The Albuquerque IEEE Joint Chapter of AP/MTT/EMC/NPS Presents

TOPIC OF TALK: An Exploration of Radiation Physics

PRESENTED BY: Dr. Edmund K. Miller
Distinguished Lecturer, IEEE Antennas and Propagation Society

TIME: 7:30 pm, Wednesday, March 25, 2015
Social begins at 5:45 pm
Dinner begins at 6:30 pm

PLACE: The Canyon Club (Formerly Four Hills Country Club),
911 Four Hills Road, SE, Albuquerque, NM 87123

DINNER: Soup of the Day, Grilled Salmon, Asparagus, Rice Pilaf,
Dinner rolls & Butter, Chef's Choice Dessert,
Coffee, Iced Tea and Water

(Vegetarian entrée available by request at time of RSVP)

COST: No charge and no reservation required to attend just the talk.
$25 per person for dinner (full-time student members of IEEE, $15)
—reservations required

RSVP by email to harrisonmgabq@comcast.net
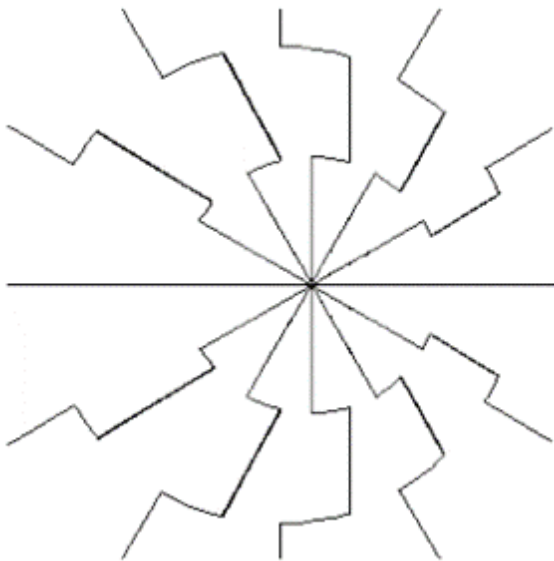or phone Mike Harrison at (505) 239-2663.

Reservations & cancellations accepted until March 23. 2015. The Canyon Club can often make late arrangements so it it is worthwhile to contact Mike Harrison after Monday March 23, if you wish to join us for dinner.

PRESENTATION SUMMARY:
All external electromagnetic fields arise from the process of radiation. There would be no

radiated, propagated or scattered fields were it not for this phenomenon. In spite of this self-evident truth, our understanding of how and why radiation occurs seems relatively superficial from a practical viewpoint. It's true that physical reasoning and mathematical analysis via the Lienard-Wiechert potentials show that radiation occurs due to charge acceleration. It's also true that it is possible to determine the near and far fields of rather complex objects subject to arbitrary excitation, making it possible to perform analysis and design of EM systems. However, if the task is to determine the spatial distribution of radiation from the surface of a given object from such solutions, the answer becomes less obvious.

One way to think about this problem might be to ask, were our eyes sensitive to X-band frequencies and capable of resolving source distributions a few wavelengths in extent, what would be the image of such simple objects as dipoles, circular loops, conical spirals, log-periodic structures, continuous conducting surfaces, etc. when excited as antennas or scatterers? Various kinds of measurements, analyses and computations have been made over the years that bear on this question. This lecture will summarize some relevant observations concerning radiation physics in both the time and frequency domains for a variety of observables, noting that there is no unanimity of opinion about some of these issues. Included in the discussion will be various energy measures related to radiation, the implications of Poynting-vector fields along and near wire objects, and the inferences that can be made from far radiation fields. Associated with the latter, a technique developed by the author called FARS (Far-field Analysis of Radiation Sources) will be summarized and demonstrated in both the frequency and time domains for a variety of simple geometries. Also to be discussed is the so-called E-field kink model, an approach that illustrates graphically the physical behavior encapsulated in the Lienard-Wiechert potentials as illustrated below. Brief computer movies based on the kink model will be included for several different kinds of charge motion to demonstrate the radiation process.

Depiction of the E-field lines for an initially stationary charge (a) that's abruptly accelerated from the origin to a speed v = 0.3c to then coast along the positive x-axis until time t1 (b) when it is abruptly stopped (c).

Biography of the Speaker:

Since earning his PhD in Electrical Engineering at the University of Michigan, E. K. Miller has held a variety of government, academic and industrial positions. These include 15 years at Lawrence Livermore National Laboratory where he spent 7 years as a Division Leader, and 4+ years at Los Alamos National Laboratory from which he retired as a Group Leader in 1993. His academic experience includes holding a position as Regents-Distinguished Professor at Kansas University and as Stocker Visiting Professor at Ohio University. Dr. Miller wrote the column "PCs for AP and Other EM Reflections" for the AP-S Magazine from 1984 to 2000. He received (with others) a Certificate of Achievement from the IEEE Electromagnetic Compatibility Society for Contributions to Development of NEC (Numerical Electromagnetics Code) and was a recipient (with others) in 1989 of the best paper award given by the Education Society for "Computer Movies for Education."

He served as Editor or Associate Editor of IEEE Potentials Magazine from 1985 to 2005 for which he wrote a regular column "On the Job", and in connection with which he was a member of the IEEE Technical Activities Advisory Committee of the Education Activities Board and a member of the IEEE Student Activities Committee. He was a member of the 1992 Technical Program Committee (TPC) for the MTT Symposium in Albuquerque, NM, and Guest Editor of the Special Symposium Issue of the IEEE MTT Society Transactions for that meeting. In 1994 he served as a Guest Associate Editor of the Optical Society of America Journal special issue "On 3 Dimensional Electromagnetic Scattering." He was involved in the beginning of the IEEE Magazine "Computing in Science and Engineering" (originally called Computational Science and Engineering) for which he has served as Area Editor or Editor-at-Large. Dr. Miller has lectured at numerous short courses in various venues, such as Applied Computational Electromagnetics Society (ACES), AP-S, MTT-S and local IEEE chapter/section meetings, and at NATO Lecture Series and Advanced Study Institutes.

Dr. Miller edited the book *"Time-Domain Measurements in Electromagnetics",* Van Nostrand Reinhold, New York, NY, 1986 and was co-editor of the IEEE Press book *Computational Electromagnetics: Frequency-Domain Moment Methods*, 1991. He was organizer and first President of the Applied Computational Electromagnetics Society (ACES) for which he also served two terms on the Board of Directors. He served a term as Chairman of Commission A of US URSI and is or has been a member of Commissions B, C, and F, has been on the TPC for the URSI Electromagnetic Theory Symposia in 1992 and 2001, and was elected as a member of the US delegation to several URSI General Assemblies. He is a Life Fellow of IEEE from which he received the IEEE Third Millennium Medal in 2000 and is a Fellow of ACES. His research interests include scientific visualization, model-based parameter estimation, the physics of electromagnetic radiation, validation of computational software, and numerical modeling about which he has published more than 150 articles and book chapters. He is listed in Who's Who in the West, Who's Who in Technology, American Men and Women of Science and Who's Who in America.