BIOGRAPHICAL SKETCH

Provide the following information for the Senior/key personnel and other significant contributors.
Follow this format for each person. **DO NOT EXCEED FIVE PAGES.**

NAME: Harris, James Stewart

ERA COMMONS USER NAME (credential, e.g., agency login): jharris

POSITION TITLE: Professor of Electrical Engineering and by courtesy, Applied Physics and Materials Science

EDUCATION/TRAINING *(Begin with baccalaureate or other initial professional education, such as nursing, include postdoctoral training and residency training if applicable. Add/delete rows as necessary.)*

INSTITUTION AND LOCATION	DEGREE *(if applicable)*	Completion Date MM/YYYY	FIELD OF STUDY
Stanford University, Stanford, CA	B.S.	1964	Electrical Engineering
Stanford University, Stanford, CA	M.S.	1965	Electrical Engineering
Stanford University, Stanford, CA	PhD.	1969	Electrical Engineering

A. Personal Statement

I have carried out research on novel semiconductor materials and their growth at atomic level dimensions for the past 50 years. At Stanford University, I have the largest research group focused on the applications of new materials to electronic and photonic devices and have been the principal PhD thesis professor for 138 PhD students. Over the past decade, I have been collaborating with faculty in the Stanford University Medical School applying my expertise into active biosensors for real-time monitoring of blood chemistry to track development and treatment of cancer, traumatic brain injury and a patients hemostatic state during dialysis or surgery and development of a retinal prosthesis. My experience and expertise are directly relevant to development of novel materials and device structures for detection of energetic photons emitted in PET scans, particularly their precise time resolution.

B. Positions and Honors

Positions and Employment

1969-1972 Member of Technical Staff, Rockwell International Science Center, Thousand Oaks, CA.
1972-1978 Manager Infrared Devices, Rockwell International Science Center, Thousand Oaks, CA.
1978-1980 Principal Scientist, Rockwell International Science Center, Thousand Oaks, CA.
1980-1982 Director Optoelectronics Research, Rockwell International Science Center, Thousand Oaks
1982-present James and Ellenor Chesebrough Professor of Electrical Engineering and by courtesy, Materials Science and Applied Physics, Stanford University.
1984-1998 Director, Solid State Laboratory, Stanford University.
1985-1999 Director, Joint Services Electronics Program, Stanford University.
1992-2006 Principal Investigator, Stanford US-Asia Technology Management Center.

Other Experience and Professional Memberships

- Member IEEE, American Physical Society, Materials Research Society, Optical Society of America, Electrochemical Society
- Serving on National Academy of Engineering review panel of NIST, 2015-16
- Serving on National Academy of Engineering review panel of US Army Research Labs, 2013-16

Honors

1963 Tau Beta Pi, Stanford University,
1964 Terman Engineering Award, Stanford University,
1964 Graduated BS with Great Distinction and Phi Beta Kappa, Stanford University,
1968 Sigma Xi, Stanford University,
1978 United Nations Visiting Professor, State University Sao Paulo, Campiñas, Brazil,
1988 Fellow, IEEE,
1991 James and Ellenor Chesebrough Professor in the School of Engineering, Stanford University
1992 Visiting Professor, Ecole Polytechnique Federale de Lausanne, Switzerland,
1992 Fellow, American Physical Society,
1994 Stanford Associates Alumni Award,
1998 Alexander von Humboldt Foundation Senior Research Prize,
1999 Humboldt Fellow and Visiting Professor, Paul Drude Institute, Berlin, Germany
1999-06 Visiting Professor and Research Fellow, Kochi University of Technology, Japan,
2000 IEEE Morris N. Liebmann Memorial Award,
2000 International Symposium on Compound Semiconductors Award and Heinrich Welker Medal,
2000 IEEE Third Millennium Medal,
2005 Fellow Optical Society of America
2008 International MBE Conference MBE Innovator Award
2009 Fellow Materials Research Society
2011 Elected Member National Academy of Engineering
2013 Semiconductor Research Corporation Aristotle Award
2014 International MBE Conference Al Cho Award

C. Contribution to Science

I have been among the most prolific researchers with respect to discovery and development of new materials and processing technologies that have enabled new electronic and photonic devices that have been successfully transferred into products that have had a major technological and societal impact. I have more than 1000 publications in the literature with more than 16,000 citations.

In the 1970s, I led a research team that became preeminent in the development of GaAs based high-speed electronics. Chief among the accomplishments were the growth of the first 3", [100] Czochralski GaAs that produced circular wafers that could then use all of the Si-based lithography and advanced processing equipment. This led to establishing a major 25 year program at DARPA for GaAs development and establishing the first GaAs pilot line for high-speed digital electronics at Rockwell. I demonstrated the successful n-type doping of semi-insulating GaAs by ion implantation which was used by Vitesse to produce the first commercial high-speed digital multiplex/demultiplex circuits that were absolutely critical for the expansion of the early optical networks from OC-12 to OC-48 and eventually OC-192. This was the foundation of the backbone communications and Internet as we know it today.

