In the application of communication to the modern very mobile army and to ships and aircraft, a number of severe limitations of space, size and weight are encountered; and the manner in which the corresponding electrical and mechanical problems have been solved were described in a series of papers dealing with this field. One of the outstanding achievements of the War was the development and use by the army of the No. 10 set, which, with a carrier wave-length of about 6 cm. and the use of pulse modulation technique, provides multiplex radio telephone facilities in an equipment of a highly mobile form. At the above wave-length the use of a large parabolic reflector gives a concentrated beam of radiation with a consequent high degree of privacy in communication. Although the effective range of each such set is in practice limited virtually to optical distances, the efficiency is such that many sets can be used in series; and it was in this way that Field-Marshal Montgomery was enabled to maintain direct telephonic communication with London during his advance through Germany.

While, as several papers described, the use of very high frequencies, corresponding to wave-lengths of a few metres and less, now plays an important part in communication, particularly for air-to-ground and other relatively short-distance operation, the bulk of long-distance communication is necessarily confined to those frequencies which are efficiently transmitted by reflexion from one or other regions of the ionosphere. In opening the session on "Propagation", Sir Edward Appleton described the British work on the exploration of the ionosphere during the past twenty years or more, and the manner in which such long-term measurements are applied to the prediction of average ionospheric conditions some months ahead. In a following paper, Messrs. K. W. Tremellen and J. W. Cox described the work of the Inter-Services Ionospheric Bureau, which was set up during the War to provide detailed forecasts of communication conditions as required from day to day for various parts of the world. The techniques thus evolved are being improved and applied to peace-time communication problems, the basic scientific work being carried out at the National Physical Laboratory under the auspices of the Radio Research Board of the Department of Scientific and Industrial Research.

At a later session, Mr. H. Bishop presented a paper in which he described the large and important part played by the Engineering Division of the British Broadcasting Corporation during the War. Very elaborate precautionary measures were initiated before the War, to ensure that the broadcasting stations in Great Britain did not provide navigational assistance to enemy aircraft, and these proved to be very successful in practice. In addition, the expansion and maintenance of adequate propaganda and information services to Europe and other parts of the world necessitated the provision of new transmitting stations of various types. As a result, Great Britain now has at Ottringham, near Hull, the highest-power medium-wave broadcasting station in the world, with an output power to the aerial of 800 kW. In addition, the world's largest short-wave broadcasting station has been erected at Skelton, in Cumberland, where twelve 100 kW. transmitters and a system of fifty-one aerials have been installed.

Other papers dealt with recent advances in radio direction-finding and certain types of navigational aids for ships and aircraft; and the Convention was brought to a close by a lecture by Sir Clifford Paterson, in which he reviewed the work of all the sessions and indicated the direction in which future progress in this subject is likely to be made. Much of the war-time experience will bear fruit in peace-time applications, particularly in connexion with civil aviation, trunk telephony, broadcasting, television and the industrial uses of radio frequency and electronics techniques.

FLUORIMETRIC ANALYSIS

A DISCUSSION was held in the rooms of the Chemical Society, Burlington House, on February 11, by the Physical Methods Group of the Society of Public Analysts, on "Fluorimetric Analysis".

The first paper was presented by Mr. E. J. Bowen as a basis for discussion of apparatus design. It was argued that although on occasion visual methods might be valuable in revealing unsuspected or unwanted changes in the colour of the fluorescence, photocell instruments have the advantage of simplicity of operation and high accuracy. The best design would seem to be a central lamp sending in opposite directions two horizontal light beams which are made parallel by lenses, monochromatic by filters, and controlled in area by diaphragms. The beams each traverse a rectangular transparent cell of solution, one a standard and the other the one to be measured. The fluorescent light emerging at right-angles to the beams is received (through filters) by two photocells connected in opposition. The measurements may be made either by the direct differential output of the photocells, or by balancing this to zero electrically or by a calibrated variable diaphragm in one of the light beams. The advantages of vacuum type photocells with valve amplification over barrier layer cells for this purpose were stressed, and it was pointed out that the still greater sensitivities obtainable with photo-electron multiplier tubes make them very suitable for fluorimeters to measure feeble fluorescence, and open up some interesting new possibilities.

