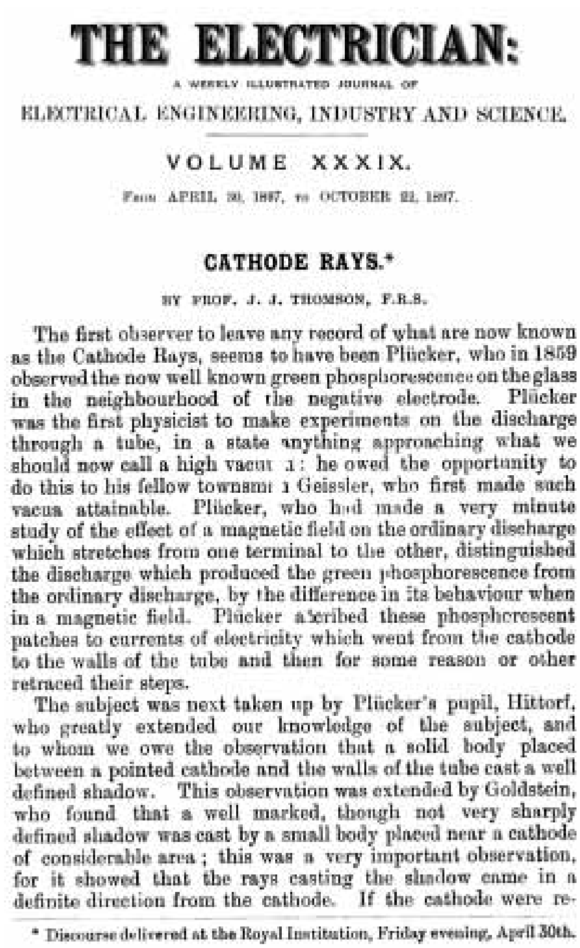
FROM THE EDITOR'S DESK



THE ELECTRICIAN:

A WEEKLY ILLUSTRATED JOURNAL OF

ELECTRICAL ENGINEERING, INDUSTRY AND SCIENCE.

VOLUME XXXIX.

FROM APRIL 30, 1897, TO OCTOBER 22, 1897.

CATHODE RAYS.*

BY PROF. J. J. THOMSON, F.R.S.

The first observer to leave any record of what are now known as the Cathode Rays, seems to have been Plücker, who in 1859 observed the now well known green phosphorescence on the glass in the neighbourhood of the negative electrode. Plücker was the first physicist to make experiments on the discharge through a tube, in a state anything approaching what we should now call a high vacuum: he owed the opportunity to do this to his fellow townsman Geissler, who first made such vacua attainable. Plücker, who had made a very minute study of the effect of a magnetic field on the ordinary discharge which stretches from one terminal to the other, distinguished the discharge which produced the green phosphorescence from the ordinary discharge, by the difference in its behaviour when in a magnetic field. Plücker ascribed these phosphorescent patches to currents of electricity which went from the cathode to the walls of the tube and then for some reason or other retraced their steps.

The subject was next taken up by Plücker's pupil, Hittorf, who greatly extended our knowledge of the subject, and to whom we owe the observation that a solid body placed between a pointed cathode and the walls of the tube cast a well defined shadow. This observation was extended by Goldstein, who found that a well marked, though not very sharply defined shadow was cast by a small body placed near a cathode of considerable area; this was a very important observation, for it showed that the rays casting the shadow came in a definite direction from the cathode. If the cathode were re-

* Discourse delivered at the Royal Institution, Friday evening, April 30th.

Introductory paragraphs from Thomson's paper, as published in the May 21, 1897 issue of The Electrician.

THE ELECTRON—or at least our recognition of its existence as an elementary particle—passes the century mark this spring. On April 30, 1897, Joseph John Thomson reported the results of his recent experiments on cathode rays to a Friday evening meeting of the Royal Institution, suggesting these rays were composed of negatively charged pieces of atoms that he dubbed "corpuscles." Six months later he published an extensive account of these experiments in the *Philosophical Magazine.* One of the classic papers of modern physics, it opened the doors of human consciousness to a radically new and often baffling world within atoms, one that has provided fertile ground for much of twentieth-century physics.

