306) **Proton Telescope (PROTEL) on the CRRES spacecraft**

1993 IEEE Transactions on Nuclear Science Vol.40 Pages 242-245

Violet MD, Lynch K, Redus R, Riehl K, Boughan E

Abstract

This report describes the design and operation of the Proton Telescope (PROTEL) on the Combined Release and Radiation Effects Satellite (CRRES) which operated in a low inclination, geosynchronous transfer orbit from 25 July 1990 to 12 October 1991. PROTEL makes well-calibrated, high angular resolution measurements of the proton differential energy spectrum once per second from 1 to 100 MeV in 24 channels. The instrument contains silicon solid-state detector arrays with both anticoincidence and multiple coincidence requirements to reduce contamination. The detector and channel characteristics derived from an extensive calibration program are provided, and initial performance and data analysis are discussed.

305) **Recent advances in avalanche photodiode technology**

1993 Proceedings of SPIE - The International Society for Optical Engineering Vol.2009 Pages 64-71

Squillante MR, Gordon JR, Farrell R, Vasile SA, Daley K, Oakes CE, Vanderpuye K

Abstract

Avalanche photodiodes (APDs) are solid state devices having an internal signal gain which gives them a better signal-to-noise ratio than standard photodiodes. Although they have been studied for years, recent advances in the fabrication techniques have allowed the construction of multielement arrays (up to 10 multiplied by 10) with high performance capability. This progress has resulted in increased potential for exploiting the advantages of APDs in a variety of important applications including measurements requiring fast response such as nuclear and high energy physics research, industrial nondestructive testing, medical instrumentation, and biomedical research using low energy particles. Recent experimental data characterizing APDs and APD arrays used as x-ray, particle, and low level light detectors are presented. 10 Refs.

304) **High sensitivity radiation detector for capillary electrophoresis**

1993 IEEE Transactions on Nuclear Science Vol.40 Pages 1162-1164

Gordon JS, Vasile S, Hazlett T, Squillante M

Abstract

Capillary electrophoresis is an important new instrumental technique capable of high resolution separation and analysis of small quantities of nucleotides, amino acids, peptides, and proteins with very high efficiency and throughput. The unprecedented sensitivity of the technique will be useful for such new applications as in vivo labeling and identification of trace substances and singles cell work. The principle limitation of this technique for radiolabeled molecules has been identified as the sensitivity of the detector, primarily due to the small sample volume (less than nl) and the short residence time of the sample in the detector (less than 3 sec). We have developed a novel high-sensitivity CdTe solid state detector used for detection ofSUP3SUP2P-labeled biomolecules with unprecedented sensitivity. This detector can be easily retrofitted into existing CE apparatus. (Author abstract) 4 Refs.

303) **InI nuclear radiation detectors**

1993 IEEE Transactions on Nuclear Science Vol.40 Pages 364-366

Squillante MR, Moy LP, Shah KS, Zhou C, Zhang J

Abstract

Semiconductor radiation detectors were fabricated on single crystal wafer of indium, iodide and tested both as direct radiation detectors and as optical detectors coupled to a scintillator crystal. The initial performance of the devices is encouraging but some chemical instability of the crystals was observed.

302) **Junction field effect transistor X-ray detectors**

1993 Materials Research Society Symposium Proceedings Vol.302 Pages 549-554

Lund JC, Olschner F, Rehn L

Abstract

We describe the theory of operation, design, and estimated performance of an n-channel JFET designed to be operated as a detector in an X-ray spectrometer system. We estimate that a room temperature (300 K) JFET detector can be built with performance comparable to a small area, cryogenically cooled Si(Li) detector.

301) **Fast avalanche photodiode detectors for the superconducting super collider**

1993 Materials Research Society Symposium Proceedings Vol.302 Pages 537-542

Vasile S, Gordon JS, Farrell R, Squillante MR

Abstract

The tracking of high energy, secondary products in the Superconducting Super Collider (SSC) presents challenging sensitivity and timing requirements for the scintillating fiber converters and the optical radiation detectors planned for use as signal readouts. Silicon Avalanche Photodiodes (APD) are very promising detectors which may ultimately meet these requirements. We have designed and manufactured 1 mmSUP2 APDs, to be operated in Geiger mode as single photon detectors for the SSC. The progress on decreasing the APD response time by platinum doping, device thinning and external avalanche quenching is reported.

300) **Performance characteristics of CDTE gamma-ray spectrometers**

1993 Materials Research Society Symposium Proceedings Vol.302 Pages 507-512

Squillante MR, Cole H, Waer P, Entine G

Abstract

The use of cadmium telluride (CdTe) semiconductor nuclear detectors is continuing to expand into new areas because of their unique properties which include room temperature operation and high detection efficiency. In addition, they remain the material of choice in many critical applications such as nuclear medicine and power plant monitoring because of their reputation for reliability and long term stability. CdTe is by far the most developed of the compound semiconductors used in nuclear detector applications and it offers a number of significant benefits to researchers, clinicians and engineers who have special requirements relating to size, sensitivity and operating temperature. Recently, there have been improvements in the growth of the crystalline material and in the fabrication procedures which have resulted in better performance and in the ability to produce arrays. This article describes the physical and electronic properties of CdTe nuclear detectors, discusses how the crystal growth and device fabrication procedures can affect these properties, and compares the performance to CdZnTe detectors.

299) **Processing and characterization of HgBrSUBxISUB2SUB minus SUBx radiation detectors**

1993 Materials Research Society Symposium Proceedings Vol.302 Pages 357-362

Zhou C, Squillante MR, Moy LP, Bennett P

Abstract

This paper reports our recent work on the crystal processing, structural and optical characterization of HgBrSUBxISUB2SUB minus SUBx nuclear radiation detectors. To understand the electrical and optical properties of the detectors, we measured the energy gap of HgBrSUBxISUB2SUB minus SUBx as a function of the Br/I ratio. The energy band of this ternary semiconductor compound can be modulated from 2.1 eV (HgISUB2) to 3.4eV (HgBrSUB2) by adjusting its chemical composition. This energy scope covers a wavelength spectrum between 365 nm and 596 nm, much of the visible spectrum. Nuclear and photoconductive detectors were fabricated from HgBrSUBxISUB2SUB minus SUBx single crystals and the responses of these devices were investigated with different radiation sources (SUP2SUP4SUP1Am, SUP1SUP3SUP7Cs).

298) **Improvements in thallium bromoiodide photodetectors for scintillation spectrometers**

1993 Materials Research Society Symposium Proceedings Vol.302 Pages 329-334

Zhang JG, Cirignano L, Daley K, Squillante MR

Abstract

Thallium bromoiodide, a tunable band gap semiconductor system, was investigated as a photodetector for scintillation spectrometers. Extensive zone refining of starting materials, based on numerical simulations, considerably enhanced the electrical resistivity to 10SUP1SUP1 Omega cm. In addition, accelerated crucible rotation technique (ACRT) crystal growth and after-growth annealing have improved the charge carrier mobility-lifetime product. However, a relatively low signal-to-noise ratio due to a high dielectric constant and relatively low quantum efficiency continues to be an obstacle to achieving high performance, large area TlBrSUBxISUB1SUB minus SUBx photodetectors.

