Disintegration of Elements.

By SIR ERNEST RUTHERFORD, F.R.S.

I HAVE been asked to say a few words about a telegram in the *Times* of March 14 giving an account of a paper communicated to the American Chemical Society at Chicago by Dr. G. Wendt and Mr. C. E. Iron. It reported that, when a powerful condenser discharge at 100,000 volts was sent through a very fine tungsten wire, the filament exploded with a "deafening report," producing a flash estimated to correspond to a temperature of at least 50,000° F. The telegram states: "After the flash he (Dr. Wendt) found atoms of tungsten decomposed into simpler atoms and the result was the change of metallic tungsten into gaseous helium." The experiments were made to investigate whether any atomic disintegration can be effected by such high temperature discharges, and apparently the authors believe that they have obtained positive results.

We must await a much fuller account of the experiments before any definite judgment can be formed; but it may be of interest to direct attention to one or two general points. During the last ten years many experiments have been recorded in which small traces of helium have been liberated in vacuum tubes in intense electric discharges, and it has been generally assumed that this helium has been in some way occluded in the bombarded material. On modern views, we

should anticipate that the disintegration of a heavy atom into lighter atoms, *e.g.* into atoms of helium, would be accompanied by a large evolution of energy. Indeed, it is to be anticipated that the additional heating effect due to this liberated energy would be a much more definite and more delicate test of disintegration of heavy atoms into helium than the spectro-scope.

Our common experience of the large effect of temperature in ordinary chemical reactions tends to make us take a rather exaggerated view of the probable effects of high temperatures on the stability of atoms. While it seems quite probable that momentary temperatures of 50,000° F. can be obtained under suitable conditions in condenser discharges, it should be borne in mind that the average energy of the electrons in temperature equilibrium with the atoms at this temperature corresponds to a fall of potential of only 6 volts. In many physical experiments we habitually employ streams of electrons of much higher energy and yet no certain trace of disintegration has been noted. In particular, in Coolidge tubes an intense stream of electrons of energy about 100,000 volts is constantly employed to bombard a tungsten target for long intervals, but no evolution of helium has so far been observed.

Obituary.

PROF. A. D. WALLER, F.R.S.

BY the death of Prof. Augustus Désiré Waller, on March 11, in his sixty-sixth year, the scientific world has lost an unique personality—a physiologist of international eminence and of exceptional calibre.

Waller studied in the Universities of Aberdeen and of Edinburgh, graduated in the former, and commenced his experimental work in Ludwig's laboratory in the year 1878. From here he proceeded to University College, London, whence he was appointed to the lectureship in physiology in the London School of Medicine for Women. He subsequently held the corresponding post in the Medical School of St. Mary's Hospital. In 1902 Waller became Director of the Physiological Laboratory of the University of London, of which, aided by the generosity of his brothers-in-law, and enabled by the wisdom and liberality of the Senate, he had been largely instrumental in securing the foundation. This post he held, amid difficulties, with conspicuous success, until his death.

Whilst at St. Mary's, Waller had felt the need of and had found the time and energy to establish and equip a library and laboratory, in his home, and it was there that most of his earlier researches were carried out. From there also he supplemented the resources of the University by the unstinted loan both of books and of valuable apparatus. He was closely associated with the Institut Marey from its inception, latterly as vice-president, and took an active part in the direction of its affairs.

Nearly 200 publications, covering a very wide field,

stand to Waller's credit. Early papers on the circulatory system led to a study of the electromotive phenomena of the heart beat and to the discovery that an electrocardiogram could be recorded on the human subject. His earliest records with the capillary electrometer, though accurate, were not what he expected them to be. Influenced by this, and misled by an insensitive instrument, he subsequently published and afterwards withdrew an inaccurate picture of the electrical events in the cardiac cycle. In consequence of this mischance the credit of Waller's discovery has been wrongly attributed to others. Some years later, with the aid of a more perfect instrument—Einthoven's string galvanometer—he returned to this work, which had been meanwhile developed and extended by Prof. Einthoven in Leiden. Thanks to Waller, the string galvanometer became now, for the first time, available for clinical diagnosis in London. Its employment spread from his laboratory in all directions, notably to University College Hospital and to the National Hospital for Diseases of the Heart, in the latter of which he was appointed consulting physician.

This, though perhaps the most notable piece of Waller's electro-physiological work, was a small fraction of its total. He was the pioneer of galvanography in physiology and was the first to record, photographically, the negative variation and the electrotonic currents of nerve, both of which he studied exhaustively. Of especial interest, in this connexion, are (1) his discovery that protracted excitation of a nerve produced the same effect on subsequent negative