I made fundamental contributions to the development of heterojunction bipolar transistors (HBTs) that were transferred from my lab at Rockwell to Conexant and Skyworks of which there are now two HBTs in the power amplifier for every cell phone today.

In 1982, I moved to Stanford and established a new MBE growth and compound semiconductor device lab. Among our accomplishments were the first precisely controlled, single phase high Tc superconductors, multi-layered, stacked and coupled InAs quantum dots for low threshold lasers and saturable absorber mirrors, MEMS tunable lasers, orientation patterned GaAs for highly efficient non-linear optical conversion, the first demonstration of the quantum confined Stark effect in Ge/Si quantum wells and demonstration of the lowest threshold communications wavelength lasers and the highest efficiency 1eV bandgap solar cells with GaInNAsSb on GaAs.

The GaInNAsSb material and patent led to the formation of Solar Junction with three of my former PhD students. Solar Junction developed high-efficiency multi-junction concentrator solar cells based upon the

technology developed in my lab on dilute nitride materials that enable optimized bandgap cells lattice matched to GaAs. My students and I pioneered this work and growth by MBE and Solar Junction was the first to put MBE into production. They were also one of four companies receiving DOE Photovoltaic Incubator Program awards in 2010 and built a manufacturing capability to produce ~250MW of concentrator solar cells/year for utility scale generation. This is the first large area device technology to utilize MBE for manufacturing and will be a key technology for large-scale electricity generation because of lower cost and land area required with double the efficiency of single junction cells.

D. Research Support

For all other individuals required to complete a biosketch, list selected ongoing and completed research projects for the past three years (Federal or non-Federal support). Briefly indicate the overall goals of the projects and your responsibilities. *Do not include number of person months or direct costs*.

<u>On-going Research Support</u>

R01EY018608 Palankar (PI) 7/1/2013 – 6/30-2017
High Resolution Photovoltaic Retinal Prosthesis
The goal of this project is the development of an implantable retina replacement to enable people suffering from macular degeneration to be able to read and drive.
Role: Co-PI

119134 Fan (PI) 9/1/2015 – 8/31/2018
Solar Thermophotovoltaics: Improving the Efficiencies of Emitters and Narrow Band Gap Photovoltaic Cells
The goal of this project is to develop a thermophotovoltaic cell that will compliment high efficiency multi-junction solar cells and achieve an overall solar-electrical conversion efficiency > 50%.
Role: Co-PI

DE-EE0004946 Cui (PI) 8/17/2011 – 12/31/2017
PVMI Bay Area Photovoltaic Consortium
The goal of this project is to develop ultra-thin, high efficiency and lower cost c-Si solar cells through a combination of photon management and advanced nanofabrication technology.
Role: Co-PI

120657 Byer (PI) 10/2/2015 – 9/30/2020
Laser Accelerators on a Chip
The goal of this project is to develop a dielectric electron accelerator using lasers and photonic crystal structures to produce an accelerating field for electrons that scales current high energy accelerators by a factor of 10E5.
Role: Co-PI

<u>Completed Research Support</u> (past 3 years)

108738 Harris (PI) 9/1/2012 – 3/31/2016
Toward High-Efficiency Thin Film Solar Cells Combining Multi-Junctions and Nano-Scale Light Management
The goal of this project was development of novel materials and photon managment to realize high efficiency multi-junction solar cells and achieve an overall solar-electrical conversion efficiency > 40%.
Role: PI

N66001-11-1-4105 Zhang (PI) 6/6/2011 – 9/30/2015
Novel Architecture for Topotronics-Based Information Processing
The goal of this project was to investigate novel 2-D topological materials and their growth by molecular beam epitaxy (MBE) and characterize their electrical transport properties.
Role: Co-PI

109465 Harris (PI) 10/1/2012 – 10/30/2014
Advanced Photonics Integrated Circuits (APIC)
The goal of this project was development of optical devices applicable to on-chip optical communications in Si ICs.
Role: PI

49908 Harris (PI) 6/1/2010 – 6/30/2014
Novel Ge Laser Integrated on Si for Optical Interconnect
The goal of this project was investigation of GeSn and suitable epitaxial growth techniques to produce a direct bandgap Group IV semiconductor material to produce a laser for on-chip optical communications and suitable for integration with Si ICs.
Role: PI

CBET0967257 Schnitzer (PI) 4/15/2010 – 3/31/2014
Chip-Scale Ultrashort Pulsed Lasers for Two-Photon Fluorescent Imaging and Sensing
The goal of this project was to develop a high intensity, short pulse integrated mode locked laser that could be incorporated into a scanning microscope that is implanted into freely mobile mice.
Role: Co-PI

105670 Harris (PI) 10/1/2011 – 9/30/2013
Compact Optical Sensor for Non-Invasive Detection of Thrombosis
The goal of this project was development of a fluorophor and protein that would produce luminescence in the presence of thrombin to enable real-time monitoring of patients hemostatic state.
Role: PI