A second contribution by Mr. Bowen dealt with the theoretical aspects of the 'quenching' of fluorescence in solution. It was suggested that this term should be confined to the phenomenon of the non time-dependent weakening of the fluorescence of a substance below a 'fluorescence efficiency' of unity. This would rule out effects caused by instrumental errors or by residual unwanted fluorescence in the solvent, cells, or filters. The use of the term 'fluorescence fatigue' to describe examples of reversible photochemical action was criticized. A systematic classification of quenching processes into three main types was presented: intramolecular energy rearrangements, intermolecular effects, and inner filter action. Experimental methods of distinguishing these types, and of the two kinds of intermolecular effects, 'collisional' and 'compound' quenching, were described. The paper concluded with a brief account of the types of photochemical change often associated with fluorescent solutions.

Dr. E. Kodicek described precise methods he has worked out for the fluorimetric analysis of such substances as riboflavine, vitamin A, etc., as a means of investigating nutritional problems.

Dr. D. M. Simpson (Cambridge) gave a short account of the applications of fluorimetric analysis to the study of pterins. She emphasized the need for

the determination of standard spectra of synthetic pterins under controlled conditions of illumination and *p*H. At present such spectra are available only for xanthopterin and leucopterin.

Fluorescence spectra alone are insufficient to identify pterins in complex mixtures. Ultra-violet absorption spectra and chemical tests should also be employed. Using these complementary methods, it has been possible to demonstrate the presence of pterins in such diverse materials as the argentaffine cells of the stomach and intestine, the fluorescent substance obtained from the eye of the dog-fish (*Squalus acanthias*) and the 'uric acid pigment' prepared by heating uric acid and water in sealed tubes at 200° C.

Few quantitative determinations of the concentrations of pterins have yet been made using fluorescence spectra. Provided that suitable precautions are employed to avoid quenching and inner filter effects, the method should be feasible if synthetic material is available for comparison. Examination of a large number of liver extracts has suggested that the intensity of fluorescence might be used as a measure of the clinical activity of these preparations.

In discussion, Drs. Winch and Cooper described tests made with a G.E.C. photocell and valve with a grid-leak of 10^5 megohms, capable of detecting 10^{-11} lumens. The instrument can detect a concentration of 1 milli μ gm./c.c. of a fluorescent substance, below which the residual fluorescence or Raman radiation of the water interferes. Dr. Cooper criticized the use of double-beam instruments with a mercury lamp on account of the movements of the narrow arc thread with time. Dr. F. Wokes raised the question of temperature effects on fluorescence, and stressed the need for publication of adequate data on fluorimeter calibration in analytical papers. Dr. Ridyard welcomed clearer definitions of the term 'quenching' because of its relation to instrument design. He suggested that the device of a transparent glass plate at 45° to the beam to reflect some of the light might be a useful modification of the double beam arrangement. Dr. White suggested that a closer study of the types of quenching observed in different instances might prove a method of distinguishing substances with similar fluorescent emission. Dr. H. W. Thompson stated that the limiting factor of sensitivity in many fluorimeters is the fluorescence of the glass or gelatine filters used before the photocell. Drs. Griffiths, Gullerson and Ellinger also made interesting contributions to the discussion, which had been keen throughout and was brought to a close only by considerations of time and temperature.

RECENT SOLAR ACTIVITY

A PAIR of sunspots making a group of exceptional size crossed the sun's disk between March 31 and April 13 in lat. 24° south. The group was the return of that reported in *Nature* of March 22, p. 396, but meanwhile it had either grown or a new formation had developed, as seems more likely, giving an even greater area than during the first disk passage during March 3–17. This latest spot, with a peak area of about 5,400 millionths of the sun's hemisphere, now heads the list of the largest spots in the Greenwich photographic records begun in 1874–75. Even in the extended period covered by reliable drawings associated with Schwabe, Carrington and others, this spot probably holds its premier position for size. As will be seen from the list below, within fourteen months the largest four spots in the Greenwich record have occurred. For this alone, the present 11-year solar cycle will be remarkable, whatever further activity is in store during the next two or three years that should include the peak of spot-frequency of the cycle.

