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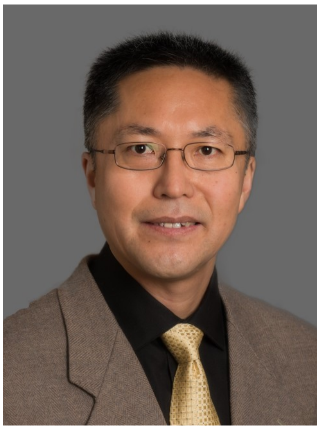

Topic of the Speech:
Super-semiconductor: An Intriguing Conducting Material

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Professor Bingqing Wei received his Bachelor's degree (1987), M.S (1989), and Ph.D. (1992) in Mechanical Engineering from Tsinghua University, Beijing, China. He is currently a Tenured Professor in the Department of Mechanical Engineering at the University of Delaware, USA. Dr. Wei was an Assistant Professor in the Department of Electrical & Computer Engineering and Center for Computation & Technology at Louisiana State University from 2003 to 2007. He was a Research Scientist at Rensselaer Polytechnic Institute, Department of Materials Science and Engineering and Rensselaer Nanotechnology Center from 2000 to 2003. Dr. Wei was a visiting scientist at Max-Planck-Institut für Metallforschung, Stuttgart, Germany in 1998 and 1999. From 1992 to 2001, he was a faculty member at Tsinghua University in Beijing.

Dr. Bingqing Wei's research interest and expertise lie in nanomaterials and nanotechnology. His research interests have been focusing on the synthesis, processing, characterization, and physical properties of carbon nanostructures, carbon nanotube nanocomposites, and applications of carbon nanostructures in energy conversion and storage devices. His scholarly achievements in the field of nanomaterials and nanotechnology are adequately reflected by his 340 papers published in refereed international journals, including Nature and Science, 122 scientific conference presentations and 212 invited talks and seminars in academia and industry worldwide. His research work has been cited more than 25500 times by peer scientists with the h-index of 79 (Web of Science) (more than 33500 times with the h-index of 89 on Google Scholar). Dr. Wei is among Highly Cited Researchers from Clarivate for his research on nanomaterials that enable energy conversion and storage.

ABSTRACT SUBMISSION
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Super-semiconductor: An Intriguing Conducting Material

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ABSTRACT (NO MORE THAN 500 WORDS:)

Solid state materials can be categorized as conductors, semiconductors, and insulators based on their electrical conductivity. For conductors, breakthrough discoveries, such as superconductors (FeSe, YBCO, etc.) and topological insulators (HgTe, Bi_2Te_3, etc.), have led the limit of conductivity falling by orders of magnitude or even to zero when certain extreme conditions, such as an ultra-low temperature or an ultra-high pressure, are met. Electrons can move freely through a superconductor without resistance when it becomes colder than a “critical temperature”, which is far below room temperature. For semiconductors (Si, GaAs, etc.), both negative charge carriers (electrons) and positive charge carriers (holes) contribute to semiconductors' conductance, the foundation of modern electric devices and integrated circuits, but with a much higher resistance than metallic conductors. Conventional wisdom holds that electrons are the dominant charge carriers of metallic conductors (Al, Cu, etc.), and holes do not contribute to metals' excellent conductance because there are infinite free electrons in them. In this presentation, I will discuss, for the first time, a transition from metallic conductors to super-semiconductors (SSCs, their resistivity is lower than the metallic conductors) at near room temperature in nanostructured bimetallic arrays where the internal electrons can no longer be regarded as infinitely numerous. Hall effect revealed that the dominant carriers have changed from electrons (the *n*-type charge carriers) to holes (the *p*-type charge carriers) along with the transition from metallic conductors to SSCs. The cause of the SSC transition and *p*-type metal formation (the metal with *p*-type semiconductor behavior) is attributed to the hot electrons and holes induced by metal plasmonic resonance in the infrared wavelength range. These results reveal the unusual and unexplored properties of nanostructured metals and alloys with limited free electrons that would have tremendous applications on metal-based ultra-low-power devices, such as diodes, transistors, and integrated circuits.