

2019 INTERNATIONAL IMAGE SENSOR WORKSHOP

Snowbird Resort, Utah, USA

June 24-27, 2019

PROGRAM

Sunday, June 23^d 2019

18:00 - **Registration**

Monday, June 24th 2019

08:00-08:30 **Registration / Welcome**

08:30-08:45 **Opening**

Session 01 **Stacking and Small Pixels**

Session Chairs: Yusuke Oike (Sony); Dun-Nian Yang (TSMC)

08:45-09:00 A new 0.8 μ m CMOS image sensor with low RTS noise and high full well capacity

R01 *Takuma Hasegawa*

09:00-09:15 A Small-size Dual Pixel CMOS Image Sensor with Vertically Broad Photodiode of 0.61 μ m pitch

R02 *Jungbin Yun*

09:15-09:30 World first mass productive 0.8 μ m pixel size image sensor with new optical isolation technology of to minimize optical loss for high sensitivity

R03 *Yunki Lee*

09:30-09:45 Digital Pixel Image Sensors with Linear and Wide-Dynamic-Range Response Developed by Pixel-Wise 3-D Integration

R04 *Masahide Goto*

09:45-10:00 The State-of-the-Art of Smartphone Imagers [abstract]

R05 *Ray Fontaine*

10:00-10:15 0.8 μ m-pitch CMOS Image Sensor with Dual Conversion Gain Pixel for Mobile Applications

R06 *Dongyoung Jang*

10:15-10:40 Break

Session 02	Noise
	Session Chair: Bumsuk Kim (Samsung)
10:40-10:55 R07	Modelling Measured 1/f Noise in Quanta Image Sensors (QIS) <i>Wei Deng</i>
10:55-11:10 R08	Several Process Techniques & Pixel Source Follower Schemes to improve the Pixel Temporal Noise <i>Manlyun Ha</i>
11:10-11:25 R09	Investigation of Field Effect Passivation Performance Using SHG Measurement For BSI Pixel <i>Sung-Kun Park</i>
11:25-11:40 R10	Identifying the Sources of Random Telegraph Noises in CMOS Image Sensors <i>Calvin Yi-Ping Chao</i>
11:40-11:55 R11	CMOS image sensors and plasma process: how PMD nitride charging acts on the dark current <i>Yolene Sacchetti</i>
11:55-12:10 R12	Random Telegraph Noise Caused by MOSFET Channel Traps and Variable Gate Induced Leakage with Multiple Sampling Readout <i>Shang-Fu Yeh</i>
12:10-13:45	Lunch
Session 03	Poster Presentations
13:45-16:55	Session Chair: Edoardo Charbon (EPFL)
P01	Active optical sensing with randomized coded light for intentional interference tolerance <i>Unghyun Kim</i>
P02	A Reconfigurable 40nm CMOS SPAD Array for LiDAR Receiver Validation <i>Sarrah Patanwala</i>
P03	A 110nm CMOS process with fully depleted high resistivity substrate for NIR, X-ray and charged particle imaging <i>Lucio Pancheri</i>

- P04 Intrinsic Si Quantum Efficiency, Responsivity, and Other Parameters Temperature Dependence for BSI Image Sensors
Sergey Velichko
- P05 Electrostatic surface passivation for p-type BSI image sensors
Thomas Dalleau
- P06 Floating Diffusion Dark Current and Dark Signal Non-Uniformity Reduction for High Dynamic Range Overflow Collection Pixels in High Temperature Applications
Michael Guidash
- P07 A large-area a-IGZO 256x256 imager using a current-mode transimpedance readout for mammography applications
Florian De Roose
- P08 Parameter-free Simulation of Photon-detection Probability in CMOS Single-photon Avalanche Diodes
Chin-An Hsieh
- P09 CMOS Single-photon Avalanche Diodes using Gated Reset Circuit with On-chip Pulse Width Modulation
Chun chang Hsu
- P10 Fast Charge Transfer in 100 μ m long PPD Pixels
Ajit Kumar Kalgi
- P11 Long Distance Ranging Performance of Gen3 LiDAR Imaging System based on 1x16 SiPM Array
Salvatore Gnechi
- P12 A Low Noise Single-Slope ADC with Signal-Dependent Multiple Sampling Technique
Sanguk Lee
- P13 Pixel with nested photo diodes and 120 dB single exposure dynamic range
Manuel Innocent
- P14 Fully Depleted SiPMs Optimized for Automotive NIR ToF in 180nm Technology
Amos Fenigstein

