IEEE Electron Devices Society

Awards

to be

presented during the

2021 IEEE International Electron Devices Meeting

December 2021
2021
IEEE Electron Devices Society
Award Recipients

IEEE EDS Fellows - Class of 2021

EDS Paul Rappaport Award

EDS George E. Smith Award

EDS Leo Esaki Award

EDS Distinguished Service Award
Dr. Samar Saha

EDS Education Award
Professor Tsu-Jae King Liu

EDS Lester F. Eastman Award
Professor Erhard Kohn

EDS J.J. Ebers Award
Dr. Bruce Gnade
IEEE Fellow is a distinction reserved for select IEEE members whose extraordinary accomplishments in any of the IEEE fields of interest are deemed fitting of this prestigious grade elevation.

Deji Akinwande
Hideaki Aochi
Benton Calhoun
Yogesh Chauhan
Vasilis Fthenakis
Robert Henderson
Ali Keshavarzi
Chang-Jin “CJ” Kim
Gourab Majumdar
Jun Ohta
Bryan Root
Ashwin Seshia
Tetsuya Suemitsu
Takatoshi Tsujimura
Yifeng Wu
Shinji Yuasa
EDS PAUL RAPPAPORT AWARD

The Paul Rappaport Award was established in 1984 to recognize the best paper appearing in a fast turn around archival publication of the IEEE Electron Devices Society, targeted to the IEEE Transactions on Electron Devices.

Winning Paper:
*Improved Air Spacer for Highly Scaled CMOS Technology*

Authors:
Kangguo Cheng, Chanro Park, Heng Wu, Juntao Li, Son Nguyen, Jingyun Zhang, Miaomiao Wang, Sanjay Mehta, Zuoguang Liu, Richard Conti, Nicholas J. Loubet, Julien Frougier, Andrew Greene, Tenko Yamashita, Balasubramanian Haran and Rama Divakaruni
EDS GEORGE E. SMITH AWARD

The George E. Smith Award was established in 2002 to recognize the best paper appearing in a fast turn around archival publication of the IEEE Electron Devices Society, targeted to the IEEE Electron Device Letters.

**Winning Paper:**

_Theoretical Limit of Low Temperature Subthreshold Swing in Field-Effect Transistors_

**Authors:**

Arnout Beckers, Farzan Jazaeri and Christian C. Enz
The EDS Leo Esaki Award was established in 2019 to recognize the best paper appearing in a fast turn around archival publication of the IEEE Electron Devices Society, targeted to the IEEE Journal of Electron Devices Society.

**Winning Paper:**

*A New 8T Hybrid Nonvolatile SRAM with Ferroelectric FET*

**Authors:**

Wei-Xiang You, Pin Su and Chenming Hu
# EDS Distinguished Service Award

The EDS Distinguished Service Award was established in 1993 by the IEEE Electron Devices Society.

The Award is presented annually and is intended to recognize and honor outstanding service to the Electron Devices Society and its sponsored activities.

## Previous Award Winners

<table>
<thead>
<tr>
<th>Year</th>
<th>Name</th>
</tr>
</thead>
<tbody>
<tr>
<td>1994</td>
<td>Friedolf M. Smits</td>
</tr>
<tr>
<td>1995</td>
<td>Lewis M. Terman</td>
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<tr>
<td>1996</td>
<td>Alfred U. Mac Rae</td>
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<tr>
<td>1997</td>
<td>George E. Smith</td>
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<tr>
<td>1998</td>
<td>W. Dexter Johnston, Jr.</td>
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<td>1999</td>
<td>John R. Brews</td>
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<td>2000</td>
<td>Michael S. Adler</td>
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<tr>
<td>2001</td>
<td>H. Craig Casey, Jr.</td>
</tr>
<tr>
<td>2002</td>
<td>Lucian A. Kasprzak</td>
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<tr>
<td>2003</td>
<td>Frederick H. Dill</td>
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<tr>
<td>2004</td>
<td>Louis C. Parrillo</td>
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<tr>
<td>2005</td>
<td>Cary Y. Yang</td>
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<tr>
<td>2006</td>
<td>Steven J. Hillenius</td>
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<td>2007</td>
<td>Richard S. Muller</td>
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<tr>
<td>2008</td>
<td>Hiroshi Iwai</td>
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<td>2009</td>
<td>Tak H. Ning</td>
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<td>2010</td>
<td>Marvin H. White</td>
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<tr>
<td>2011</td>
<td>Ilesanmi Adesida</td>
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<tr>
<td>2012</td>
<td>Douglas P. Verret</td>
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<tr>
<td>2013</td>
<td>Cor L. Claeys</td>
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<tr>
<td>2014</td>
<td>Yuan Taur</td>
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<td>2015</td>
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<tr>
<td>2016</td>
<td>Renuka P. Jindal</td>
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<tr>
<td>2017</td>
<td>Paul K.L. Yu</td>
</tr>
<tr>
<td>2018</td>
<td>Shuji Ikeda</td>
</tr>
<tr>
<td>2019</td>
<td>Albert Z. H. Wang</td>
</tr>
<tr>
<td>2020</td>
<td>Jacobus W. Swart</td>
</tr>
</tbody>
</table>
Samar Saha works as the Chief Research Scientist at Prospicient Devices, Milpitas, California and is an Adjunct faculty in the Electrical Engineering department at the Santa Clara University, California, USA. Since 1984, he has worked in various technical and managerial positions at National Semiconductor, LSI Logic, Texas Instruments, Philips Semiconductors, Silicon Storage Technology, Synopsys, DSM Solutions, Silterra USA, and SuVolta. In academia, he was a faculty member in the Electrical Engineering departments at Southern Illinois University at Carbondale, Illinois; Auburn University, Alabama; the University of Nevada at Las Vegas, Nevada; and the University of Colorado at Colorado Springs, Colorado.