Together with the discovery of X rays and radioactivity during the preceding two years, and the introduction of the quantum three years later, this breakthrough led to a revolutionary conception of matter that has since had major impacts on other sciences, on modern technology and art, and even on the way we talk and think. The smooth, continuous, comfortable world of late nineteenth-century Europe was shattered into myriad bewildering fragments—some of which interact via forces that nobody had ever before encountered. Whether atoms themselves existed or not was in hot dispute at the time; among those who believed they did were prominent physicists who regarded them as vortex rings in the luminiferous aether. A century later, despite many superb advances, we are still struggling to achieve a grand synthesis of all the disparate shards encountered since.

To commemorate this pivotal breakthrough—and, in a more catholic sense, the discovery of

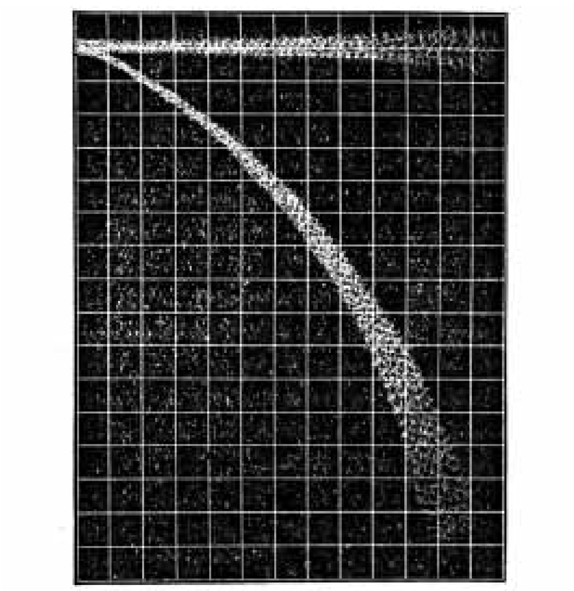


Fig. 5.—Hydrogen (Ammeter, 12 ; Voltmeter, 1,600).

Illustration from Thomson's article showing luminous paths of cathode rays (lower trace) bending in a magnetic field. The upper trace is due to ionized atoms in the gas.

subatomic particles—the *Beam Line* Editorial Board organized this special anniversary issue and asked me to serve as its guest editor. It has been a truly stimulating and rewarding experience. I am privileged to have worked with some of the nation's most literate physicists, who have contributed perceptive essays in honor of Thomson's fabulous discovery.

Three theorists open this issue by offering us their perspectives on the discovery, the meaning and the evolution of elementary particles. While Abraham Pais relates how the concept of the electron emerged from nineteenth-century research on electrochemistry and vacuum-tube discharges, Steven Weinberg and Chris Quigg take more modern and personal viewpoints. They examine what it means to call a particle "elementary" and try to assess where our discipline is headed as its second century begins.

The final three articles concern "applications" of our knowledge of subatomic particles—in electronics technology, in pushing back the frontiers of high-energy research itself, and in understanding the origin and evolution of the Universe. My article indicates how our knowledge of the electron *as a particle* has proved crucial to the surging growth of what is now the world's biggest industry. Taking a retrospective look at particle accelerators and colliders, Wolfgang Panofsky evaluates various avenues being considered for the future of this technology. And Virginia Trimble closes this anniversary issue by surveying how the tiniest things in existence are closely linked to the structure and behavior of the largest.

What will historians think, a hundred years hence, when they gaze back upon our own time? What conceptions that we hold dear today will be regarded then as we now regard the aether of 1897? What will be the "elementary particles" of the late twenty-first century? We can only guess. Whatever the answers, however, there can be little doubt that the hundred years that began with Thomson's discovery will be viewed as a remarkable period of scientific, technological and cultural achievement.