

PROCEEDINGS OF SPIE

Hard X-Ray, Gamma-Ray, and Neutron Detector Physics XXI

**Ralph B. James
Arnold Burger
Stephen A. Payne**
Editors

**12–14 August 2019
San Diego, California, United States**

Sponsored and Published by
SPIE

Volume 11114

Proceedings of SPIE 0277-786X, V. 11114

SPIE is an international society advancing an interdisciplinary approach to the science and application of light.

The papers in this volume were part of the technical conference cited on the cover and title page. Papers were selected and subject to review by the editors and conference program committee. Some conference presentations may not be available for publication. Additional papers and presentation recordings may be available online in the SPIE Digital Library at SPIDigitalLibrary.org.

The papers reflect the work and thoughts of the authors and are published herein as submitted. The publisher is not responsible for the validity of the information or for any outcomes resulting from reliance thereon.

Please use the following format to cite material from these proceedings:

Author(s), "Title of Paper," in *Hard X-Ray, Gamma-Ray, and Neutron Detector Physics XXI*, edited by Ralph B. James, Arnold Burger, Stephen A. Payne, Proceedings of SPIE Vol. 11114 (SPIE, Bellingham, WA, 2019) Seven-digit Article CID Number.

ISSN: 0277-786X
ISSN: 1996-756X (electronic)

ISBN: 9781510629219
ISBN: 9781510629226 (electronic)

Published by

SPIE

P.O. Box 10, Bellingham, Washington 98227-0010 USA
Telephone +1 360 676 3290 (Pacific Time) · Fax +1 360 647 1445

SPIE.org

Copyright © 2019, Society of Photo-Optical Instrumentation Engineers.

Copying of material in this book for internal or personal use, or for the internal or personal use of specific clients, beyond the fair use provisions granted by the U.S. Copyright Law is authorized by SPIE subject to payment of copying fees. The Transactional Reporting Service base fee for this volume is \$21.00 per article (or portion thereof), which should be paid directly to the Copyright Clearance Center (CCC), 222 Rosewood Drive, Danvers, MA 01923. Payment may also be made electronically through CCC Online at copyright.com. Other copying for republication, resale, advertising or promotion, or any form of systematic or multiple reproduction of any material in this book is prohibited except with permission in writing from the publisher. The CCC fee code is 0277-786X/19/\$21.00.

Printed in the United States of America by Curran Associates, Inc., under license from SPIE.

Publication of record for individual papers is online in the SPIE Digital Library.

**SPIE. DIGITAL
LIBRARY**

SPIDigitalLibrary.org

Paper Numbering: *Proceedings of SPIE* follow an e-First publication model. A unique citation identifier (CID) number is assigned to each article at the time of publication. Utilization of CIDs allows articles to be fully citable as soon as they are published online, and connects the same identifier to all online and print versions of the publication. SPIE uses a seven-digit CID article numbering system structured as follows:

- The first five digits correspond to the SPIE volume number.
- The last two digits indicate publication order within the volume using a Base 36 numbering system employing both numerals and letters. These two-number sets start with 00, 01, 02, 03, 04, 05, 06, 07, 08, 09, 0A, 0B ... 0Z, followed by 10-1Z, 20-2Z, etc. The CID Number appears on each page of the manuscript.

Contents

vii	Authors
xi	Conference Committee
xv	Introduction

SESSION 1 SEMICONDUCTOR DETECTORS I

11114 04	VSIPMT: a new solution in photon detection [11114-3]
----------	---

SESSION 2 SCINTILLATOR DETECTORS I

11114 07	Novel inorganic scintillators for future space-based solar gamma-ray and neutron research (Invited Paper) [11114-7]
11114 09	Recent advances in neutron detection with organic scintillators (Invited Paper) [11114-9]

SESSION 3 APPLICATIONS I

11114 0A	The innovative Cherenkov camera based on SiPM sensors of the ASTRI-Horn telescope: from the T/M and electrical design to the full assembly and testing in a harsh environment [11114-10]
11114 0D	Characterization and assembly of near-ultraviolet SiPMs for the Schwarzschild-Couder medium-size telescope proposed for the CTA Observatory [11114-13]