297) **New compound semiconductor materials for nuclear detectors**

1993 Materials Research Society Symposium Proceedings Vol.302 Pages 319-328

Squillante MR, Zhang J, Zhou C, Bennett P, Moy L

Abstract

In many instances, the ability of scientists and engineers to make nuclear radiation measurements is only limited by the properties of available radiation detectors. Because of this, research into new semiconductor materials for radiation detection has been, and continues to be, a very active field. This article reviews recent research on several promising new' materials.

296) **Evanescent-wave infrared fiber optic biosensor**

1993 Proceedings of SPIE - The International Society for Optical Engineering Vol.1796 Pages 349-359

Rochemont LP, Downer NW, May TE, Smith HG, Oakes CE, Ertan-Lamontagne M

Abstract

An infrared fiber-optic neurotoxin biosensor was constructed by applying a biologically active cladding to the core of an infrared transmitting chalcogenide fiber. Binding of the surface bound receptor protein was monitored by performing infrared difference spectroscopy on the fiber-optic probe before and after its exposure to various concentrations of neurotoxin in solution. Signals measuring conformational change(s) as a result of these interactions are observed to saturate in agreement with established biochemical kinetics for the receptor.

295) **Junction field effect transistor X-ray detectors**

1993 Semiconductors for Room-Temperature Radiation Detector Applications Symposium Vol. Pages 549-554

Lund JC, Olschner F, Rehn L -- Edited by James RB, Schlesinger TE, Siffers P, Franks L

Abstract

We describe the theory of operation, design, and estimated performance of an n-channel JFET designed to be operated as a detector in an X-ray spectrometer system. We estimate that a room temperature (300 K) JFET detector can be built with performance comparable to a small area, cryogenically cooled Si(Li) detector.

294) **High sensitivity radiation detector for capillary electrophoresis**

1993 IEEE Trans. Nucl. Sci. Vol.40 Pages 1162-1164

Gordon JS, Vasile S, Hazlett T, Squillante M

Abstract

Capillary electrophoresis (CE) is an instrumental technique capable of high resolution separation and analysis of small quantities of nucleotides, amino acids, peptides, and proteins with very high efficiency and throughput. The unprecedented sensitivity of this technique will be useful for such new applications as in vivo labeling and identification of trace substances and single cell work. The principal limitation of this technique for radiolabeled molecules has been identified as the sensitivity of the detector, primarily due to the small sample volume (<1 nl) and the short residence time of the sample in the detector (<3 sec). The authors report the development of a high-sensitivity CdTe solid-state detector used for detection of /sup 32/P-labeled biomolecules with unprecedented sensitivity. This detector can be easily retrofitted into existing CE apparatus.

293) **Recent results with a CdTe imaging portal scanner for radiation therapy**

1993 IEEE Trans. Nucl. Sci. Vol.40 Pages 1012-1016

Entine G, Redus RH, Feyder A, Biggs PJ

Abstract

*A prototype portal imager using a linear array of 256 CdTe photovoltaic detectors, each 2 mm*2 mm*2 mm, is constructed. The array is attached to a compact linear scanner which is to be mounted in a cassette shaped package located below the patient table. The array of detectors is moved under the patient during image acquisition. The high stopping power of the CdTe allows a high contrast image to be made using a single linac pulse for each array position. In tests conducted with a 4-MV linac, this system produces 50-cm*35-cm images with an open field signal-to-noise ratio of 143 and 2-mm spatial resolution in less than 3 s. This corresponds to a signal-to-noise ratio of 1 for 1% contrast objects. Ultimately, signal-to-noise ratio greater than 5 and 1% contrast should be achievable with no loss of spatial resolution or increase in acquisition time.*

292) **Evanescent-wave infrared fiber-optic biosensor**

1993 Proc. SPIE - Int. Soc. Opt. Eng. Vol.1796 Pages 349-359

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Abstract

An infrared fiber-optic neurotoxin biosensor was constructed by applying a biologically active cladding to the core of an infrared transmitting chalcogenide fiber. Binding of the surface bound receptor protein was monitored by performing infrared difference spectroscopy on the fiber-optic probe before and after its exposure to various concentrations of neurotoxin in solution. Signals measuring conformational change(s) as a result of these interactions are observed to saturate in agreement with established biochemical kinetics for the receptor. Fiber-optic components are shown to be much more sensitive than bulk optical components in performing these measurements.

291) **Recent advances in avalanche photodiode technology**

1993 Annual meeting of the Society of Photo-Optical Instrumentation Engineers (SPIE), San Diego, CA Vol.July 11-16 Pages 64-71

Squillante MR, Gordon JR, Farrell R, Vasile SA, Daley K, Oakes CE, Vanderpuye K -- Edited by Orphan VJ

Abstract

Avalanche photodiodes (APDs) are solid state devices having an internal signal gain which gives them a better signal-to-noise ratio than standard photodiodes. Also, their high quantum efficiency provides an advantage over photomultiplier tubes in some applications. Although they have been studied for years, recent advances in the fabrication techniques have allowed the construction of multielement arrays (up to 10 x 10) with high performance capability. This progress has resulted in increased potential for exploiting the advantages of APDs in a variety of research, industrial nondestructive testing, medical instrumentation, and biomedical research using low energy particles. For example, the direct detection of the distribution of tritium labeled, beta emitting compounds has been achieved. No other solid state detector is capable of doing this. Recent experimental data characterizing APDs and APD arrays used as x-ray, particle and low level light detectors are presented. In addition, their suitability in various applications is discussed.

290) **Automated imaging of semiconductor crystal/melt interface zone**

1993 Appl. Radiat. Isot. Vol.44 Pages 1301-1311

Nagarkar VV, Gordon JS, Daley K, Entine G, Squillante MR

Abstract

In semiconductor manufacturing processes, the shape and position of the solid-liquid transition interface significantly affects the material properties. A prototype of a real-time imaging instrument has been developed to monitor and control the interface shape and location utilizing computed tomography methods. This device is promising for controlling growth of semiconductors and other materials. The instrument uses a high sensitivity, solid state CdTe gamma-ray detector and a sup 137 Cs source. The prototype has demonstrated density contrast resolution of < 3% and spatial resolution of < 500 mu m.

289) **InI nuclear radiation detectors**

1993 IEEE Trans. Nucl. Sci. Vol.40 Pages 364-366

Squillante MR, Zhou C, Zhang J, Moy LP, Shah KS

Abstract

Semiconductor radiation detectors were fabricated on single crystal wafers of indium iodide and tested both as direct radiation detectors and as optical detectors coupled to a scintillator crystal. The initial performance of the devices is encouraging but some chemical instability of the crystals was observed.

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Capillary electrophoresis is an important new instrumental technique capable of high resolution separation and analysis of small quantities of nucleotides, amino acids, peptides, and proteins with very high efficiency and throughput. The unprecedented sensitivity of this technique will be useful for such new applications as in vivo labeling and identification of trace substances and single cell work. The principle limitation of this technique for radiolabeled molecules has been identified as the sensitivity of the detector, primarily due to the small sample volume (< 1 nl) and the short residence time of the sample in the detector (< 3 sec). The authors have developed a novel high-sensitivity CdTe solid-state detector used for detection of sup 32 P-labeled biomolecules with unprecedented sensitivity. This detector can be easily retrofitted into existing CE apparatus.