In one important respect, the latest spot has been surprising; no great magnetic storm, nor even a small one, occurred during the interval, two days before and four days after central meridian passage (April 6–8 U.T.), when great magnetic activity associated with big sunspots is most likely to begin. It is significant that available solar observations indicate an absence of marked chromospheric activity, especially intense solar flares, associated with the spot; but until central meridian passage few observations could be made in Great Britain owing to cloudy skies. However, radio data of fade-outs on short-wave long-distance transmission, as reported to the Royal Observatory, Greenwich, by Cable and Wireless, Ltd., entirely support the sampling from direct solar observation that no intense solar flare occurred over the spot when it was more nearly in line with the earth. Previous experience has shown that intense flares, such as those recorded with the two great sunspots of 1946, are synchronized by complete and prolonged fade-outs of an hour's duration or more on daylight circuits. The evidence for no intense flare will be virtually complete when similar data are obtained for daylight circuits during Greenwich night hours, in addition to solar observations made in America, Australia and India.

The list of giant spots that have exceeded 3,000 millionths of the sun's hemisphere on one or more days may now be given as follows. The areas given for the 1946 and 1947 spots are provisional only, pending the measurement at Greenwich of a completed series of photographs.

Year	Central meridian passage	Maximum area	Magnetic storm: Great or small	Magnetic storm: Begins
1947	April 6·8	5400	None	—
46	Feb. 5·5	4900	G	Feb. 7·4*
47	March 10·2	4300	S	March 8·3
46	July 26·8	3950	G	July 26·8*
26	Jan. 24·5	3716	G	Jan. 26·7*
38	Jan. 18·4	3627	G	Jan. 22·2*
37	Oct. 4·5	3340	S	Oct. 3·5
38	Oct. 11·9	3003	(S	Oct. 7·4)

An asterisk denotes that an exceptionally intense solar flare was observed in *Hα* (6563 A.) at one or more observatories at the following respective time-intervals preceding the beginning of the storm: 18, 26¼, 24 and 29 hours.

FORTHCOMING EVENTS

*(Meetings marked with an asterisk * are open to the public)*

Monday, April 21

INSTITUTION OF ELECTRICAL ENGINEERS (at the Central Hall, Westminster, London, S.W.1), at 6 p.m.—Mr. J. Hacking: "The Generation and Wholesale Distribution of Electricity" (Faraday Lecture).*

SOCIETY OF PUBLIC ANALYSTS AND OTHER ANALYTICAL CHEMISTS, BIOLOGICAL METHODS GROUP (in the West Hall, Royal Society of Medicine, 1 Wimpole Street, London, W.1), at 6 p.m.—Symposium on "The Production and Care of Laboratory Animals", Part 2. Dr. H. J. Parish: "Common Diseases"; Mr. N. T. Gridgeman: "Records".

ROYAL STATISTICAL SOCIETY, SHEFFIELD GROUP OF THE INDUSTRIAL APPLICATIONS SECTION (at the Royal Victoria Station Hotel, Sheffield), at 6.30 p.m.—"The Application of Statistical Control to Research and Testing".

Tuesday, April 22

INSTITUTION OF POST OFFICE ELECTRICAL ENGINEERS (at the Institution of Electrical Engineers, Savoy Place, Victoria Embankment, London, W.C.2), at 5 p.m.—Mr. W. A. J. Paul: "Photography in the Post Office".

INSTITUTE OF PHYSICS, ELECTRONICS GROUP (at the Royal Society, Burlington House, Piccadilly, London, W.1), at 5.30 p.m.—Mr. S. Rodda: "Electron Multipliers".