At Prospicient Devices he is working on exploratory device research to develop next generation integrated circuit devices for advanced technology at the nanometer nodes. He has authored over 100 research papers; two books entitled, *FinFET Devices for VLSI Circuits and Systems*, CRC Press, Florida (2020) and *Compact Models for Integrated Circuit Design: Conventional Transistors and Beyond*, CRC Press, Florida (2015); one book chapter on Technology Computer-Aided Design (TCAD), titled, *Introduction to Technology Computer-Aided Design*, in Technology Computer Aided Design: Simulation for VLSI MOSFET, C.K. Sarkar (Editor): CRC Press, Florida (2013). He was awarded 12 US patents. His patent on double-halo metal-oxide-semiconductor field-effect transistor has contributed significantly to continued scaling of planar-complementary metal-oxide-semiconductor (CMOS) technologies that has a global impact on CMOS IC chip business with a total value over USD 300 billion per year.

In the IEEE, he has served as the 2016-2017 elected President of the Electron Devices Society (EDS) and currently serving as the Senior Past President. In editorial board, he has served as the guest editor for Special Issues of the IEEE TRANSACTIONS ON ELECTRON DEVICES (T-ED) and the IEEE JOURNAL OF ELECTRON DEVICES SOCIETY (J-EDS). Currently, he is a lead co-editor of the *Frontiers in Computational Neuroscience* for publishing a collection of focused articles in the journal. He has, also, served as a member of the editorial board of the World Journal of Condensed Matter Physics (WJCMP) published by Scientific Research Publishing (SCIRP).

Dr. Saha has been living in the San Francisco Bay Area / Silicon-Valley for last four decades. He received the PhD degree in Physics from Gauhati University and an MS degree in Engineering Management from Stanford University. He is a distinguished Lecturer of EDS, an IEEE Life Fellow, and a Fellow of the Institution of Engineering and Technology (IET), UK.
DR. SAMAR SAHA
KEY POSITIONS HELD