287) **Recent results with a CdTe imaging portal scanner for radiation therapy**

1993 IEEE Trans. Nucl. Sci. Vol.40 Pages 1012-1016

Entine G, Redus RH, Feyder A, Biggs PJ

Abstract

One of the most promising means for improving the quality of radiation therapy is the use of real-time imaging systems for routine portal position verification. The authors have constructed a prototype portal imager using a linear array of 256 CdTe photovoltaic detectors, each 2X2X2 mm. The array is attached to a compact linear scanner which is to be mounted in a cassette shaped package located below the patient table. The array of detectors is moved under the patient during image acquisition. The high stopping power of the CdTe allows a high contrast image to be made using a single linac pulse for each array position. In tests conducted with a 4 MV linac, this system produced 50 cm x 35 cm images with an open field signal-to-noise ratio of 143 and 2 mm spatial resolution in less than 3 seconds. This corresponds to a signal-to-noise ratio of 1 for 1% contrast objects. Ultimately, a signal-to-noise ratio greater than 5 at 1% contrast should be achievable with no loss of spatial resolution or increase in acquisition time.

286) **Recent advances in avalanche photodiode technology**

1993 PROC SPIE INT SOC OPT ENG Vol.2009 Pages 64-71

Squillante MR, Gordon JS, Farrell R, Vasile SA, Daley K, Oakes CE, Vanderpuye K

Abstract

Avalanche photodiodes (APDs) are solid state devices having an internal signal gain which gives them a better signal-to-noise ratio than standard photodiodes. Although they have been studied for years, recent advances in the fabrication techniques have allowed the construction of multielement arrays (up to 10 x 10) with high performance capability. This progress has resulted in increased potential for exploiting the advantages of APDs in a variety of important applications including measurements requiring fast response such as nuclear and high energy physics research, industrial nondestructive testing, medical instrumentation, and biomedical research using low energy particles. Recent experimental data characterizing APDs and APD arrays used as x-ray, particle, and low level light detectors are presented.

285) **Evanescent-wave infrared fiber optic biosensor**

1993 PROC SPIE INT SOC OPT ENG Vol.1796 Pages 349-359

Rochemont LP, Downer NW, May TE, Smith HG, Oakes CE, Ertan-Lamontagne M

Abstract

An infrared fiber-optic neurotoxin biosensor was constructed by applying a biologically active cladding to the core of an infrared transmitting chalcogenide fiber. Binding of the surface bound receptor protein was monitored by performing infrared difference spectroscopy on the fiber-optic probe before and after its exposure to various concentrations of neurotoxin in solution. Signals measuring conformational change(s) as a result of these interactions are observed to saturate in agreement with established biochemical kinetics for the receptor. Fiber-optic components are shown to be much more sensitive than bulk optical components in performing these measurements.

284) **AN ALARM SYSTEM FOR FINDING RADIOACTIVE SOURCES IN WASTE SITES**

1993 HEALTH PHYS Vol.64 Page S51

Squillante MR, Redus R, Nagarkar V, Cirignano L, Gordon JS, Zirkes A

283) **A phase-sensitive pump-probe technique for the study of electron wavepackets**

1993 Opt Commun Vol.103 Page 79

Christian JF, Broers B, Hoogenraad JH, van der Zande WJ, Noordam LD

282) **Time-resolved dynamics of electronic wavepackets above the classical field-ionization threshold**

1993 Phys Rev Lett Vol.71 Page 334

Broers B, Christian JF, Hoogenraad JH, van der Zande WJ, van Linden van den Heuvell HB, Noordam LD

281) **Ne+ + C60 collisions: The dynamics of charge and energy transfer, fragmentation, and endohedral complex formation**

1993 J Chem Phys Vol.99 Page 3468

Christian JF, Wan Z, Anderson SL

280) **Collision of alkali ions with C60/C70: Insertion, thermionic emission and fragmentation**

1993 J Chem Phys Vol.99 Page 5858

Wan Z, Christian JF, Anderson SL

279) **A phase-sensitive pump-probe technique applied to the study of electron wavepacket dynamics above the classical field-ionization threshold**

1993 Eur Res Conf on Very High Resolution Spectroscopy with Photoelectron: Excited State Spectroscopy and Dynamics, Giens, France Vol.Sept. 18-23

Christian JF, Broers B, Hoogenraad JH, van der Zande WJ, Noordam LD

278) **Low nose charge sensitive preamplifier using drain current feedback**

1993 IEEE Trans Nucl Sci Vol.NS-40 Feb.

Lund J, Olschner F

277) **High-speed X-ray imaging camera for time-resolved diffraction studies**

1992 IEEE Transactions on Nuclear Science Vol.49 Pages 2415-2419

Tipnis SV, Nagarkar VV, Gaysinskiy V, Miller SR, Shestakova I

Abstract

We report on a high-speed X-ray imaging camera, specifically developed for time resolved diffraction studies using synchrotron and laboratory X-ray sources. This camera is capable of acquiring six X-ray images at speeds of up to 2300 frames per second (f/s). The system is based on a modified architecture CCD optically coupled to a fiber-optic taper via an image intensifier. The front end of the taper is coupled to a specially designed microstructured CsI(Tl) scintillator screen capable of providing high light output, very high-detection efficiency, and excellent spatial resolution. In addition to the time resolved diffraction studies, this detector will be extremely valuable in applications such as dynamic imaging of small animals, X-ray microtomography, and materials science applications. This paper discusses the design and performance characterization of the imaging system. Additionally, we present some preliminary high-speed X-ray imaging data obtained using laboratory X-ray sources.

276) **Measurements of the operating characteristics of a large-area avalanche photodiode**

1992 Optical Engineering Vol.31 Pages 48-52

Martin F, Entine G, Farrell R

Abstract

The dark current (I-d) and noise equivalent power (NEP) of four large-area avalanche photodiodes (APD) has been measured to determine their sensitivity limit for detecting weak optical communication signals. From room temperature down to about -10 C, the I-d decreased by one-half for every 8-deg drop in temperature; the NEP decreased by one-half for every 16-deg drop in temperature. Below this temperature, the NEP leveled off at somewhat less than 5 pW in a 100-kHz bandwidth. The statistical properties of these APDs are discussed according to the model developed by McIntyre et al. (1974).

275) **Solid state neutron dosimeter for space applications**

1992 IEEE Transactions on Nuclear Science Vol.39 Pages 966-970

Nagarkar V, Entine G, Stoppel P, Cirignano L, Swinehart P

Abstract

One of the most important contributions to the radiation exposure of astronauts engaged in space flight is the significant flux of high energy neutrons arising from both primary and secondary sources of ionizing radiation. Under NASA sponsorship, we are developing a solid state neutron sensor capable of being incorporated into a very compact, flight instrument to provide high quality real time measurement of this important radiation flux. The dosimeter uses a special, high neutron sensitivity, PIN diode that is insensitive to the other forms of ionizing radiation. The dosimeter will have the ability to measure and record neutron dose over a range of 50 microgray to tens of milligrays (5 millirads to several rads) over a flight of up to 30 days. The performance characteristics of the PIN diode with a detailed description of the overall dosimeter is presented.

274) **Recent developments in the search for new semiconductor gamma-ray detector materials**

1992 In: Gamma-ray detectors; Proceedings of the Meeting, San Diego, CA Vol.July 21-22 Pages 140-145

Lund JC, Olschner F, Shah KS, Squillante MR

Abstract

The requirements of a semiconductor material intended to operate in a gamma-ray detector at room temperatures are discussed, and the status of the search for alternative materials is reviewed. The important material characteristics of a semiconductor gamma-ray detector material are high average atomic number, material's uniformity, resistivity, and electron and holes transport properties. Materials under investigation include GaAs, InP, TlBr, and PbI2. Theoretically, it is considered to be feasible to built a large volume semiconductor gamma-ray detector capable of good energy resolution at room temperature. But it is very unlikely that a semiconductor detector with germanium-like performance will be available in the next five years.

