experimented with a helicopter, but much of his work was of a confidential nature. He received the honour of C.B. in 1892, in 1906 was made a honorary member of the Royal Engineers' Institute, and in 1922 a foundation member of the National Academy of Ireland.

MR. C. J. MERFIELD

THE tragic death of Mr. Merfield as the result of a motor accident occurred on Jan. 23, 1931, but it did not become known in England until later. He was a very zealous and active worker, and undertook a large number of extensive astronomical computations. In his early career he was a surveying engineer, but even then he computed the orbits of comets in his spare time; the orbits of comets 1897 I, 1901 I, etc., were published in *Astronomische Nachrichten*. The last was a very bright southern comet; Mr. Merfield's elements, which indicate a period of 39,000 years, are accepted as definitive.

A few years later, Mr. Merfield joined the staff of the Sydney Observatory; he moved to Melbourne Observatory in 1908, and became chief assistant there in 1919, a position which he held until his death. He continued his work on comets, deducing an accurate orbit of Halley's comet from the early observations, and tracing the perturbations of the Pons-Winnecke comet for a long period, including its near approach to the earth in 1927. In his earlier years he had studied under Dr. R. T. A. Innes; it was doubtless at the suggestion of the latter that he performed the laborious task of computing the secular perturbations of Eros, Ceres, and Iris; these were published in *Astronomische Nachrichten* in 1907 and 1909.

Mr. Merfield was also interested in eclipses, and computed their circumstances in Australia and the neighbourhood; he observed the total solar eclipses of 1901, 1910, and 1911. His son, Mr. Z. A. Merfield, is the Australian representative on the Solar Eclipse Committee of the International Astronomical Union. We are indebted for many of the above details to Mr. J. A. Moroney, president of the Astronomical Society of Victoria, of which Mr. Merfield was the first president on its formation in 1922.

PROF. HOLLAND CROMPTON, formerly professor of organic chemistry at Bedford College, London, who died on Dec. 22, 1931, was born in Preston, Lancashire, on April 30, 1866. He attended school in Stuttgart and later studied chemistry under Prof. H. E. Armstrong at the City and Guilds Institute. In 1888 he was appointed lecturer and head of the Department of Chemistry at Bedford College, London, in succession to Spencer U. Pickering. He held this post until 1919, when the department was divided, and from that date until his retirement in 1927, on account of ill-health, he was head of the Department of Organic Chemistry. Crompton never enjoyed robust health, and in his later years it became steadily worse. He will be remembered by both organic and physical chemists on account of his work on acenaphthene, atomic energy and the specific heat of gases, molecular association and molecular magnitudes, osmotic pressure and the electrolytic dissociation theory.

WE regret to announce the following deaths:

Prof. Clarence L. E. Moore, professor of mathematics in the Massachusetts Institute of Technology, Cambridge, Mass., who devoted particular attention to the geometry of the sphere and circle in space, on Dec. 5, aged fifty-five years.

Prof. R. Stenhouse Williams, first director of the National Institute for Research in Dairying, Shinfield, Reading, and research professor in dairy bacteriology in the University of Reading, on Feb. 2, aged sixty years.

News and Views

Determinism Defined

SIR ARTHUR EDDINGTON'S characteristically fascinating address on "The Decline of Determinism", which we publish as our Supplement this week, will be welcomed as a clear, unequivocal statement, by a leading authority, on a question which, even among the many revolutionary aspects of the new physics, holds a pre-eminent place for importance and interest. Such a statement is the more necessary because of the almost universal tendency for discussions of determinism to be concerned at bottom with words rather than ideas, and Sir Arthur has quite properly begun by stating definitely what he means by the determinism which he holds has declined. His thorough analysis leaves little room for disagreement, but many will wonder whether he has not achieved a Pyrrhic victory by conceding to the determinist the substance of his doctrine and destroying only the shadow. "The rejection of determinism is in no sense an abdication of scientific method", and "indeterministic or secondary law . . . can be used for predicting the future as satisfactorily as primary law". In other words, Sir Arthur does not allow that the first Morning of Creation wrote what the last Dawn of Reckoning shall read, but he allows that it might have read what the last Dawn shall write. Even the most perfervid determinist will scarcely ask more. Furthermore, he acknowledges that he does not know whether Dirac, whose book "goes as deeply as anyone has yet penetrated into the fundamental structure of the physical universe", is a determinist or not. It would seem, therefore, that the determinism in question cannot be of much importance even in physics.