IEEE & EDS Activities

2001-2004  EDS Compact Modeling Technical Committee Member
2004-Present  EDS Santa Clara Valley Chapter
2005-2006  EDS Meetings Committee Member
2005-2006  EDS Santa Clara Valley Chapter Treasurer
2005-2008  EDS Compact Modeling Technical Committee Chair
2005-2008  EDS Representative to the Council of Electronic Design Automation
2005-Present  EDS Distinguished Lecturer (DL)
2006-2008  IEEE TSM Editorial Steering Committee Member
2006  Head Guest Editor, T-ED Special Issue
2007  EDS Regions/Chapters Vice-chair
2007  EDS Santa Clara Valley Chapter Vice-Chair
2007-2020  Founding Editor-In-Chief, QuestEDS
2008  Co-founder and first General chair, CAD-TFT Conference
2008  EDS Regions/Chapters, North-America West Chair
2008  EDS Santa Clara Valley Chapter Chair
2009  Head Guest Editor, T-ED Special Issue
2009-2013  EDS Vice-President of Publications
2009-2013  EDS Paul Rappaport Award Chair for ‘IEEE Transactions on Electron Devices (T-ED)’ best paper
2009-2013  EDS George Smith Award Chair for ‘IEEE Electron Device Letters (EDL)’ best paper
2009-2021  EDS Early Career Award Committee Member
2009-2021  EDS Finance Committee Member
2012  IEEE TAB Conference Publications Committee Member
2012-2014  EDS Elected member, Board-of-Governors
2012-2017  EDS Membership Committee Member
2013  Guest-Editor, T-ED Special Issue
2013-2014  IEEE TAB Periodicals Committee Member
2014-2015  EDS President-Elect
2014-2015  EDS Early Career Award Committee Chair
2014-2021  EDS Awards Committee Member
2015-2017  EDS Meetings Committee Member
2016-2017  EDS Nominations and Election Committee Member
2016-2017  EDS President
2016-2017  IEEE TAB Presidents Forum Member
2016-2017  EDS Celebrated Member Committee Chair
2017  Launched IEEE Electron Devices Technology and Manufacturing (EDTM) conference
2018-2019  EDS Nominations and Election Committee Chair
2018-2021  EDS Celebrated Member Committee Member
2017-2021  EDS Newsletter Committee Member
2018  Co-founder/Co-General IFETC Chair
2018  IEEE TAB Educational Activities Ad Hoc Committee Chair
2018-2019  EDS Awards Chair
2018-2019  EDS Junior Past-President
2018-2021  EDS Education Award Committee Member
2018-2021  EDS Region 9 Outstanding Student Paper Award Committee Member
2018-2021  IEEE Press Coordinator
2019  EDS Fellow Evaluation Committee Member
2019  Guest Editor, J-EDS Special Issue
2020  Head Guest Editor, J-EDS Special Issue
2020-2021  EDS Fellow Evaluation Committee Chair
2020-2021  EDS Humanitarian Committee Member
2020-2021  EDS Education Awards Committee Member
2020-2021  EDS J.J. Ebers Award Chair
2020-2021  EDS Publications Committee Member
2020-2021  EDS Sr. Past President
2020-2021  EDS Strategic Directions Committee
2020-2021  EDS Undergraduate Student Scholarship Committee Chair
2020-2021  IEEE Future Directions Committee - Rebooting Computing
2021  Head Guest Editor, J-EDS Special Issue
EDUCATION AWARD

The EDS Education Award was established in 2006 by the IEEE Electron Devices Society.

The Award is presented annually and is intended to recognize distinguished contributions to education within the fields of interest of the IEEE Electron Devices Society.

PREVIOUS AWARD WINNERS

2006    Mark S. Lundstrom
2007    Meyya Meyyappan
2008    Robert W. Dutton
2009    David L. Pulfrey
2010    Sorab K. Ghandhi
2011    Chenming Hu
2012    Jesús Del Alamo
2013    Charvaka Duvvury
2014    Juin J. Liou
2015    Roger T. Howe
2016    Hiroshi Iwai
2017    Mansun Chan
2018    Muhammad Ashraful Alam
2019    Chennupati Jagadish
2020    Valipe Ramgopal Rao
2021 EDUCATION AWARD RECIPIENT

PROFESSOR TSU-JAE KING LIU

“For outstanding contributions to education in the field of electron devices and achievements on diversity and inclusion”

Tsu-Jae King Liu was born in Ithaca, NY in 1963 and raised in the San Francisco Bay Area. She earned her B.S., M.S. and Ph.D. degrees in electrical engineering (EE) from Stanford University. In 1992 she joined the research staff at the Xerox Palo Alto Research Center, where she worked on thin-film transistor technology for large-area electronics applications. In 1996 she joined the faculty of the Department of Electrical Engineering and Computer Sciences (EECS) at the University of California, Berkeley, where she has taught and conducted research on semiconductor logic and memory devices and technology, and has held a number of administrative leadership positions. She began her tenure as Dean of the College of Engineering in July 2018.

Liu has authored or co-authored over 550 publications and holds close to 100 patents. She is a fellow of the Institute of Electrical and Electronics Engineers (IEEE), an elected member of the U.S. National Academy of Engineering, a fellow of the National Academy of Inventors, and a board member for Intel Corporation and for MaxLinear, Inc. Her awards include the Ross M. Tucker AIME Electronics Materials Award for seminal work in polycrystalline silicon-germanium thin films, the Intel Outstanding Researcher in Nanotechnology Award, the Semiconductor Industry Association University Research Award, the IEEE Aldert van der Ziel Award for distinguished educational and research contributions to the field of electronic devices and materials, and the DARPA Significant Technical Achievement Award for her role in the development of the FinFET, an advanced transistor design used in all leading-edge computer chips today.