273) **Computer simulation of gamma-ray spectra from semiconductor detectors**

1992 Proceedings of SPIE - The International Society for Optical Engineering Vol.1734 Pages 262-266

Lund JC, Olschner F, Shah KS

Abstract

Traditionally, researchers developing improved gamma ray detectors have used analytical techniques or, rarely, computer simulations to predict the performance of new detectors. However, with the advent of inexpensive personal computers, it is now possible for virtually all detector researchers to perform some form of numerical computation to predict detector performance. Although general purpose code systems for semiconductor detector performance do not yet exist, it is possible to perform many useful calculations using commercially available, general purpose numerical software packages (such as spreadsheet' programs intended for business use). With a knowledge of the rudimentary mechanics of detector simulation most researchers, including those with no programming skills, can effectively use numerical simulation methods to predict gamma ray detector performance. In this paper we discuss the details of the numerical simulation of gamma ray detectors with the hope of communicating the simplicity and effectiveness of these methods. In particular, we discuss the steps involved in simulating the pulse height spectrum produced by a semiconductor detector.

272) **Silicon-drift photodiodes for gamma-ray scintillator photodetection**

1992 Proceedings of SPIE - The International Society for Optical Engineering Vol.1734 Pages 232-241

Olschner F, Lund JC, Shah KS, Squillante MR

Abstract

Silicon drift photodiodes have been developed over the last five years and are a derivative of silicon drift chambers. These devices, while lacking the position sensitivity of the silicon drift chamber, retain the qualities of low capacitance and large area. These properties make them attractive for use in applications requiring low noise high efficiency photodetection, such as for scintillation light detectors in nuclear spectroscopy. These devices might also find other uses in photonics; as replacements for silicon p-i-n photodiodes in other applications demanding low noise operation. We report on our progress in fabricating silicon drift photodiodes for use as scintillator photodetectors, specifically optimized for detecting the 550 nm emission from CsI(Tl). The design we chose to build was a square photodiode 1 cmSUP2 in area, having the general features of that described by Avset et al. Although some technical problems have temporarily delayed us from producing working drift photodiodes, we have made some diagnostic measurements on our devices and have made observations that may be of general interest.

271) **New uses of position-sensitive photomultiplier tubes**

1992 Proceedings of SPIE - The International Society for Optical Engineering Vol.1734 Pages 187-197

Gordon JS, Redus RH, Nagarkar V, Squillante MR

Abstract

Recent advances in photomultiplier tube technology have led to the availability of position sensitive photomultiplier tubes (PSPMTs). These tubes make it possible to build a new generation of imaging instruments for gamma rays and other types of ionizing radiation. We have investigated the use of these tubes for the construction of several prototype instruments. The first application investigated measures the quantity and distribution of radioactive compounds on filter papers used in microbiology research. The intent of this instrument is to replace film autoradiography with an electronic imaging system which can analyze samples 75 to 110 times faster than film. The second application involved the development of an intraoperative imaging probe to help surgeons identify cancerous tissue and ensure its complete removal. This instrument will replace a non-imaging probe now in use at many hospitals. A third prototype instrument under evaluation is an imaging nuclear survey system which obtains both a video and gamma ray image for the purpose of locating and quantifying radioactive materials. This system would be used at nuclear power plants and radioactive materials preparation facilities. A modification of this system could be built into robots used for inspecting and repairing power plants. 19 refs.

270) **InI photodetectors for scintillation spectroscopy**

1992 Proceedings of SPIE - The International Society for Optical Engineering Vol.1734 Pages 161-165

Shah KS, Moy L, Zhang J, Medrick S, Olschner F, Squillante MR

Abstract

Photoconductive detectors have been developed from a new wide bandgap (ESUBg equals 2.01 eV) semiconductor, InI, and these photodetectors are intended for use in scintillation spectroscopy of nuclear radiation. InI single crystals were produced using the Bridgman process and these crystals were characterized by measuring their optical transmission spectrum, micro-hardness, electrical resistivity, and charge transport properties. Photodetectors were fabricated from InI crystal slices by evaporating thin (less than 100 angstrom) Pd front contacts, and applying graphite back contacts. These photodetectors showed considerable promise due to their high quantum efficiency (greater than 60%) in the 300 nm to 600 nm wavelength region and their uniform photo-response over the active detector area. Finally, these photodetectors were coupled to CsI(Tl) scintillator and were successfully tested as spectrometers at room temperature by irradiating the scintillator with 5.5 MeV alpha particles (SUP2SUP4SUP1Am source) and 662 keV gamma rays (SUP1SUP3SUP7Cs source).

269) **Recent developments in the search for new semiconductor gamma-ray detector materials**

1992 Proceedings of SPIE - The International Society for Optical Engineering Vol.1734 Pages 140-145

Lund JC, Olschner F, Shah KS, Squillante MR

Abstract

Germanium has been the leading semiconductor detector material for use in gamma -ray detectors for over three decades. During this time however, many groups have sought alternative detector materials. We discuss the essential properties of a gamma -ray semiconductor material and review the status of the search for alternative materials.

268) **Recent results with a CdTe imaging portal scanner for radiation therapy**

1992 Conference Record of the 1992 IEEE Nuclear Science Symposium and Medical Imaging Conference Vol.2 Pages 1348-1350

Entine G, Redus RH, Feyder A, Biggs PJ

Abstract

A prototype portal imager has been constructed using a linear array of 256 CdTe photovoltaic detectors, each 222 mm. The array is attached to a compact linear scanner which is to be mounted in a cassette-shaped package located below the patient table. The array of detectors is moved under the patient during image acquisition. The high stopping power of CdTe allows a high-contrast image to be made using a single linac pulse for each array position. In tests conducted with a 4 MV linac, this system produced 50 cm 35 cm near-real-time images with an open field signal-to-noise ratio (SNR) of 143 and 2 mm spatial resolution in less than three seconds. This corresponds to a SNR of 1 for 1% contrast objects. Ultimately, a SNR greater than 5 at 1% contrast should be achievable with no loss of spatial resolution or increase in acquisition time.

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Abstract

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264) **Large area real-time system for screening DNA libraries**

1992 IEEE Trans. Nucl. Sci. Vol.39 Pages 1485-1489

Gordon JS, McGann W, Daley K, McConchie L, Squillante MR

Abstract

A nuclear imaging system based on a position-sensitive photomultiplier tube (PSPMT) and scintillating fiber optics is described. A real-time, large-area imaging system has been constructed and tested using realistic phantoms and biological samples. This prototype, which has an active area of 112 cm/sup 2/ was found to be more than 100 times more sensitive for detection of /sup 32/P radiation than film and provided a spatial resolution of approximately 1.7 mm. By choosing suitable fiber dimensions and packing methods on the PSPMT this system is capable of producing images over an area equal to X-ray film and with spatial resolution approaching 0.5 mm. The digital nature of the image allows a great deal of freedom in processing and displaying data, including automatic identification and location of the desired features.

