Dr. Peter Bermel leads the Energy & Nanophotonics research group at Purdue University that leverages nanophotonics to improve the performance of photovoltaics, thermophotovoltaics, and secure electronics. He serves as the PI for two multi-million dollar centers in secure electronics: ASSURE and Cornerstone. Funding of **$3,383,657** was awarded for his Purdue group alone; **$6,941,156** for center-level efforts where he serves as PI; and **$52,085,121** for a total of 27 awards from major research sponsors, such as the National Science Foundation, the Office of Naval Research, the Department of Energy, the Semiconductor Research Corporation, Northrop Grumman Corporation, NEC Corporation, the Purdue Research Foundation, Indiana Innovation Institute, and the US Army. He is a recipient of a National Science Foundation (NSF) CAREER award, a Winston Churchill Foundation Scholarship, an NSF Graduate Research Fellowship, and an MIT Compton Fellowship. Dr. Bermel is widely published in scientific peer-reviewed journals, and has been cited over 6,500 times, for an h-index of 31. His work is a recurring topic in publications geared towards the general public, including the *Economist* and Medium – most recently, for an approach to effectively integrate solar power with existing agricultural practices.

His signature contribution to photovoltaics has been to advance the state-of-the-art in modeling new types of solar cells, and then to apply these new approaches in experiments to demonstrate improved photonic performance. He collaborated with Prof. Mark Lundstrom to calculate not only the initial absorption of incoming light, but also track the re-emission of photons, followed by potential reabsorption, in a process known as photon recycling. To apply this modeling capability to experiments, he collaborated with Prof. Minghao Qi to develop a new type of solar cell, inspired by opal gems. These artificial opal backings increase spectrally-averaged absorptivity quite dramatically, turning translucent orange absorbers into a coal-black color, enhancing the power production of the solar cells by 10%. Most recently, he extended his photovoltaic modeling capabilities to the scale of agricultural fields, and showed in *Nature Sustainability* that combining novel tracking, mounting, and ground sculpting can dramatically reduce crop shadowing for sustainable co-production of clean food, energy, and water. The performance of this system is now being measured by a recently launched experiment in the Purdue ACRE farm.

In thermophotovoltaics, he focuses on developing new types of thermal emitters to efficiently convert waste heat into light or electricity. His team has designed, built, and measured novel 1D and 2D-periodically nanostructured emitters that selectively emit high-energy photons as thermal radiation across various temperatures. If these emitters are then coupled with photovoltaic cells, the latter can convert that emission into electricity with high efficiencies. In the best case, this selectivity can improve efficiencies from 15% up to 42%. He has extended this approach to incandescent light bulbs, to show in experiments that their efficiency can be tripled by the introduction of highly selective filters. Most recently, in collaboration with Prof. Yi Cui (Stanford), he has experimentally demonstrated that silicon wafers turned into thin films via wet etching can be used to create durable, high-temperature selective thermal emitters.

His work in secure microelectronics as PI of the ASSURE center aims to address cyber security capability gaps in three critical research areas: (1) inherently secure & adaptable hardware and software, (2) ultra-reliable hardware under extreme conditions, and (3) counterfeit prevention and detection. As a result, he successfully demonstrated new electronics capable of extended lifetimes under extreme conditions, as measured using a novel combined automated probe station / thermoreflectance method. This allows one to detect nanoscale hotspots and voids early, which provide reliable prediction of failure in integrated circuits. He also developed an advanced secure electronics software and hardware platform serving a broad range of potential users. Most recently, he launched a new multi-institutional public private academic partnership known as the Cornerstone Microelectronics Workforce Consortium for training/recruiting the next generation of DoD engineers to work in trusted & secure microelectronics using SOTA design concepts, components, and technologies for military systems in all environments.