In addition to excelling in research, Liu has demonstrated a strong commitment to enhancing the educational experience of students. As department chair she oversaw major renovations to electronics design and computing labs to create a vibrant and collaborative learning environment for undergraduate students. As dean she has bolstered programs to support the academic success and well-being of both undergraduate and graduate engineering students. Throughout her career she has actively engaged in efforts to diversify the K-12 pipeline to engineering degree programs, to support the success of women and students from underrepresented minority groups and first-generation college students, and to increase the diversity of engineering graduate students and faculty. She strives to cultivate a more inclusive engineering culture that values and leverages diversity to unlock individual and collective potential. Her dedication to excellence in education earned Liu the EE Division Outstanding Teaching Award, UC Berkeley Distinguished Faculty Mentoring Award and the Semiconductor Research Corporation Aristotle Award.
EDS LESTER F. EASTMAN AWARD

The Lester F. Eastman Award was established in 2019 by the IEEE Electron Devices Society. It is intended to recognize individuals with outstanding achievement in high-performance semiconductor devices.

PREVIOUS AWARD WINNERS

2020 Asif Khan
2021 EDS Lester F. Eastman Award Recipient

Professor Erhard Kohn

“For outstanding achievement in high-performance semiconductor devices”

Erhard Kohn is a professor at Ulm University, heading the Institute of Electron Devices and Circuits until his retirement in 2009. Since then, he has been visiting professor to the Technical University of Vienna, Notre Dame and presently NCSU.

He received his Dr. Ing. degree from the Technical Univ. of Aachen (Germany) in 1975 with work on GaAs based field effect transistors, highlighted by the realization of an integrated differential MESFET amplifier pair with integrated current source (IEDM 1974). After 2 years at the University of Newcastle upon Tyne (UK) this was followed by an approx. 15 year period going through industrial research before returning to academia.

Stations were AEG Telefunken in Germany, Thomson CSF-DAG in France and Siemens Corp. Research in Princeton, NJ. At Thomson CSF the challenge was to set up a GaAs IC pilot line technology for analogue and digital applications based on ion-implantation. This work was accompanied by 5 subsequent sabbaticals to Cornell University in Lester Eastman’s group. It was a unique experience and the beginning of a long lasting relationship with Lester and Cornell. During the 1980’s the Siemens Company decided to set up a semiconductor technology department at their NJ Research and Technology Laboratory, extending their Munich based GaAs activities. Drawing heavily from Lester’s experience, the first GaAs HEMT crossing the 100 GHz threshold could be demonstrated. However, the many changes did also represented a heavy load on his family, especially his 2 children, but was perfectly mastered by Renate, his wife.

In 1989 the Inst. of Electron Devices and Circuits was established at Ulm University. Work moved to III-nitrides and diamond, two wide bandgap materials with ceramic-like stability and ultra-hard properties. Investigating both materials side by side enabled many new device structures, covering the field of electronics, biochemistry, electrochemistry, thermal management as well as MEMS sensors and actuators. As an example, InAIN/GaN HEMT operation at 1000 °C in vacuum could be demonstrated, not expected for an In-containing III-nitride compound. The key was a native 2D-oxide passivation layer discovered in a “golden experiment” by accident, the technology also permitting diamond overgrowth of fully processed GaN devices. The work resulted in more than 130 journal contributions and more than 300 conference and workshop presentations and the formation of 2 spin-off companies.

Erhard had been a distinguished IEEE lecturer and served on the board of the German IEEE-EDS chapter. For many years he was the European Chair and a Trustee of the DRC and for 10 years an executive board member of the Elsevier Diamond conference.
EDS J.J. EBERS AWARD

The J.J. Ebers Award was established in 1971 by the IEEE Electron Devices Society. It is intended to foster progress in electron devices and to commemorate the life activities of Jewell James Ebers, whose distinguished contributions, particularly in the transistor art, shaped the understanding and technology of electron devices. The award is intended to recognize and honor accomplishments of unusual merit in the electron device field and is given for outstanding technical contributions to electron devices.