263) **High contrast, CdTe portal scanner for radiation therapy**

1992 IEEE Trans. Nucl. Sci. Vol.39 Pages 1480-1484

Entine G, Squillante MR, Hahn R, Cirignano LJ, McGann W, Biggs PI

Abstract

A solid state, CdTe, linear array, portal imaging system is presented. One of the most promising new technologies for improving the quality of radiation therapy is the use of real-time systems to produce portal images. In the approach presented, a linear array of 256 CdTe photovoltaic detectors attached to a very compact linear scanner, all of which will be mounted in a cassette shaped package to be located under the patient table, is constructed. The high stopping power of the CdTe allows a high contrast image to be made using only a single linac pulse per line, resulting in a high contrast image in under 5 s.

262) **CdTe detectors in nuclear radiation dosimetry**

1992 Nucl. Instrum. Methods Phys. Res. A, Accel. Spectrom. Detect. Assoc. Equip. Vol.A322 Pages 623-627

Nagarkar V, Squillante MR, Entine G, Stern I, Sharif D

Abstract

Research in dosimetry systems at Radiation Monitoring Devices has resulted in the development of a technique which permits the energy deposited in the CdTe detector to be directly related to the tissue dose over a wide range of energy. This relationship has been utilized in the development of two prototype dosimeter instruments. The first of these serves as the basis for a compact unit which provides nearly tissue equivalent response to personnel exposure to potentially large and uncharacterized doses of radiation. The second instrument is a solid state integrating dosimeter system which is designed to monitor crew exposure to gamma rays and particles. Several CdTe detectors were used with filtering and anticoincidence techniques to separately monitor exposure to gamma rays and charged particles.

261) **New applications of CdTe nuclear detectors**

1992 Nucl. Instrum. Methods Phys. Res. A, Accel. Spectrom. Detect. Assoc. Equip. Vol.A322 Pages 569-574

Squillante MR, Entine G

Abstract

The unique properties of CdTe nuclear detectors offer a number of significant benefits to researchers, clinicians and engineers who have special requirements relating to size, sensitivity, and operating temperature. The use of CdTe nuclear detectors is continuing to expand into new areas as its unique properties and capabilities become better known and as improved manufacturing techniques increase the overall quality and yield of detectors. There is also continuing growth in areas where CdTe has become established, such as include biomedical research, medical diagnosis, cancer therapy, medical and industrial imaging and process control. In particular, there have been new procedures developed in the field of nuclear medicine, many of which require a small, sensitive detector. The authors review several new areas for CdTe detectors and detector arrays.

260) **HgBr/sub x/I/sub 2-x/ photodetectors for use in scintillation spectroscopy**

1992 Nucl. Instrum. Methods Phys. Res. A, Accel. Spectrom. Detect. Assoc. Equip. Vol.A322 Pages 509-513

Shah KS, Moy L, Zhang J, Olschner F, Lund JC, Squillante MR

Abstract

The authors have characterized photodetection properties of a new ternary semiconductor, HgBr/sub x/I/sub 2-x/. High quality crystals of HgBr/sub x/I/sub 2-x/ are produced using purified starting materials. These crystals are characterized by measuring their optical, electrical and crystallographic properties. Photodetectors are fabricated from these ternary crystals and these photodetectors are evaluated by measuring their quantum efficiency as a function of the wavelength of incident light and their performance as scintillation spectrometers. The dominant factors limiting the performance of these photodetectors are identified and the direction of the future research in order to overcome these limitations is also presented.

259) **Thallium bromide semiconductor X-ray and gamma -ray detectors**

1992 Nucl. Instrum. Methods Phys. Res. A, Accel. Spectrom. Detect. Assoc. Equip. Vol.A322 Pages 504-508

Olschner F, Shah KS, Lund JC, Zhang J, Daley K, Medrick S, Squillante MR

Abstract

Over the last few years, thallium bromide (TlBr) has been investigated for use as a semiconductor radiation detection material. This article reviews the history of TlBr detector development and describes the fabrication of state-of-the-art TlBr gamma -ray detectors. Studies of TlBr detectors of different chemical purity indicate that their performance is no longer limited by chemical purity, as was true previously. This is a result of purification methods, which employ multipass zone-refining. The authors also report on the performance of vacuum-deposited (by sublimation, approximately=100 mu m thick) TlBr films as single photon detectors. They have surprisingly high mu tau for sublimed films, and X-ray detectors made from these films may find use in some X-ray imaging applications, including xeroradiography.

258) **An improvement in growing large, oriented lead iodide single crystals for detector applications**

1992 Nucl. Instrum. Methods Phys. Res. A, Accel. Spectrom. Detect. Assoc. Equip. Vol.A322 Pages 499-503

Zhang J, Shah KS, Olschner F, Lund JC, Moy LP, Daley K, Cirignano L, Squillante MR

Abstract

Recent improvements have been made in growing large, oriented lead iodide (PbI/sub 2/) single crystals for room temperature X-ray detector applications. The effect of ampoule design on the growth of crystals by the Bridgman-Stockbarger technique was studied. Crystals, optimal for detector fabrication, were obtained using a necked ampoule with a 60 degrees bend. This ampoule produced single crystals with the c-axis parallel to the axis of the ampoule.

257) **Automatic control of semiconductor crystal-metal interface using tomographic imaging**

1992 IEEE Trans. Am. Nucl. Soc. Vol.65 Pages 76-79

Nagarkar V, Daley K, Gordon J, Squillante MR, Hazlett T

Abstract

In semiconductor crystal growth processes, the quality of the final product strongly depends on adequate control of freezing parameters including rate of solidification, the position and shape of the liquid-solid interface, and the temperature gradient at the interface. In particular, the shape and position of the interface directly affects material properties and must be controlled to a particular geometry to prevent loss of crystallinity and the formation of defects like spurious nucleation and twinning. The interface shape also affects stress in the crystals and can help prevent the resolidified material from sticking to the ampoule.

256) **High contrast, CdTe portal scanner for radiation therapy**

1992 IEEE Trans. Nucl. Sci. Vol.39 Pages 1480-1484

Entine G, Squillante MR, Hahn R, Cirignano LJ, McGann W, Biggs PI

Abstract

This paper reports on one of the most promising new technologies for improving the qualify of radiation therapy, the use of real-time systems to produce portal images. In the authors' approach, they are constructing a linear array of 256 CdTe photovoltaic detectors attached to a very compact linear scanner, all of which will be mounted in a cassette shaped package to be located under the patient table. The high stopping power of the CdTe allows a high contrast image to be made using only a single Linac pulse per line, resulting in a high contrast image in under 5 seconds.

255) **Large area real-time system for screening DNA libraries**

1992 IEEE Trans. Nucl. Sci. Vol.39 Pages 1485-1489

Gordon JS, Daley K, Squillante MR, McGann W, McConchie L

Abstract

A nuclear imaging system based on a position-sensitive photomultiplier tube and scintillating fiber optics is described in this paper. Its target application is the detection of radiolabeled DNA fragments as an aid in the isolation and harvesting of clones for sequencing the human genome. The system represents s substantial improvement in acquisition speed and dynamic range over the current method, autoradiography, while remaining competitive in terms of resolution. The digital nature of the image allows a great deal of freedom in processing and displaying data, including automatic identification and location of the desired features. Ultimately this system will be made compatible with a fully automated DNA processing system.

