Vacuum Technology
Room 2000 - Session VT-ThM

Special History Session - Franklin and the Future

Moderator: T.E. Madey, Rutgers University

8:00am **VT-ThM1 Benjamin Franklin and the Meaning of Public Science, *J.E. Chaplin,*** Harvard University **INVITED**

Where did Benjamin Franklin do his science? The famous American Founder is closely associated with his political career, meaning his public life. Compared to that public life, Franklin's science has seemed to be an odd, private hobby, which he managed to do somehow (and somewhere) alongside his work in politics. But Franklin's scientific and political efforts were interconnected. In fact, he performed much of his science in public places. To be sure, he did some of his scientific investigations in private, at home. (He used his house as an experimental space for his work on heat and rigged up the house itself as a piece of electrical apparatus.) But in Franklin's Philadelphia, the best space for science was a public one: the Pennsylvania State House, now Independence Hall. Franklin had helped to found a learned society, the Library Company of Philadelphia, which for some time used rooms in the State House's west wing. There, the company had hosted a series of scientific lectures, including demonstrations with an air pump, which created an experimental vacuum; there, as well, Franklin and his collaborators did most of their famous electrical experiments. The open area outside the State House proved useful for astronomical observations and for the launch of the first balloon in the United States. The public space for science also functioned as a place for politics. A platform built for observations of the 1769 Transit of Venus was the very spot on which, seven years later, the Declaration of Independence had its first public reading. This lecture will explain why Franklin and his contemporaries expected their science to fit comfortably into public life--and public space. What kind of science was it?

8:40am **VT-ThM3 Monolayers Films: From Franklin's Oil-Drop Experiments to Self-Assembled Monolayer Structures, *G.L. Richmond,*** University of Oregon **INVITED**

Although we often view the explosive growth in studies of molecular self assembly and monolayer films on surfaces as a relatively recent phenomena, in fact, reports dating from Roman times note the value of the spreading of oil on the surface of water in calming the seas. But arguably the beginning of the field as a scientific discipline dates back to the experiments of Benjamin Franklin who reported to the Royal Society in 1774 that placing as little as one teaspoon of oil on the surface calmed the ripples on a small area that quickly extended to have an acre. This presentation will provide an overview of how this area of science has evolved from these early times where oil was used to calm the raging seas, to the present day where studies of self assembled monolayers structures and their application to a variety of technological, biological and environmental processes are all the rage.

9:20am **VT-ThM5 The Science and Technology of Electrophotography, *L.B. Schein,*** Independent Consultant **INVITED**

Electrophotography, one of the most prevalent applications of electrostatics, is the technology used in copiers and laser printers. In this review, the basis of the technology will be discussed, from the basic six steps to the underlying physics of the process. Discussions will include the physics of surface charging of insulators based on Paschen breakdown, the static electrification of insulating particles (sometimes called triboelectricity) and current challenges in color electrophotography, all of which evolved from Franklin's early experiments in electrostatics.

10:00am **VT-ThM7 From Lightning to Lighting: Physics and Technology Discharged from Franklin's Kite Experiment, *R.T. McGrath,*** The Ohio State University **INVITED**

In April 1749, Benjamin Franklin first sketched his experiments for demonstrating the "sameness of electrical matter" (heretofore generated using rubbed glass rods) "with that of lightning." By summer of 1752, the successful execution in France of the high tower, iron rod, sentry box experiment proposed by Franklin made him an international celebrity, while in Philadelphia the delayed completion of the Christ Church steeple led an impatient Franklin to devise and execute his "whimsical" and famous electrical kite experiment. Forsaking patents for the common good, Franklin's approach to technology transfer was to broadly publish his theories and experimental results, with lightning rods first installed on buildings in Philadelphia in the summer of 1752 and then disseminating throughout Europe and the then United States, quickly thereafter. Along the way, Franklin devised the one-fluid theory of electrical flow, designating that flow as positive and thereby condemning subsequent generations of freshman physics students to confusion about the direction of current flow, but also introducing such seminal concepts as conservation of charge and electrical action at a distance. From these rich ideas, each grounded in meticulously devised and executed demonstration experiments, flowed forth 250 years of subsequent theory, experimentation and understanding of electricity and discharge physics. Today, many of the indispensable conveniences of modern life, such as micro-discharges within our plasma televisions; discharges driving our domestic fluorescent lighting; reactive chemistry discharges used to manufacture our laptops, ipods and cell phones; and mega-amp tokamak discharges striving to provide us with fusion power; all derive their roots from that curious fellow with a kite from Philadelphia.

10:40am **VT-ThM9 Progress and Prospects in the Generation of High Voltage*, *H.F. Dylla,*** Jefferson Lab **INVITED**

In 1738, in the tradition of Robert Boyle, Benjamin Franklin's Library Company of Philadelphia -- a learned society founded by Franklin partly in imitation of the Royal Society -- obtained an air pump for study of vacua. In 1747, the organization obtained an electrostatic machine. By advancing the scientific understanding of electricity, Franklin helped light the way to countless not-then-foreseen modern applications of high voltage, from cathode-ray and photomultiplier tubes to huge systems for electrical power distribution. Because Franklin subscribed to the particle theory of matter, he would no doubt be fascinated by the particle accelerator, today's linkage of vacuum technology and high voltage for elucidating matter's particle structure. This talk will trace that linkage from Franklin's time to the International Linear Collider, which is now being designed to comprise two facing linear accelerators, each 20 kilometers long, that will hurl beams of electrons and positrons toward each other at nearly the speed of light -- and at energies planned eventually to reach the teravolt scale. * This work supported by US DOE Contract No. DE-AC05-84ER40150

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