effective stratum too suddenly, the rays will be bent away upward or downward, and scattered, at the place of dislocation, and may not be able to get adjusted into the new stratum of transmission. If, however, the stratum is thick, the dislocation will be incomplete, extending over only part of it. The stratum may be expected to be of varying height, some function of the local solar time ; but it is too high for any merely meteorological derangement. All rays emitted not nearly horizontally are lost : a good local earth would assist the antennas here. We can think of the constituent beam of rays connecting the transmitter with a receiver anywhere along the path : it travels most of the way, without loss except by spreading sideways, in the effective stratum, in which all such beams unite to form a nearly horizontal band of rays, the rough analogue of an optical caustic, in the almost vacuous region above. Each receiver collects from an area around it of the order of the square of the wave-length : it thus appears from numerical estimate that the amount of energy available need not be at all inadequate to account for the now familiar features of free electric transmission round the earth, even to the antipodes and beyond.

Obituary.

Dr. J. E. Campbell, F.R.S.

THE sudden death, at sixty-two years of age, of John Edward Campbell has come as a grievous shock to many. It removes from among us, in the height of his powers, a pure mathematician of strong individuality, and of conspicuous achievement in departments of research where few, in the British Isles at any rate, could bear him company. It deprives the small fraternity of mathematical lecturers in Oxford of a recognised leader, both revered and beloved. It means the loss to his College of a tutor no less devoted and successful than distinguished, who also served it in administration as acting head during the last years of its great Principal, Dr. Boyd. It leaves certain causes of philanthropic and religious work in Oxford sadly the worse off for working friends.

Campbell was the son, born at Lisburn, Co. Antrim, in 1862, of Dr. John Campbell. After going through the Belfast College of the Queen's University with distinction he came to Oxford, rather older than most undergraduates, as a scholar of Hertford. Later he became fellow and tutor of the same College, after gaining all the ordinary academical honours. He was also for a good many years lecturer of University College. He became a fellow of the Royal Society in 1905. In the years 1920–22 he was president of the London Mathematical Society ; while the University of Belfast made him an honorary doctor of science.

Geometry was the strong point of Oxford mathematics in Campbell's young days, and it was natural for him to choose his line of research with a certain geometrical predilection, but he never became a devotee of the pure geometry of Chasles like others who surrounded him. Prettinesses did not much appeal to him : he wanted to plough broad acres. Looking afield for them, he began the study of the theories of continuous groups and of contact transformations which that master-geometer Sophus Lie had exploited, and with Sophus Lie he stayed long. Most of his earlier writings were contributions to Lie's theories, and presently he wrote a comprehensive book upon them, the first one by a British author, and far from a slavish reproduction of Lie's ideas. The differential geometry of surfaces has for long been another subject of his study and productiveness. More recently he has plunged into the time-space of Einstein in hopes of finding firm ground, as witness his presidential address to the London Mathematical Society.

There was a wonderful charm about Campbell's personality. Transparent rectitude, playful humour, the courage of his opinions, all shone from him to those who knew him. Affectation was as alien to his nature as idleness, and he could not be ungenial. In fact, he was the sort of Irishman whom it is a joy to run against. Some, hearing him for the first time, may have fancied that he had brought his Scotch name and his quaint accent unfamiliar to southern ears from somewhere to the east rather than the south-west of Campbeltown, and perhaps a comparatively remote Scottish ancestry may have had to do with the sturdiness of his principle and the forcefulness of his determination. Patient he was at his work, tolerant of stupidity, kindly in his joking, but there was a fire underneath which showed itself when what he thought wrong was in question. In the middle of 1914 he was a heated Ulster patriot. August came, and the lesser patriotism was submerged by a flood of the greater. A dearly loved son was an early sacrifice. During the War there was nothing else to him that mattered. He lived to serve those who fought for the right.

The War over, Campbell returned to his mathematics and to his tutorial work with young men. Of the latter, another generation or two have learned to be thankful for his precept and example. Of the former, a new book from his pen—one on differential geometry —will shortly speak.

WE much regret to record the death on October 4, at the age of seventy-seven, of Dr. Joseph Moeller, emeritus professor of pharmacognosy in the University of Vienna, and we are indebted to the *Chemiker Zeitung* for the following details of his life and work. Dr. Moeller studied in Vienna and was appointed an assistant in the pharmacological department in 1871. After the publication of his work, " Vergleichende Anatomie des Holzes," he lectured on natural products in the technical high-school at Vienna, and he was awarded the *venia legendi* for pharmacology of the University. In 1886 he was appointed professor of pharmacognosy at Innsbruck, and in 1893 he left that University for Graz. Later he returned to the Medical Faculty of Vienna, where an independent Institute of Pharmacognosy was built for him. Among other publications Dr. Moeller was the author of " Mikroskopie der Nahrungs- und Genussmittel," which has been translated into several languages ; " Anatomie der Baumrinde " ; and, with Ewald Geissler, of the " Real-Encyklopädie der gesamten Pharmacie."