254) **Solid state neutron dosimeter for space applications**

1992 IEEE Trans. Nucl. Sci. Vol.39 Pages 966-970

Nagarkar V, Entine G, Stoppel P, Cirignano L, Swinehart P

Abstract

One of the most important contributions to the radiation exposure of astronauts engaged in space flight is the significant flux of high energy neutrons arising from both primary and secondary sources of ionizing radiation. Under NASA sponsorship, the authors are developing a solid state neutron sensor capable of being incorporated into a very compact, flight instrument to provide high quality real time measurement of this important radiation flux. The dosimeter uses a special, high neutron sensitivity, PIN diode that is insensitive t the other forms of ionizing radiation. The dosimeter will have the ability to measure and record neutron dose over a range of 50 microgray to tens of milligrays (5 millirads to several rads) over a flight of up to 30 days. the performance characteristics of the PIN diode with a detailed description of the overall dosimeter is presented. in this paper.

253) **A nuclear survey instrument with imaging capability**

1992 IEEE Trans. Nucl. Sci. Vol.39 Pages 948-951

Redus RH, Nagarkar V, Cirignano LJ, McGann W, Squillante MR

Abstract

A new nuclear survey instrument with an imaging capability is being developed for remotely locating high level radioactive sources with minimal operator exposure. It combines an image of the distribution of radioactivity with a video image of the area containing the source, allowing rapid, remote location of the source. The nuclear imaging system is based on a position sensitive photomultiplier tube and a diverging hole collimator. In this paper the design and measured performance of a prototype device are discussed.

252) **New technique for tissue-equivalent gamma ray dosimetry**

1992 Radiation Protection Management Vol.8 Pages 58-62

Squillante MR, Stern I, Nagarkar V, Entine G

Abstract

The use of semiconductor sensors in dosimeters is attractive for a variety of reasons including potential low cost and high sensitivity. However, the accurate measurement of the radiation dose to tissue using solid state detectors is made difficult by the relatively high atomic number of semiconductor materials. This leads to an over response to gamma ray energies below 100 keV and an under response above that. If the energy spectrum is known, corrections can be applied to yield accurate dose. In real life situations, however, the energy spectrum is not always known and may be difficult to determine at high flux rates. Also, in some cases, the energy spectrum may change with time. This paper reports that, by operating a custom-designed CdTe sensor in the pulse mode and measuring the average energy deposited, a nearly-linear relationship between the tissue dose rate and the sensor signal was obtained. Based on this technique, a prototype detector and dosimeter system were developed.

251) **New uses of position-sensitive photomultiplier tubes**

1992 PROC SPIE INT SOC OPT ENG Vol.1734 Pages 187-197

Gordon JS, Redus RH, Nagarkar V, Squillante MR

Abstract

Recent advances in photomultiplier tube technology have led to the availability of position sensitive photomultiplier tubes (PSPMTs). These tubes make it possible to build a new generation of imaging instruments for gamma rays and other types of ionizing radiation. We have investigated the use of these tubes for the construction of several prototype instruments. The first application investigated measures the quantity and distribution of radioactive compounds on filter papers used in microbiology research. The intent of this instrument is to replace film autoradiography with an electronic imaging system which can analyze samples 75 to 110 times faster than film. The second application involved the development of an intraoperative imaging probe to help surgeons identify cancerous tissue and ensure its complete removal. This instrument will replace a non-imaging probe now in use at many hospitals. A third prototype instrument under evaluation is an imaging nuclear survey system which obtains both a video and gamma ray image for the purpose of locating and quantifying radioactive materials. This system would be used at nuclear power plants and radioactive materials preparation facilities. A modification of this system could be built into robots used for inspecting and repairing power plants.

250) **Performance evaluation of new large-area avalanche photodiodes for scintillation spectroscopy**

1992 Nucl. Instrum. Methods Phys. Res., Sect. A. Vol.313 Pages 196-202

James KM, Masterson MJ, Farrell R

Abstract

Avalanche photodiodes (APDs) appear promising for certain applications as a solid state replacement for the photomultiplier tube. The increase in leakage current and capacitance noise with device active area has in the past kept the size of commercially available devices to <1 mm sup 2 . Recent advances in fabrication technology have, however, resulted in relatively low-noise devices of up to 1 in. in diameter. We have recently evaluated the performance as scintillation spectroscopy detectors of two commercial large-area avalanche photodiodes. These APDs exhibit exceptional performance: At 662 keV a 1 in. diameter device coupled to a CsI(Tl) scintillator and operating at room temperature yielded 6.9% resolution and 1-cm device coupled to CsI(Tl) and cooled to 260 K gave 4.4% resolution, which is believed to be the best resolution ever recorded for a scintillation spectrometer. (orig.).

249) **Recent progress in lead iodide X-ray spectrometer development**

1992 Nucl. Instrum. Methods Phys. Res., Sect. A. Vol.322 Pages 464-466

Lund JC, Shah KS, Olschner F, Zhang J, Moy L, Medrick S, Squillante MR

Abstract

Lead iodide shows great promise as an X-ray spectrometer material for use at room temperature and above. The pioneering work on lead iodide detectors was promising but resulted in detectors with poor energy resolution. Later, we discovered that by carefully preparing the starting materials, lead iodide detectors with good energy resolution (< 1 keV FWHM at 5.9 keV) could be fabricated. We have continued to develop these detectors with significant progress being made in the areas of purification, crystal growth and device fabrication. (orig.).

248) **CdTe detectors in nuclear radiation dosimetry**

1992 Nucl. Instrum. Methods Phys. Res., Sect. A. Vol.322 Pages 623-627

Nagarkar V, Squillante MR, Entine G, Stern I, Sharif D

Abstract

Research in dosimetry systems at Radiation Monitoring Devices has resulted in the development of a technique which permits the energy deposited in the CdTe detector to be directly related to the tissue dose over a wide range of energy. This relationship has been utilized in the development of two prototype dosimeter instruments. The first of these serves as the basis for a compact unit which provides nearly tissue equivalent response to personnel exposure to potentially large and uncharacterized doses of radiation. The second instrument is a solid state integrating dosimeter system, developed for space flight applications, which is designed to monitor crew exposure to gamma rays and particles. Several CdTe detectors were used with filtering and anticoincidence techniques to separately monitor exposure to gamma rays and charged particles. (orig.).

247) **HgBr sub x I sub 2-x photodetectors for use in scintillation spectroscopy**

1992 Nucl. Instrum. Methods Phys. Res., Sect. A. Vol.322 Pages 509-513

Shah KS, Moy LP, Zhang J, Olschner F, Lund JC, Squillante MR

Abstract

We have characterized photodetection properties of a new ternary semiconductor, HgBr sub x I sub 2-x . High quality crystals of HgBr sub x I sub 2-x are produced using purified starting materials. These crystals are characterized by measuring their optical, electrical and crystallographic properties. Photodetectors are fabricated from these ternary crystals and these photodetectors are evaluated by measuring their quantum efficiency as a function of the wavelength of incident light and their performance as scintillation spectrometers. The dominant factors limiting the performance of these photodetectors are identified and the direction of the future research in order to overcome these limitations is also presented. (orig.).

246) **New applications of CdTe nuclear detectors**

1992 Nucl. Instrum. Methods Phys. Res., Sect. A. Vol.322 Pages 569-574

Squillante MR, Entine G

Abstract

The unique properties of CdTe nuclear detectors offer a number of significant benefits to researchers, clinicians and engineers who have special requirements relating to size, sensitivity, and operating temperature. The use of CdTe nuclear detectors is continuing to expand into new areas as its unique properties and capabilities become better known and as improved manufacturing techniques increase the overall quality and yield of detectors. There is also continuing growth in areas where CdTe has become established, such as include biomedical research, medical diagnosis, cancer therapy, medical and industrial imaging and process control. In particular, there have been many new procedures developed in the field of nuclear medicine, many of which require a small, sensitive detector. This paper reviews several new areas for CdTe detectors and detector arrays. (orig.).