P15 Pixel Design Utilized P-type Substrate to Achieve Superior NIR Sensitivity and Resolution with Low Dark Noise

Takanori Usuki

P16 A 132 by 104 10 μ m-Pixel 250 μ W 1kefps Dynamic Vision Sensor with Pixel-Parallel Noise and Spatial Redundancy Suppression

Chenghan Li

P17 Extending Dynamic Range at Native Image Sensor Resolution by Pixel Coded Exposure

Rahul Gulve

P18 A versatile 3D stacked vision chip with massively parallel processing enabling low latency image analysis

Stephane Chevobbe

P19 A 2-Mpixel CMOS Image Sensor with Device Authentication and Encryption Key Generation based on Physically Unclonable Function

Shunsuke Okura

P20 A high dynamic range, 1.9 Mpixel CMOS image sensor for X-ray imaging with in-pixel charge binning and column parallel ADC

Renato Turchetta

P21 A Novel Threshold Calibration Methodology for Quanta Image Sensors (QIS)

Dakota A. Starkey

15:30-15:55 Break

P22 DUV Optimized CCD with Oxide Micro-lenses

Joseph Summa

P23 Optimization of fully-depleted PPD gated pixel for achieving high-speed charge transfer

Yun-Tzu Chang

P24 Large Format Global Shutter CMOS Image Sensors

Tomas Geurts

P25 Leakage Current Non-Uniformity and Random Telegraph Signal in CMOS Image Sensor Floating Diffusions used for In-Pixel Charge Storage

Alexandre Le Roch

- P26 Demonstration of Monolithically Integrated Pixel Sensors Based on Optical Back Biasing in 28nm node FDSOI Technology
Laurent Grenouillet
- P27 Imaging by single quantum processing: large pixels with brains or attopixels without?
Erik H.M. Heijne
- P28 SPAD array sensitivity enhancement by diffractive microlens
Jerome Vaillant
- P29 SPAD based imaging of Cherenkov light in radiation therapy
Arthur Petusseau
- P30 A 2.5 μ m 9.5 Mpixel high framerate CMOS imager with hybrid output multiplexer and 58Gb/s data rate
Jeroen Rptte
- P31 A CMOS Image Sensor with In-Pixel Temperature Sensors for Dark Current Compensation
Accel Abarca Prouza
- P32 High speed 25M global shutter image sensor with 2.5 μ m pixel
Cheng Ma
- P33 Sensor Modeling and Benchmarking --- Enabling Sensor/Algorithm Co-Design
Andrew Berkovich
- 16:55 - **Poster Viewing**

Tuesday, June 25th 2019

Session 04 **Pixels & Optics**

Session Chair: Hidekazu Takahashi (Canon)

08:30-08:45 Back Side Illuminated, Fully Depleted, Pinned Trench Photo MOS for Imaging Applications
R13 *Francois Roy*

08:45-09:00 Pixel Technology for Improving IR Quantum Efficiency of Backside-illuminated CMOS Image Sensor
R14 *Jonghoon Park*

09:00-09:15 An 8-tap CMOS Lock-in Pixel Image Sensor for Short-Pulse Time-of-Flight Measurements
R15 *Yuya Shirakawa*

09:15-09:30 A technique for phase-detection auto focus under near-infrared-ray incidence in a back-side illuminated CMOS image sensor pixel with pyramid textured interfaces for diffraction.
R16 *Tatsuya Kunikiyo*

09:30-09:45 Electrical characterization of the backside interface on BSI global shutter pixels with Tungsten-shield test structures on CDTI process
R17 *Célestin Doyen*

