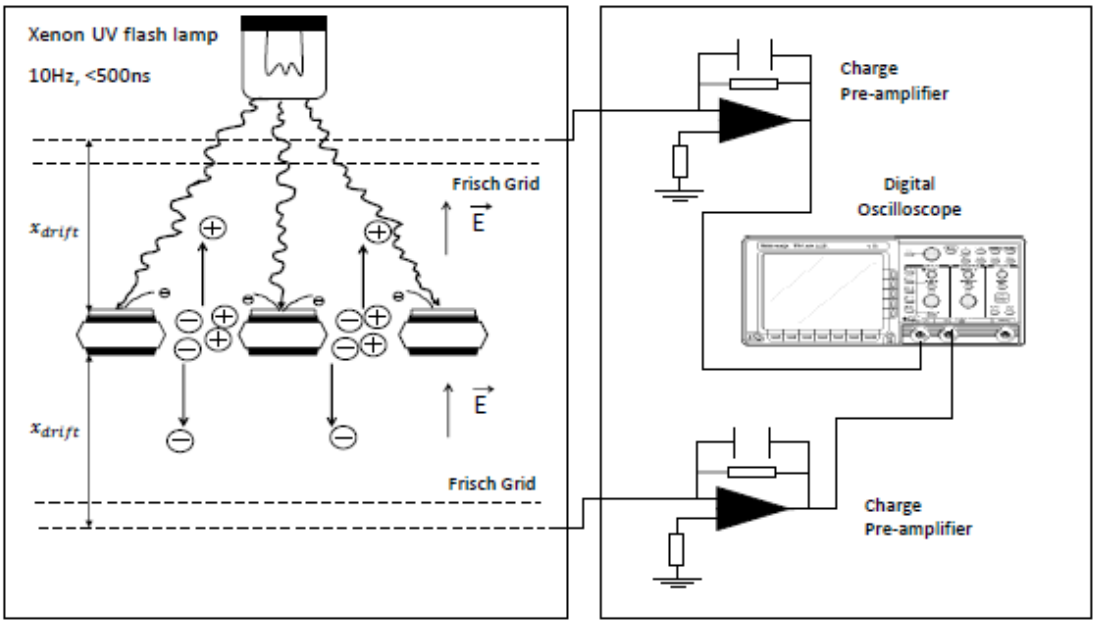

Fig. 1 – Schematic of the Dual-Polarity Ion Drift Chamber (DP-IDC)

References

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O13 - Proton Radiation Sensitivity of Gamma-Ray CdTe Detectors

J. M. Maia[1,2], R. M. Curado da Silva[1,3], M. Moita[1], P. Crespo[1,3], S. J. C. do Carmo[4], F. Alves[5]

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ABSTRACT: The analysis of the potential effects of the orbital radiation environment on space instrumentation is essential to project a high-energy astrophysics space mission. Thus, it is crucial to study detectors materials’ radiation damage and the effects in their operational performances in conditions as similar as possible to the ones existing in the orbital radiation environment. In any orbit, to foresee the operational performances and the expected lifetime of a detection device it is critical to know the environment radiation type and profile. Semiconductor detection planes, particularly CdTe planes [1] require further space equivalent radiation environment tests in order to improve new instrument concepts’ sensitivity in orbit, such as 3D CZT/CdTe detection planes and Laue lens CZT/CdTe focal planes applied in γ-ray astrophysics.

The present work reports the proton radiation sensitivity of two 1.0 mm thick EURORAD CdTe detectors, irradiated with low energy proton beam generated in a PET cyclotron facility [1,2]. The CdTe crystals were exposed to a low MeV proton radiation field, 3–14 MeV, with total fluence equivalent to the proton fluence accumulated in ~1 up to ~20 years in a Low-Earth Orbit (LEO). The impact of the proton radiation field was analyzed through the charge transport properties – the mobility-lifetime product for electrons, $(\mu\tau)_e$, and holes, $(\mu\tau)_h$, and the spectroscopic properties – the energy resolution for γ-ray lines within 60–662 keV [2].

References

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POSTER SESSION

AD1 LOBBY - PHYSICS DEPARTMENT, 1ST FLOOR

11:30 – 12:30

P1 - Polarimetry with a multi-layer CdTe prototype detector for High-energy Astrophysics

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ABSTRACT: In high-energy astrophysics, polarimetry is a promising subject with a wide scientific potential, relatively unexplored due to the complexity of the required detection. Several of the gamma-ray mission telescope proposals are based on multi-layer spectro-imager focal plane solutions with polarimetric capabilities. Herein we study a new Compton polarimeter prototype based on a two-layer CdTe pixelized spectro-imager operated in coincidence. The two CdTe detectors are 2 mm thick anode 8×8 pixels' segmented matrices with 2 mm pitch. This detection system configuration allows an assessment of the polarimetric potential of multi-layer solution focal planes as well as the polarimetric potential of a possible 3D spectro-imager by analysing the polarimetric performance when changing the distance between the two CdTe detection layers. The polarimetric modulation factors for intra-layer (Q~0.4) and inter-layer (up to 0.13) double events were measured for 6 mm and for 10 mm distance between planes. The measured polarization angle resolution was lower than 5º. The potential of CdTe spectro-imager focal plane solutions with polarimetric capabilities for the next generation space missions based on both Laue lenses and 3D segmented focal planes is also discussed.