245) **Thallium bromide semiconductor X-ray and gamma -ray detectors**

1992 Nucl. Instrum. Methods Phys. Res., Sect. A. Vol.322 Pages 504-508

Olschner F, Shah KS, Lund JC, Zhang J, Daley K, Medrick S, Squillante MR

Abstract

Over the last few years, thallium bromide (TlBr) has been investigated for use as a semiconductor radiation detection material. This article reviews the history of TlBr detector development and describes the fabrication of state-of-the-art TlBr gamma -ray detectors. Studies of TlBr detectors of different chemical purity indicate that their performance is no longer limited by chemical purity, as was true previously. This is a result of our purification methods, which employ multipass zone-refining. We also report on the performance of vacuum-deposited (by sublimation, approx-equal 100 mu m thick) TlBr films as single photon detectors. They have surprisingly high mu tau for sublimed films, and X-ray detectors made from these films may find use in some X-ray imaging applications, including xeroradiography. (orig.).

244) **N+ + C60 reactive scattering: Substitution, charge transfer, and fragmentation**

1992 J Phys Chem Vol.96 Pages 10597

Christian JF, Wan Z, Anderson SL

243) **O+ + C60: C600+ production and decomposition, charge transfer, and formation of C590+. Dopeyball or [CO@C58]+**

1992 Chem Phys Lett Vol.199 Pages 373

Christian JF, Wan Z, Anderson SL

242) **C61+ production and decomposition in 13C+ + C60 collisions: C-atom exchange and the fragmentation pattern as a function of energy**

1992 J Phys Chem Vol.96 Pages 3574

Christian JF, Wan Z, Anderson SL

241) **Collision of Li+ and Na+ with C60: Insertion, fragmentation, and thermionic emission**

1992 Phys Rev Lett Vol.69 Pages 1352

Wan Z, Christian JF, Anderson SL

240) **Ne+ + C60: Collision energy and impact parameter dependence for endohedral complex formation, fragmentation and charge transfer**

1992 J Chem Phys Vol.96 Pages 3344

Wan Z, Christian JF, Anderson SL

239) **Oxidation reactions of metal and semi metal cluster ions**

1992 IN: Gas Phase Metal Cluster Reactions; Editor: Fontijn A, North Holland, Amsterdam Vol.605 Pages

Hintz PA, Sowa MB, Christian JF, Wan Z, Anderson SL

238) **Collision dynamics and reactivity of A+ + C60, where A+ = Ne+, C+, N+, O+, C2+; and preliminarily, B+ and F+**

1992 Netherlands Physical Society, Autumn Meeting of the Atomic Physics and quantum Electronics Section, Lunteren, The Netherlands Vol.Nov. 5-6 Pages

Christian JF, Wan Z, Anderson SL

237) **Large area real time system for screening DNA libraries**

1992 IEEE Trans Nucl Sci Vol.April Pages

Gordon JS, McGann WJ, Daley K, McConchie L, Squillante MR

236) **Application of a CdTe gamma-ray spectrometer to remote character of high-level radioactive waste tanks**

1992 IEEE Trans Nucl Sci Vol.April Pages

Keele BD, Addleman RS, Blewett GR, McClellan CS, Subrahmanyam VB, Troyer GL

235) **Applications of position sensitive photomultiplier tubes. (Abstract).**

1992 Presented to the Gamma Ray Detectors Conference, Scan Diego Vol. Pages

Squillante MR, Gordon JS, Redus RH, Nagarkar V, Daley K, Cirignano L

234) **High resolution, low energy avalanche photodiode X-ray detectors**

1991 Transactions on Nuclear Science Vol.38 Pages 144-147

Farrell R, Vanderpuye K, Entine G, Squillante MR

Abstract

Silicon avalanche photodiodes have been fabricated, and their performance as X-ray detectors has been measured. Photon sensitivity and energy resolution were measured as a function of size and operating parameters. Noise thresholds as low as 212 eV were obtained at room temperature, and backscatter X-ray fluorescence data were obtained for aluminum and other light elements. It is concluded that the results with the X-ray detector are extremely encouraging, and the performance is challenging the best available proportional counters. While not at the performance level of either cryogenic silicon or HgI2, these device operate at room temperature and can be reproduced in large numbers and with much larger areas than typically achieved with HgI2. In addition, they are rugged and appear to be indefinitely stable.

233) **Comparison of NaI(Tl), CdTe, and HgI(sub)2 surgical probes: Physical characterization**

1991 Medical Physics Vol.18 Pages 373-381

Barber HB, Barrett HH, Hickernell TS, Kwo DP, Woolfenden JM, Entine G, Ortale Baccash C

Abstract

The physical properties of three surgical probes containing different radiation detectors are compared: a NaI(Tl) scintillator with a flexible, fiber optic light guide, and two semiconductor detectors that operate at room temperature, CdTe and HgI(sub)2. Also compared are spectra, energy resolutions, and counting efficiencies measured at a variety of gamma ray energies between 30 and 1000 keV. The energy resolution of the NaI probe is substantially poorer than that of either semiconductor probe due in part to light losses in coupling the scintillator to the fiber optics. The semiconductor probes have complex spectral response due to charge carrier trapping and K x ray escape, and not all photoelectric interactions in these detectors contribute to the useful part of the photopeak. Above 120 keV the counting efficiency for the NaI probe is an order of magnitude higher than for the CdTe and HgI(sub)2 probes. Both energy resolution and counting efficiency are slightly better for the HgI(sub)2 probe than for the CdTe probe.

232) **High resolution, low energy avalanche photodiode X-ray detectors**

1991 Transactions on Nuclear Science Vol.38 Pages 144-147

Farrell R, Vanderpuye K, Entine G, Squillante MR

Abstract

Silicon avalanche photodiodes have been fabricated, and their performance as X-ray detectors has been measured. Photon sensitivity and energy resolution were measured as a function of size and operating parameters. Noise thresholds as low as 212 eV were obtained at room temperature, and backscatter X-ray fluorescence data were obtained for aluminum and other light elements. It is concluded that the results with the X-ray detector are extremely encouraging, and the performance is challenging the best available proportional counters. While not at the performance level of either cryogenic silicon or HgISUB2, these device operate at room temperature and can be reproduced in large numbers and with much larger areas than typically achieved with HgISUB2. In addition, they are rugged and appear to be indefinitely stable.

231) **Large area real-time system for screening DNA libraries**

1991 Conference Record of the 1991 IEEE Nuclear Science Symposium and Medical Imaging Conference Vol.3 Pages 1561-1565

Gordon JS, McGann W, Daley K, McConchie L, Squillante MR

Abstract

A nuclear imaging system based on a position-sensitive photomultiplier tube and scintillating fiber optics is described. Its target application is the detection of radiolabeled DNA fragments as an aid in the isolation and harvesting of clones for sequencing the human genome. The system represents a substantial improvement in acquisition speed and dynamic range over the current method, autoradiography, while remaining competitive in terms of resolution. The digital nature of the image allows a great deal of freedom in processing and displaying data, including automatic identification and location of the desired features. Ultimately this system will be made compatible with a fully automated DNA processing system.