09:45-10:00 Image Artifacts in Backside Illumination CMOS Image Sensors Associated with Electrostatic Charge
R18 *Thad Smith*

10:00-10:25 Break

Session 5 **Photon Counting**

Session Chair: Jiaju Ma (Gigajot)

10:25-10:45 **Invited Presentation I**
I1 Vladlen Koltun - "Learning To See In The Dark"

10:45-11:00 Photon-Counting Imaging with Multi-Bit Quanta Image Sensor
R19 *Jiaju Ma*

11:00-11:15 Dual Layer 3D-Stacked High Dynamic Range SPAD Pixel
R20 *Robert Henderson*

- 11:15-11:30 Iterative image reconstruction for quanta image sensor by using variance-based motion estimation
R21 *Kiyotaka Iwabuchi*
- 11:30-11:45 Crystalline Selenium-Based Stacked CMOS Image Sensor with in-Pixel Pulse-Generating Operation Suitable for Single-Photon Counting
R22 *Shigeyuki Imura*
- 11:45-12:00 High Dynamic Range Imaging with Quanta Image Sensor
R23 *Abhiram Gnanasambandam*
- 12:00- **Lunch / Social Event**

Wednesday, June 26th 2019

- Session 6** **Range Imaging**
Session Chair: Neal Dutton (ST Microelectronics)
- 08:30-08:45 A Direct TOF Sensor with In-Pixel Differential Time-to-Charge Converters for Automotive Flash LiDAR and Other 3D Applications
R24 *Yibing Wang*
- 08:45-09:00 1kFPS Time-of-Flight Imaging with a 3D-stacked CMOS SPAD Sensor
R25 *Istvan Gyongy*
- 09:00-09:15 A Close-in LiDAR for Diffusive Media based on a 32 × 32 CMOS SPAD Image Sensor
R26 *Scott Lindner*
- 09:15-09:30 Analysis of a modular SPAD-based direct time-of-flight depth sensor architecture for wide dynamic range scenes in a LiDAR system
R27 *Preethi Padmanabhan*
- 09:30-09:45 A Time-Resolved Lock-in Pixel Image Sensor Using Multiple-Tapped Diode and Hybrid Cascade Charge Transfer Structure
R28 *Shoji Kawahito*
- 09:45-10:00 Pandion: A 400 × 100 SPAD sensor for ToF LiDAR with 5 Hz median DCR and 11 ns mean dead-time
R29 *Darek Palubiak*

10:00-10:25 **Break**

Session 7 **HDR**

Session Chair: Xinyang Wang (Gpixel)

10:25-10:40 A 4 Mpix, 160 fps High Dynamic Range BSI CMOS Image Sensor with Dual Ramp Polarity Single-slope ADC Architecture for Lateral Overflow Pixel Readout

R30 *Daniel Van Blerkom*

10:40-10:55 A High Optical Performance 2.8 μ m BSI LOFIC Pixel with 120ke⁻ FWC and 160 μ V/e⁻ Conversion Gain

R31 *Ken Miyauchi*

10:55-11:10 Sub-pixel architecture of CMOS Image Sensor achieving over 120dB Dynamic-Range with Motion Artifact-less behavior

R32 *Tomohiko Asatsuma*

11:10-11:25 A 1280x960 2.8 μ m HDR CIS with DCG and Split-Pixel Combined

R33 *Sindre Mikkelsen*

11:25-11:40 A scalable 12b-16b charge-domain multi-slope column ADC for HDR imagers with 86dB DR at 1 μ s conversion time

R34 *Simon Louwsma*

11:40-11:55 3.0 μ m Backside illuminated, lateral overflow, high dynamic range, LED flicker mitigation image sensor

R35 *Scott Johnson*

11:55-13:30 **Lunch**

Session 8 **High Speed**

Session Chair: Alex Krymski (Alexima)

13:30-13:45 Over 100 Million Frames per Second 368 Frames Global Shutter Burst CMOS Image Sensor with In-pixel Trench Capacitor Memory Array