PREVIOUS AWARD WINNERS

1971 John L. Moll 1996 Tetsushi Sakai
1972 Charles W. Mueller 1997 Marvin H. White
1973 Herbert Kroemer 1998 B. Jayant Baliga
1974 Andrew S. Grove 1999 James T. Clemens
1975 Jacques I. Pankove 2000 Bernard S. Meyerson
1976 Marion E. Hines 2001 Hiroshi Iwai
1977 Anthony E. Siegman 2002 Lester F. Eastman
1979 James M. Early 2004 Jerry G. Fossum
1980 James D. Meindl 2005 Bijan Davari
1983 Adolf Goetzberger 2008 Mark R. Pinto
1984 Izuho Hayashi 2009 Baruch Levush
1985 Walter F. Kosonocky 2010 Mark E. Law
1986 Pallab K. Chatterjee 2011 Stuart Ross Wenham
1987 Robert W. Dutton 2012 Yuan Taur
1988 Al F. Tasch, Jr. 2013 Nobukazu Teranishi
1989 Tak H. Ning 2014 Joachim N. Burghartz
1990 Yoshiyuki Takeishi 2015 Jack Yuan-Chen Sun
1991 Simon M. Sze 2016 Jaroslav Hynceck
1994 Alfred U. MacRae 2018 Michael Shur
1995 Martin A. Green 2019 H.-S. Philip Wong
1996 Arokia Nathan
2021 EDS J.J. EBERS AWARD RECIPIENT

DR. BRUCE GNADE

“For materials contributions to CMOS and flexible electronics technologies”

For over 30 years, Bruce Gnade has been an influential leader in electronic materials and device technologies, from device physics to science and engineering policy. His contributions while at Texas Instruments (TI) to low-k and high-k dielectrics in Si-CMOS and the development of high resolution display technology have been significant in both industries. His contributions to electronic materials, device engineering, and technology development resulted in 77 US patents, 54 international patents, and over 200 journal papers. He has delivered over 100 keynote/invited presentations and continues to serve as an advisor to universities and companies around the world.

After receiving his BA in Chemistry from St. Louis University in 1976 and his Ph.D. in Nuclear Chemistry from the Georgia Institute of Technology in 1982, he joined the Central Research Labs at Texas Instruments in Dallas, TX where he led several research and technology groups from 1982-1996. He left TI in 1996 to join the Defense Advanced Research Projects Agency (DARPA) as a program manager in the Microsystems Technology Office. As a DARPA program manager, he initiated new programs in micro-displays, flexible electronics, and molecular electronics. His early vision continues to influence technical progress in these important areas. Flexible electronics is now being implemented in applications ranging from implantable medical devices to foldable displays.

In 2003 he joined the faculty at the University of Texas at Dallas as a professor of Electrical Engineering. He had two prominent roles at the University of Texas at Dallas (UTD). As founding chair of the UTD Mat. Sci. & Eng. Dept., he built the department into a leading center of excellence in electronic materials. Later as VP of Research and the Distinguished Chair in Microelectronics for 10 years, he helped grow UT Dallas into a Carnegie Tier 1 research university focused on basic Science and Engineering. He is currently Professor Emeritus at UT Dallas, and the Executive Director of the Hart Center for Engineering Leadership in the Lyle School of Engineering at Southern Methodist University, where he is giving back to the engineering community by mentoring and teaching the young engineering students at SMU. He serves as Chair of the Board of Directors of Oak Ridge Associated Universities. He has served on the Editorial Boards of IEEE/OSA Journal of Display Technology and the Journal of Vacuum Science and Technology. He was a Guest Editor for a special issue on Flat Panel Display Technology in the Proc. of the IEEE. He is a Fellow of APS, IEEE, and National Academy of Inventors.
IEEE EDS Members enjoy an incredible array of free and deeply discounted, members-only benefits for only US$10.00 per year. IEEE Student members save even more and can join EDS for US$5.00 a year!

Exclusive access to EDS content, community events and funding:

- NEW EDS Resource Center - a portal to electron device content
- NEW Podcast Series - personal interviews with internationally known engineers
- Attend live EDS Webinars, or replays of past events in the EDS Webinar Archive
- Attend Virtual Chapter Events throughout the world
- Keep abreast of the latest technical content with free access to some of our top Journals and conference proceedings in the IEEE Xplore Digital Library
- Network with EDS members
- Receive Technical Briefs and Society News in the EDS Newsletter
- Access to Grants with our Student Fellowship Programs
- Volunteer Opportunities in Society Governance and Humanitarian Programs
- Monthly EDS Society Brief featuring important announcements

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EDS OFFICERS & AWARD CHAIRS

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Jr. Past President, Fernando Guarin

Sr. Past President, Samar K. Saha

Secretary, M.K. Radhakrishnan

Treasurer, Bin Zhao

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Fellows Chair, Samar Saha

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George E. Smith Award Chair, Joachim Burghartz

Leo Esaki Award, Joachim Burghartz

Distinguished Service Award Chair, Ravi Todi

Education Award Chair, Muhammad Alam

Lester F. Eastman Award Chair, James Hwang

J.J. Ebers Award Chair, Samar Saha