230) **Solid state neutron dosimeter for space applications**

1991 Conference Record of the 1991 IEEE Nuclear Science Symposium and Medical Imaging Conference Vol.2 Pages 1173-1177

Nagarkar V, Entine G, Stoppel P, Cirignano L, Swinehart P

Abstract

One of the most important contributions to the radiation exposure of astronauts engaged in space flight is the significant flux of high energy neutrons arising from both primary and secondary sources of ionizing radiation. A solid state neutron sensor capable of being incorporated into a very compact flight instrument to provide high-quality realtime measurement of this important radiation flux is being developed. The dosimeter uses a special, high-neutron-sensitivity p-i-n diode that is insensitive to the other forms of ionizing radiation. The dosimeter will have the ability to measure and record neutron dose over a range of 5 mrd to several rd over a flight of up to 30 days. The performance characteristics of the p-i-n diode with detailed description of the overall dosimeter are presented.

229) **High contrast, CdTe portal scanner for radiation therapy**

1991 Conference Record of the 1991 IEEE Nuclear Science Symposium and Medical Imaging Conference Vol.3 Pages 1892-1896

Entine G, Squillante MR, Hahn R, Cirignano LJ, McGann W, Biggs PI

Abstract

One of the most promising technologies for improving the quality of radiation therapy is the use of real-time systems to produce portal images. A linear array of 256 CdTe photovoltaic detectors attached to a very compact linear scanner, all of which will be mounted in a cassette shaped package to be located under the patient table, is being constructed. The high stopping power of the CdTe allows a high-contrast image to be made using only a single linac pulse per line, resulting in a high-contrast image in under 5 s. This imager, with its scanning head having an area and thickness not very much larger than those of the presently used film cassettes, should be able to be retrofit to most existing accelerators with a minimum of complexity and expense.

228) **Intraoperative nuclear imaging probe**

1991 Conference Record of the 1991 IEEE Nuclear Science Symposium and Medical Imaging Conference Vol.3 Pages 1887-1891

Redus RH, Gordon J, McGann WJ, Entine G, Brill AB, Liu H, Karellas A

Abstract

Novel radiopharmaceuticals have recently generated a resurgence of interest in the use of hand-held, intraoperative nuclear probes to provide in vivo localization of tumors. A hand-held intraoperative nuclear imaging probe is being developed based on a position-sensitive photomultiplier tube. A compact bench-top prototype system has been built which is capable of providing real-time images with 2.5-mm resolution (for /sup 99m/Tc) over a 7-cm-diameter active area. The design and measured performance of the prototype are discussed.

227) **A nuclear survey instrument with imaging capability**

1991 Conference Record of the 1991 IEEE Nuclear Science Symposium and Medical Imaging Conference Vol.2 Pages 1354-1357

Redus RH, Nagarkar V, Cirignano LJ, McGann W, Squillante MR

Abstract

A novel nuclear survey instrument with an imaging capability is being developed for remotely locating high-level radioactive sources with minimal operator exposure. It combines an image of the distribution of radioactivity with a video image of the area containing the source, allowing rapid, remote location of the source. The nuclear imaging system is based on a position-sensitive photomultiplier tube and a diverging hole collimator. The design and measured performance of a prototype device are discussed.

226) **TlBr/sub x/I/sub 1-x/ photodetectors for scintillation spectroscopy**

1991 Conference Record of the 1991 IEEE Nuclear Science Symposium and Medical Imaging Conference Vol.1 Pages 192-196

Shah KS, Lund JC, Olschner F, Zhang J, Moy LP, Squillante MR, Moses WW, Derenzo SE

Abstract

The authors report on the evaluation of photodetectors fabricated from a ternary semiconductor, TlBr/sub x/I/sub 1-x/, for application in scintillation spectroscopy. These photodetectors are characterized in terms of their resistivity, charge transport parameters, quantum efficiency as a function of wavelength, and their performance as scintillation spectrometers. The details of TlBr/sub x/I/sub 1-x/ purification, crystal growth, and device fabrication are also addressed.

225) **High resolution, low energy avalanche photodiode X-ray detectors**

1991 IEEE Trans. Nucl. Sci. Vol.38 (1) Pages 144-147

Farrell R, Vanderpuye K, Entine G, Squillante MR

Abstract

Silicon avalanche photodiodes have been fabricated, and their performance as X-ray detectors has been measured. Photon sensitivity and energy resolution were measured as a function of size and operating parameters. Noise thresholds as low as 212 eV were obtained at room temperature, and backscatter X-ray fluorescence data were obtained for aluminum and other light elements. It is concluded that the results with the X-ray detector are extremely encouraging, and the performance is challenging the best available proportional counters. While not at the performance level of either cryogenic silicon or HgI/sub 2/, these devices operate at room temperature and can be reproduced in large numbers and with much larger areas than typically achieved with HgI/sub 2/. In addition, they are rugged and appear to be indefinitely stable.

224) **High resolution, low energy avalanche photodiode X-ray detectors**

1991 IEEE Trans. Nucl. Sci. Vol.38(2) Pages 144-147

Farrell R, Vanderpuye K, Entine G, Squillante MR

Abstract

This paper reports on silicon avalanche photodiodes fabricated and their performance as X-ray detectors measured. Photon sensitivity and energy resolution was measured as a function of size and operating parameters. Noise thresholds as low as 212 eV were obtained at room temperature and backscatter X-ray fluorescence data was obtained for aluminum and other light elements.

223) **Accurate automatic exposure controller for mammography: design and performance**

1991 Radiology Vol.178 Pages 393-396

Frederick EE, Squillante MR, Cirignano LJ, Hahn RW, Entine G

Abstract

An automatic exposure controller has been designed that controls the optical film density for film, screen, and radiographic techniques typically used in mammography to within 0.05 over a range of 1.3-6.7-cm thickness of Lucite. This degree of accuracy is better than that reported for presently available controllers. The detector system consists of four cadmium telluride detectors and involves the use of a control algorithm to read the detectors and turn off the mammography unit at the correct time. This algorithm is implemented by a microprocessor, which also provides the means for a convenient calibration.

222) **Recent developments in the search for new semiconductor gamma-ray detector materials**

1991 Proc. SPIE - Int. Soc. Opt. Eng. Vol.1734 Pages 140-145

Lund JC, Olschner F, Shah KS, Squillante MR

Abstract

Germanium has been the leading semiconductor detector material for use in gamma -ray detectors for over three decades. During this time however, many groups have sought alternative detector materials. The authors discuss the essential properties of a gamma -ray semiconductor material and review the status of the search for alternative materials.

221) **Internal and translational energy effects on cluster ion chemistry**

1991 NATO ASI on Metal-Ligand Interactions: From Atoms, to Clusters, to Surfaces, Cetraro, Italy Vol.June 10-21

Christian JF, Wan Z, Anderson SL

220) **HgBrxI2-x photodetectors for use in scintillation spectroscopy. (Abstract)**

1991 Workshop on Room Temperature Semiconductor X and Gamma-Ray Detectors, Ravello, Italy Vol.Sept.

Shah KS, Olschner F, Squillante MR, et al.

219) **Improvement in growing large oriented lead iodide monocrystals for detector application. (Abstract)**

1991 Workshop on Room Temp. Semiconductor X-ray Detectors, Ravello, Italy Vol.Sept

Zhang J, Daley K, Squillante MR, et al.