



**1993 IEEE Workshop on
Charge-Coupled Devices and Advanced Image Sensors**

June 9-11, 1993

**William G. Davies Centre for Computer Research
University of Waterloo, Waterloo
Ontario, Canada N2L 3G1**



Sponsored by IEEE Electron Devices Society

In cooperation with:

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Center for Space Microelectronics Technology**

IEEE Kitchener-Waterloo Section

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University of Waterloo**

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TECHNICAL PROGRAM

1993 IEEE Workshop on Charge-Coupled Devices and Advanced Image Sensors

June 9-11, 1993

All talks will be held at the William G. Davies Centre for Computer Research (DC)
in Room DC 1302.

TUESDAY, JUNE 8

Room DC 1301

8:00 pm - 10:00 pm

Workshop Registration

WEDNESDAY, JUNE 9

Room DC 1302

8:30

Opening Remarks

S. G. Chamberlain (Chairman)

E. R. Fossum (Technical Program Chairman)

Chairmen

E. R. Fossum and S. G. Chamberlain

8:45

A High Packing Density Pixel With Punchthrough Read-out Method for an HDTV Interline-CCD

T. Ozaki, H. Ono, H. Tanaka, A. Sato, M. Nakai

Central Research Laboratory, Hitachi Limited, Kokubunji, Tokyo 185, Japan

9:30

Deposited Multi-Spectral Filter Stripes on Transparent Tin Oxide Gate CCD Imaging Arrays

B. Frias, L. Colquitt, A. Santos, R. Tacka, T. Turley

Westinghouse Electric Corp., P.O. Box 1521, MS 3D12, Baltimore, MD 21203

J. Aguilera, R. Shimshock, Deposition Sciences Inc., 386 Tesconi Ct.

Santa Rosa, CA 95401

10:00

COFFEE BREAK

Room DC 1301

10:30

UV Response Stability of Back Side Illumination CCDs

M. Muramatsu, N. Suyama, K. Yamamoto

Solid State Division, 5th Res. & Dev. Group, Hamamatsu Photonics K.K.

Hamamatsu City, Ichino-cho, 1126-1, Japan

11:00

Development of a Back Thinned CCD for the Medium Resolution Imaging Spectrometer

M.A. Cutter, Sira Limited, South Hill, Chislehurst Kent BR7 5EH, U.K.

P. Pool, EEV Ltd., Clockhouse Lane, Chelmsford, Essex, U.K.

D. Burt, Hirst Research Centre, East Lane, Wembley, Middlesex, U.K.

11:30

Issues in the Design of Systems Incorporating Electron Bombarded CCDs

A. Reinheimer

CCD Product Group, Tektronix Inc., P.O. Box 500, Beaverton, OR 97077

12:00

LUNCH

Room DC 1301

Chairmen N. Teranishi and W. Washkurak

1:30 *A Floating Gate Wide Dynamic Range Photodetector*
B.D. Washkurak, S.G. Chamberlain
DALSA Inc., 605 McMurray Road, Waterloo, Ontario N2V 2E9, Canada

2:00 *The Effects of Potential Wells on Charge Transfer in Image Sensors*
J.P. Lavine, E.K. Banghart, C.V. Stancampiano, E.G. Stevens,
D.N. Nichols, B.C. Burkey
Microelectronics Tech. Div., Bldg. 81, Room 554, Eastman Kodak Co.
Rochester, NY 14650-2008

2:30 *Simulation and Verification of Proton-Induced Transient Responses in Bilinear CCD Imaging Arrays*
T.S. Lomheim, W.F. Woodward, T.E. Dutton, R.M. Shima, C.J. Choy,
L.W. Schumann, L.S. Kalman, R.A. Keller
The Aerospace Corporation, Sensor Systems Subdivision
P.O. Box 92957, El Segundo, CA 90009-2957
D-L. Seeley, D.R. Debs
Loral-Fairchild Imaging Sensors, 1801 McCarthy Blvd., Milpitas, CA 95035

3:00 **COFFEE BREAK** **Room DC 1301**

3:30 *Frame-Transfer CCD's with All-Gates Pinning: Device Modelling and Dark Current Evaluation*
J.T. Bosiers, E. Roks, H.L. Peek, A.C. Kleimann, A. G. van der Sijde,
P. Opmeer, M.L. Horemans
Philips Imaging Technology, Philips Research Laboratories, WAGI
P.O. Box 80000, 5600 J A Eindhoven, The Netherlands

4:15 *VOD Photo Response Analysis in CCD Image Sensor*
S. Kawai, M. Morimoto, N. Mutoh, N. Teranishi
NEC Corporation, Sensor Research Laboratory
1120 Shimokuzawa, Sagamihara, Kanagawa, 229 Japan