P2 - High-energy Future Space Telescopes Source Sensitivity in the Multi-Messenger Era

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ABSTRACT: The observation of two simultaneous signatures, a GW by LIGO and Virgo ground facilities and GRBs by space observatories, emitted by a neutron star

merger, has initiated the new era of multi-messenger astrophysics. Herein, we will address this exciting new scientific field by taking part in AMEGO consortium to build a gamma-ray all-sky space observatory for transient localization, with increased sensitivity, by one or two orders of magnitude. Furthermore, it will provide polarimetric capabilities and, for the first time, pair production polarimetry.

New astronomy windows of opportunity will be researched such as sources of GWs or neutrino-gamma events, and an increased number of new sources will be observed (>10 times more). Ground-breaking polarimetry science and data will be explored.

P3 - Compton Telescope CubeSat Prototype

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ABSTRACT: Progressing from WP9 'Gamma-ray Experiments' in AHEAD1, a CubeSat-compatible prototype will be developed to realise a compact Compton Telescope (`COMCUBE') design that offers game-changing GRB polarimetric capability in the few hundred keV range. Performance assessment will be carried out by simulations, construction of prototype including high speed electronics, lab measurements and balloon flight offered through the EU HEMERA (Integrated access to balloon-borne platforms for innovative research and technology) or national sounding balloon programmes as a piggy-back payload. This task will raise the TRL of novel silicon technologies crucial for the realisation of next-generation MeV gamma-ray astrophysics missions for gamma-ray burst discovery and polarimetry.

P4 - Terrestrial Gamma-Ray Flashes Analysis for Aircraft Transport Safety

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ABSTRACT: TGF (Terrestrial Gamma-ray Flashes) are gamma-ray emissions, produced by cumulonimbus clouds. These emissions that were discovered in 1994, are being recorded by astrophysics space missions, such as AGILE (Astrorivelatore Gamma ad Immagini LEggero). TGF are produced at the top of thunderclouds by avalanches of electrons accelerated within thunderstorm strong electric fields and abruptly braked in the atmosphere. Exhibiting energies from a few keV up to several tens of MeV, TGF are the most energetic phenomenon naturally occurring on Earth and can represent a severe risk for airplanes and aircraft transports, both for the crew and the on-board electronics. We will evaluate typical TGF flux at commercial flight altitude (~10 km), the potential dose absorbed crew and the probability of being caught by TGF in certain types of flight routes.

P5 - Characteristics of gaseous mixtures based on noble gases as detection medium

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ABSTRACT: In gas detectors, the detection medium can change substantially their characteristics. It was our plan to study rare gas-based gas mixtures with molecular gases considered potentially interesting in international experiments in which the group is involved: NEXT (Neutrino Experiment with a Xenon TPC) and IXPE (X-ray Imaging Polarimetry Explorer). To achieve our goal, an experimental setup was built which includes: A gas Proportional Scintillation Counter; A proportional counter; A device to determine the positive ion mobility in the parent gas; An apparatus to determine the VUV light absorption; A device to study electron mobility and diffusion parameters.

P6- Simulation of the performance of a Multi-Grid High-Pressure Gas Proportional Scintillation Counter for gamma rays

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ABSTRACT: Recently a new prototype of a high-pressure gas detector of the Gas Proportional Scintillation Counter (GPSC) type [1], the Multi-Grid High-Pressure Gas Proportional Scintillation Counter (MGHP-GPSC), was built and tested with alpha particles [2]. This detector has a cylindrical geometry, and recent studies have proved that the detector concept works and that the new geometry exhibits better overall performance than the previous planar one [2,3].
The detection of ionizing radiation in this type of detector relies on the secondary scintillation as the amplification stage followed by the production of photoelectrons in a photosensitive material, namely a cesium iodide film, which is in direct contact with the gas. The main advantage, when compared with the most common GPSC's that use a photomultiplier tube to detect the light, is that it is more ruggedized, which can be important in some field applications, ranging from homeland security to instrumentation for boreholes in geological prospection.

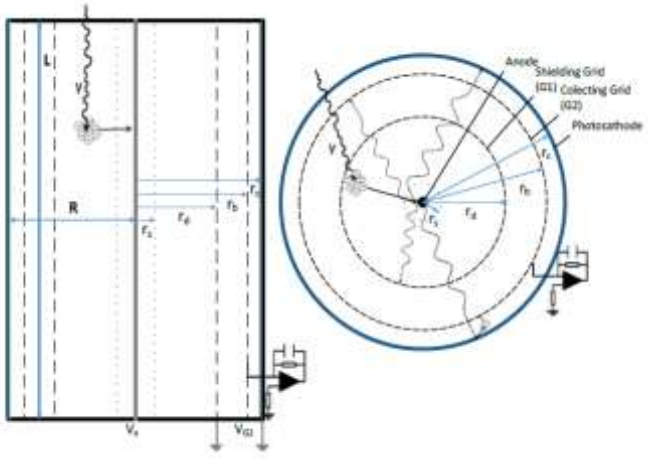

Fig. 1 – Schematic of the prototype of the cylindrical MGHP-GPSC

Although the prototype was tested with alpha particles with promising results [2], its performance for gamma-rays may need some improvements, due to the larger range of interaction of these particles in the gas. Eventually solid angle corrections for interactions occurring in different positions along the detector axis may have to be considered, as well as the effect of the finite detector dimension on the electric field at the detector ends.

Also, a different detector's grid biasing, or a different position of the grids in the detector can allow a better performance for gamma-ray detection, and these possibilities should be studied in this more challenging detection of gamma-rays.

All these possibilities will be studied by simulating the detector performance for gamma-rays using the GEANT4 code. According to the results of the simulation, some changes in the detector may be implemented, before testing its performance for gamma-rays.

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