SESSION 4 APPLICATIONS II

11114 0F	PROSPECT: a precision reactor oscillation and spectrum experiment (Invited Paper) [11114-16]
11114 0G	Charge counting readout LSI for x-ray imaging and its applications (Invited Paper) [11114-18]
11114 0H	Xenon gamma-ray spectrometers: development and applications (Invited Paper) [11114-19]

SESSION 5 SEMICONDUCTOR DETECTORS II

11114 0N **4H-SiC epitaxial Schottky detectors: deep-level transient spectroscopy (DLTS) and pulse height spectroscopy (PHS) measurements (Invited Paper)** [11114-24]

SESSION 6 APPLICATIONS III

11114 0R **Silicon photomultipliers based neutron detector design: validation of Geant4 simulations** [11114-28]

SESSION 7 SEMICONDUCTOR DETECTORS III

11114 0T **Investigation on origin of Ru-induced deep-level defects in 4H-SiC epilayer based Schottky diodes by DLTS and theoretical calculations** [11114-30]

SESSION 8 SCINTILLATOR DETECTORS II

11114 0X **Consistent principles for particle identification by pulse shape discriminating systems (Invited Paper)** [11114-34]

11114 11 **Geant4-based multiphysics simulation toolkit for analysis of radiation detector performance** [11114-38]

SESSION 9 IMAGING DIAGNOSTICS

11114 12 **Three-dimensional characterization of the third line-of-site neutron imaging pinhole at NIF** [11114-39]

11114 13 **Time Resolved Near Field (TRNF) diagnostic four-frame nanosecond gated hybrid CMOS image sensor** [11114-40]

11114 14 **Spectral response measurement of the National Ignition Facility Kirkpatrick-Baez microscope** [11114-41]

11114 15 **Development of radiation tolerant monitor cameras used at the National Ignition Facility** [11114-43]

11114 16 **Evaluation of x-ray transmission photocathode detection issues in the energy range of 8-30 keV** [11114-44]

SESSION 10 DETECTORS FOR ICF APPLICATIONS

- 11114 17 **Design of a free-space image-relay optical time domain reflectometer to measure fiber-optic time delays at inertial confinement fusion relevant wavelengths** [11114-45]
- 11114 18 **Design techniques used to minimize impact of SEU's targeting Microsemi FPGA's at the NIF target chamber** [11114-46]

SESSION 11 APPLICATIONS IV

- 11114 1B **An associated particle imaging system for soil-carbon measurements** [11114-49]
- 11114 1D **Photon-counting x-ray computed tomography using a YAP(Ce)-PMT detector and beam hardening** [11114-51]
- 11114 1E **Intense nickel-K-photon irradiation from weakly-ionized linear plasma x-ray source with a reflector** [11114-52]
- 11114 1F **Reformatting data from common emergency radiation measurement systems into International Radiological Information Exchange (IRIX) for harmonization** [11114-53]

SESSION 12 COMPUTED TOMOGRAPHY

- 11114 1G **High-fidelity calibration and characterization of a spectral computed tomography system (Invited Paper)** [11114-54]
- 11114 1H **Investigation of low-dose energy-dispersive x-ray computed tomography utilizing beam hardening** [11114-55]

POSTER SESSION

- 11114 1L **Device "Nuclide" for the detection and identification of radioactive debris in near-Earth space** [11114-60]
- 11114 1M **Digital time-resolved spot diagnostic** [11114-61]
- 11114 1N **Growth and characterization of detector-grade CdZnTeSe by horizontal Bridgman technique** [11114-62]
- 11114 1P **High-temperature Hall-effect investigations of Cd_{0.85}Mn_{0.10}Zn_{0.05}Te crystals** [11114-64]
- 11114 1Q **Ab initio GGA+U investigations of the structural, electronic, and magnetic properties of Cd_{1-x}Mn_xTe alloy** [11114-65]

- 11114 1S **Effect of the thickness of CdTe crystals on electrical and detection properties of Cr/CdTe/Au Schottky-diode detectors** [11114-67]
- 11114 1T **Crystal growth, characterization, and fabrication of large-area Cd_{0.9}Zn_{0.1}Te pixelated detectors for high-energy gamma-ray detectors** [11114-68]
- 11114 1V **Mechanisms contributing to dark current across metal/CdMnTe/metal structures** [11114-70]
- 11114 1X **Design of a multi-hole collimator for 3D gamma ray imaging** [11114-73]