4:45 *A Noise Model for a Charge-Coupled Device Pixel*
R.D. McGrath
Polaroid Corporation, 21 Osborn St., Cambridge, MA 02139

5:15 **BREAK** **Room DC 1301**

POSTER PAPER PRESENTATION **Room DC 1302**

5:30 *Transient Analysis of Signal Charge Transfer in Long Diffused Regions of Spectroscopic Image Sensors*
David A.B. Dobson, S.G. Chamberlain
DALSA Inc., 605 McMurray Road, Waterloo, Ontario N2V 2E9, Canada

5:35 *A One Dimensional BCCD Model*
B.D. Washkurak, S.G. Chamberlain
DALSA Inc., 605 McMurray Road, Waterloo, Ontario N2V 2E9, Canada

- 5:40** *Very Sensitive UV Pick-up Tube Using Avalanche Multiplication in an Amorphous Selenium Target*
M. Kubota, J. Yamazaki, M. Kosugi, K.Tanioka, NHK Science & Technical Research Lab., 1-10-11, Kinuta, Setagaya-ku, Tokyo 157, Japan
T. Hirai, Central Research Lab., Hitachi Ltd., Kokubunji-shi, Tokyo 305, Japan
- 5:45** *5040 x 5040 Multi-Tap Image Sensor for High Frame Rate Applications*
M. Farrier, S.R. Kamasz, F. Ma, W.D. Washkurak, S.G. Chamberlain, P.T. Jenkins
DALSA Inc., 605 McMurray Road, Waterloo, Ontario N2V 2E9, Canada
- 5:50** *A Progress Report on the Design of a Data Push Architecture for a Pixel Array of Optimized Time Tagging Pixels*
S. Shapiro, D. Cords, Stanford Linear Accelerator Center, Stanford U. Stanford, CA 94309
S. Mani, UC Davies, Davies, CA 95616
E.L. Atlas, Adept IC Design, 440 DeAnza Ct., Oceanside, CA 92057
- 5:55** *A Reset-Noise Free High-Speed Read-out Mode for a Floating-Diffusion Detector with Resistive Feedback*
P. Centen
Broadcast Television Systems, P.O. Box 90159, 4800 RP Breda
The Netherlands
- 6:00** *2-D Modeling of CCDs*
J. Pinter
Loral-Fairchild Imaging Sensors, Ford Road, Newport Beach, CA 92658
- 6:05** *Design of a CMOS/CCD High Speed Memory for use in Parallel/Pipelined Sampled-Analog Signal Processing*
J. Strombosky, D. McClure, K. Donahue, R. Whiting
MIT Lincoln Lab, Lexington, MA 02173-9108
W. Washkurak, S. Agwani
DALSA Inc., 605 McMurray Road, Waterloo, Ontario N2V 2E9, Canada
- 6:10** *A Fast Overall Reset Multi-tap Linear Image Sensor*
D.N. Prince, W.D. Washkurak, S.G. Chamberlain, C.R. Smith
DALSA Inc., 605 McMurray Road, Waterloo, Ontario N2V 2E9, Canada
- 6:15** *Photocurrent Multiplication in a Si:H Photoconversion Layer*
K. Sawada, J. Yamazaki*, T. Ando
Research Institute of Electronics, Shizuoka University
3-5-1 Johuku, Hamamatsu 432, Japan
*NHK Science & Technical Research Lab., 1-10-11, Kinuta, Setagaya-ku Tokyo 157, Japan
- 6:20** *3000 Pixel InGaAs Linear Arrays Around the Earth*
X. Hugon
Thomson-CSF Semiconducteurs Specifiques, Avenue de Rocheplaine
BP 123, 38521 St. Egrevé, Cedex, France
- 6:25** *A Fast Framing 512(H) x 512(V) CCD Image Sensor*
Steve Strunk, Pao Chen, Hsin Fu Tseng
EG&G Reticon, Sunnyvale, CA
- 6:30** *Temperature Dependence of Radiation Induced Noise Characteristics in CCDs*
Richard Murowinski, Jamal Deen, Gao Linzhuang

- 6:40** **POSTER VIEWING in Room DC 1301**
- 6:40 - 7:30** **RECEPTION, HOST BAR in Room DC 1301**
- 7:30** **DINNER** **Room DC 1301**
- 7:40 - 8:45** **CASH BAR** **Room DC 1301**