R36 *Manabu Suzuki*

13:45-14:00 Multi-tap macro-pixel based compressive ultra-high-speed CMOS image sensor

R37 *Keiichiro Kagawa*

- 14:00-14:15 Evolution of BSI Multi-Collection-Gate Image Sensors -From Light-in-Flight imaging to Giga-fps Continuous Imaging-
R38 *Takeharu G Etoh*
- 14:15-14:30 CMOS Sensor with Panel Readout and Serialization using multiple PLLs
R39 *Alex Krymski*
- 14:30-14:45 16.7Mpixel 8000fps sparse binarized scientific image sensor
R40 *Peng Gao*
- 14:45-15:10 **Break**
- Session 9** **New Applications and Non-visible Imaging**
Session Chair: Pierre Magnan (ISAE)
- 15:10-15:30 **Invited Presentation II**
- I2 Dave Shafer, Intuitive Surgical - "Image Sensor Applications in Minimally Invasive Surgery"
- 15:30-15:45 A Sub-Electron Temporal Noise High Modulation Contrast NIR Lock-In Pixel CMOS Image Sensor for Non-Contact Physiological Measurement
R41 *Chen Cao*
- 15:45-16:00 Energy Harvesting Pixel Array with Deep Trench Isolated Diodes for Self-Powered Imaging
R42 *Filip Kaklin*
- 16:00-16:15 Advanced Fundus Camera with Color Image Acquisition in 0-lx Visible Light with Innovative NIR Multispectral Imaging System -Application Field Development of Dynamic Intelligent Systems Using High-Speed Vision-
R43 *Hirofumi Sumi*
- 16:15-16:30 Organic- and QD-based image sensors integrated on 0.13 μm CMOS ROIC for high resolution, multispectral infrared imaging
R44 *Epimiteas Georgitzikis*
- 16:30-16:45 A VGA Optical Filter-less CMOS Image Sensor with UV-selective and Visible Light Channels by Differential Spectral Response Pixels
R45 *Yhang Ricardo Sipauba Carvalho da Silva*
- 16:45-17:00 UV Photon Counting Detectors for High-Altitude Balloon and Sounding Rocket Experiments
R46 *Shouleh Nikzad*

18:30- **Dinner / Award Session**

Thursday, June 27th 2019

Session 10 **Specialty Imaging** Session Chair: Shouleh Nikzad (JPL)

08:30-08:45 A Radiation Hardened CMOS Image Sensor with Almost Zero Dark Current Increase During Radiation

R47 *Takashi Watanabe*

08:45-09:00 Multi-spectral High-Speed Backside Illuminated TDI CCD-in-CMOS Imager

R48 *Pierre Boulenc*

09:00-09:15 Partially Pinned Photodiode Performances in for Emerging Space and Nuclear Applications

R49 *Serena Rizzolo*

09:15-09:30 Image Sensor Capable of Analog Convolution for Real-time Image Recognition System Using Crystalline Oxide Semiconductor FET

R50 *Seiichi Yoneda*

09:30-09:55 **Break**

Session 11 **Global Shutter** Session Chair: Assaf Lahav (TowerJazz)

09:55-10:10 Back Side Illuminated High Dynamic Range 4.0 μ m Voltage Domain Global Shutter Pixel with Multiple Gain Readout

R51 *Kazuya Mori*

10:10-10:25 A High Performance 2.5 μ m Charge Domain Global Shutter Pixel

R52 *Ikuo Mizuno*

10:25-10:40 Near Infra-Red Enhanced 2.8 μ m Global Shutter Pixel with Light Pipe Structure and High Resistivity P-type Substrate

R53 *Masafumi Tsutsui*

10:40-10:55	Global Shutter Efficiency Improvement to >100dB in Advanced Global Shutter Imager with Correction Processing
R54	<i>Kai Shen</i>
10:55-11:10	A BSI Global Shutter Pixel with Background Light Suppression for Multi-Frame Differential Imaging
R55	<i>Xiaoliang Ge</i>
11:10-11:15	Closing Remarks