Physical Inference and Prediction

APPARENTLY, however, in spite of the unqualified statement concerning prediction quoted above, Sir Arthur denies that we can predict the behaviour of electrons more certainly than that of horses, and the importance, to all but the physicist, of the "decline

of determinism " therefore depends on the recognition of electrons as bodies co-equal with ordinary physical objects. To establish this he claims that since physical objects, as well as electrons and such particles, are all ' inferences ', they differ only in degree and not in kind. We must not, however, be deceived by words. Objects which we see and handle may be, as he says, as inferential as an undiscovered planet inferred from irregularities in the motion of Uranus, but the inferences are of different kinds ; otherwise, why, when a planet was seen in a different position from that inferred from the irregularities, was it *without question* preferred to the ' undiscovered ' inferential planet ? There was not even an instinctive estimate of the ' degree ' of validity to be attributed to the two ' inferences '. Unless Sir Arthur assigns to " direct observation " a status essentially different from that of rational deduction, it is difficult to see how his position can be " in no sense an abdication of scientific method ". All this, however, does not affect determinism in relation to physical objects, and it is to be hoped that Sir Arthur's plain statement will do much to remove the widespread delusion that modern physics has revealed a universe of unrestrained caprice.

Centenary of Octave Chanute

ON Feb. 18 occurs the centenary of the birth of the distinguished American engineer Octave Chanute, who by his experiments on gliding made in his later years, and by his writings on flight, gained for himself a place among the chief pioneers of aviation. Born in Paris on Feb. 18, 1832, he was the son of a professor of history who in 1838 removed to the United States to become a vice-president of the Jefferson College in Louisiana. There and in New York young Chanute attended school and, in his own words, became thoroughly Americanised. Leaving school at the age of seventeen, he entered the service of the Hudson River Railroad Company, and during the next four years gained considerable engineering experience. He next spent ten years on various railroads farther west, and from 1863 until 1867 was chief engineer of the Chicago and Alton Railroad. In 1868 he built the first bridge over the Missouri at Kansas City, in 1873 became chief engineer of the Eric Railroad, and about ten years later established himself as a consulting engineer in Kansas. He had already served on the commission of engineers which led to the building of the elevated railways of New York, and at Kansas he was responsible for the construction of the Sibley Bridge over the Missouri, and for the Mississippi Bridge at Fort Madison, Indiana. He retired to Chicago in 1889 after some forty years' work, much of which had contributed to making the railway system of the United States the most extensive in the world.

CHANUTE'S interest in flight was first aroused in 1874, but it was not until he was nearly sixty years of age that he was able to devote himself wholeheartedly to the study of the subject. In 1891 he published his first work, " Aerial Navigation ", and this was followed in 1894 by his " Progress in Flying Machines ", a work of great historical value. He had carefully examined the results of the experiments made by Otto Lilienthal in Germany, and just before that pioneer's death in 1896 had secured a Lilienthal glider and had begun his own experiments on the 90 ft. sand-hills in Dune Park, near Lake Michigan. Finding the Lilienthal machine unsafe and treacherous, Chanute built a glider with five superimposed planes, which was afterwards altered to a quadruplane and then to a triplane. From these was evolved " the famous Chanute biplane of novel and exquisite design ". One important feature introduced by Chanute was the means of moving the wings in a fore and aft direction to maintain balance, thus obviating the necessity for violent body movements. The experiments begun in June 1896 were continued until September, but after then were never resumed. An account of them was given in a paper published in the *Journal of the Society of Western Engineers* in 1897. While abandoning experiments, Chanute, although then sixty-four years of age, retained his enthusiasm for everything connected with flight, assisted and encouraged Wilbur and Orville Wright, and when an old man wrote his " Recent Progress in Aviation ". He died at Chicago on Nov. 23, 1910, at the age of seventy-eight. Chanute possessed the truly scientific spirit, and was an acute observer as well as a gifted inventor. Courageous and generous, his character caused him to be both respected and honoured.

The Earthquake in Cuba

ON Feb. 3 a series of destructive earthquakes, beginning at 2.40 A.M., ruined about one-third of the city of Santiago, at the east end of Cuba, including the cathedral and many important buildings. The number of persons killed is reported as twelve, and the number of wounded as about three hundred. The earthquake was recorded at Kew Observatory as a disturbance of moderate intensity. The first impulses arrived at 6h. 26m. 45s. A.M. (G.M.T.), and the earthquake must have occurred at 6h. 16m. The neighbourhood of Santiago has long been known as one of the most active earthquake centres in the West Indies. The city was founded in 1514, and since then there have been great destructive earthquakes in 1624, 1678, 1766 (the greatest of all Cuban earthquakes), and 1852. Though the full extent of the damage is not yet known, the recent earthquake was probably of the second order of intensity among destructive earthquakes. The Santiago earthquakes are chiefly interesting owing to the position of their centres along a well-known dislocation, nearly 1250 miles long, that skirts the southern coast of the east end of the island and forms the northern boundary of the Bartlett Trough, a depression that in one part reaches a depth of 3506 fathoms, or about four miles.

An Ancient Mexican Tomb

A VALUABLE addition to our knowledge of a little-known culture of ancient Mexico, that of the Mixtec, is promised by a recent find of which news has reached New York. In a dispatch from the *Times'* correspondent which appears in the issue of Jan. 20,