THURSDAY, JUNE 10 **Room DC 1302**

Chairmen A. J. P. Theuwissen and T. Ando

- 8:30** *Active Pixel Sensors vs. CCDs*
E.R. Fossum
Jet Propulsion Laboratory, M/S 300-315, 4800 Oak Grove Drive
Pasadena, CA 91109
- 9:15** *CMD Image Sensor - a new approach to a future smart imager*
T. Nakamura, K. Matsumoto
Semiconductor Tech. Center, Olympus Optical Center, Japan
J. Nakamura, Technology Dev. Center, Olympus Corp., Torrance, CA 90505
- 9:45** *Recent Performance Improvements in BCMD Image Sensors*
J. Hynecsek
Texas Instruments M/S 8228, P.O. Box 225474, 8360 LBJ Freeway
Dallas, TX 75243
- 10:15** **COFFEE BREAK** **Room DC 1301**
- 10:45** *An Active Silicon Pixel Detector for High Intensity Particle Physics Experiments*
M. Campbell
CERN, CH-1211, Geneve 23, Geneva, Switzerland
- 11:15** *A Smart Pixel Array for High Luminosity Particle Detection Experiments at the Superconducting SuperCollider*
E. Beauville, F. Forti, O. Milgrome, J. Millaud, D. Nygren, M. Wright
Lawrence Berkeley Lab., MS 50B-6222, 1 Cyclotron Rd., Berkeley, CA 94720
- 11:45** *Spatial Resolution Measurements Using a Pixel Detector Telescope at FNAL*
D. Cords, S. Shapiro, Stanford Linear Accelerator Center, Stanford U., CA 94309
J.G. Jernigan, J. Arens, D. Vezie, Space Sciences Lab., UC Berkeley, CA
G. Lynch, Lawrence Berkeley Lab., UC Berkeley, CA
T. Collins, Hughes Aircraft Co., Carlsbad, CA
J. Krider, Fermi National Accelerator, Batavia, IL
P. Skubic, University of Oklahoma, Norman, Oklahoma

12:15 **LUNCH** **Room DC 1301**

Chairmen L. Yao and M. Farrier

1:30 *CCD Imagers for Soft X-ray Astronomy*
B.E. Burke

Lincoln Laboratory, Massachusetts Institute of Technology
Room L1-127, P.O. Box 73, Lexington, MA 02173-9108

2:15 *2048 × 2048 CCD, 3 Side Buttable Designed for Large Focal Planes*

J.A. Cortiula and V. Nguyen

Thomson-CSF Semiconducteurs Specifiques, Avenue de Rocheplaine
BP 123, 38521 St. Egreve, Cedex France

2:45 **COFFEE BREAK** **Room DC 1301**

3:15 *Self-Analysis of CCD Image Sensors Using Dark Current Spectroscopy*

W.E. McColgin, J.P. Lavine, C.V. Stancampiano, J. Kyan, D.N. Nichols
Eastman Kodak Company, Bldg. 81, Microelectronics Tech. Division
Rochester, NY 14650-2008

4:00 *Characterization of High-Resolution TDI-CCD Imagers*

H-S.P. Wong, Y.L. Yao, F.P. Giordano

IBM, Thomas J. Watson Research Center, P.O. Box 704, Room J1C80
Yorktown Heights, NY 10598

4:30 *The CCD-Addressed Liquid Crystal Light Valve*

U. Efron, W.R. Byles, N.W. Goodwin, K. Sayyah, A. Au, S. Wu

Hughes Research Laboratories, Bldg. 250, MS RL69
3011 Malibu Canyon Road, Malibu, CA 90265

7:30 **BARBECUE**

Location - Court opposite Bon Apetite

(Rain location - Festival Room, South Campus Hall)

FRIDAY, JUNE 11

Room DC 1302

Chairmen J. Bosiers and D. Dobson

8:30 *On-Chip A/D Conversion for Image Sensors*
S. Mendis, R. Nixon, E. Olsen, B. Pain, E. Fossum
Columbia University, NY and
Jet Propulsion Laboratory, M/S 300-315, 4800 Oak Grove Drive
Pasadena CA 91109

9:00 **COFFEE BREAK** **Room DC 1301**

9:30 *1 GHz Multiple Output 128 × 256 Element Area Array*
B.D. Washkurak, S.G. Chamberlain
DALSA Inc., 605 McMurray Road, Waterloo, Ontario N2V 2E9, Canada

10:00 *Analysis and Results of a Random Access Charge Injection Device*
J. Zarnowski, M. Pace, J. Carbone, E. Eid
CID Technologies Inc., 101 Commerce Blvd.
Liverpool, NY 13088-0455

10:30 *Investigating the Uniphase Operation of a GaAs Resistive Gate Charge-Coupled Device Using Time Domain Techniques*
M. LeNoble, J.V. Cresswell
TRIUMF, 4004 Westbrook Ball, Vancouver, BC V6T 2A3, Canada

11:00 **CONCLUSIONS**