

It is impossible, within the limits of this short report, to give justice to all the papers. Unquestionably, the main interest was centered on the symposium on exchange, which at the present time is a rather controversial subject. Slater presented his method of approach in which all functions in the molecular orbitals treatment are orthogonalized and the correlation energy taken into account. His results on the paramagnetic oxygen molecule seem to be most promising. Van Vleck described the generalized Heisenberg approximation in which nonintegral moments of atoms follow from inclusion of excited configurations. This may lead to an understanding of many phenomena which lie beyond the limits of the classical Heisenberg model. Stoner presented (in place of Wohlfarth) the collective electron theory of magnetism and its success in correlating magnetic properties with other phenomena and in predicting their behavior. Finally, Zener discussed his theory in which the important exchange interaction is assumed to be between the d and s electrons rather than between the d -shells themselves. Neutron diffraction results, which undoubtedly will provide some of the most crucial evidence for clarification of the theory of ferromagnetism, at present seem to be unable to help in deciding between the various theoretical approximations.

Among other topics which drew much attention at the conference one may mention thermomagnetic measurements, spontaneous magnetization near the Curie temperature, properties and order of permalloys, mechanism of magnetization of ferrites, their structure and transformations, coexistence of antiferromagnetism and "parasitic" ferromagnetism, ordered distribution of vacancies in pyrrhotite (Fe_xS_y), application of Kerr effect to the study of domains, neutron diffraction data on atomic moments in alloys below and above Curie temperature, Hall effect in ferromagnetic materials, paramagnetism of various crystals, relaxation effects in ferromagnetics, ferromagnetic and paramagnetic Faraday effects, paramagnetic and antiferromagnetic resonance, powder magnets, oxides and, finally, a spin-wave theory of antiferromagnetism.

The proceedings of the conference will appear in the January 1953 issue of *The Reviews of Modern Physics*.

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X-Ray Diffraction

Fortieth Anniversary Celebrated

A meeting of the X-ray Analysis Group of the Institute of Physics of Great Britain to celebrate the 40th anniversary of the discovery of x-ray diffraction by crystals was held at the Royal Institution in London on October 24th and 25th. Approximately 200 crystallographers attended the two sessions to hear a series of five papers. Dr. W. H. Taylor, Cavendish Laboratory, Cambridge University, Chairman of the X-ray Analysis Group, who presided over the sessions, opened the meeting on Friday afternoon by extending a welcome to the visitors from overseas. Two of these were Pro-

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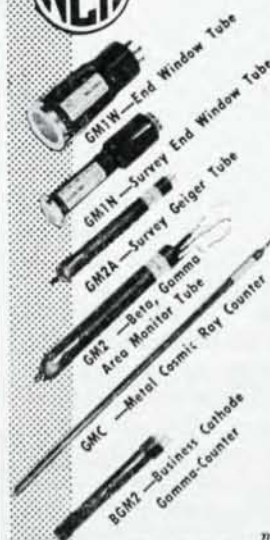
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fessor J. M. Bijvoet, University of Utrecht, President of the International Union of Crystallography, and Professor Max von Laue, Kaiser-Wilhelm Institute, who suggested the experiments which produced the first x-ray diffraction pattern, that of a crystal of copper sulfate, in Munich in 1912.

The first paper, "Historical Survey", was presented by Professor Sir W. L. Bragg, Cavendish Laboratory, Cambridge University. Professor Bragg noted that the title of his paper was really a misnomer, as he intended to discuss only the first years of x-ray crystallography and not the relatively recent work which would have been familiar to the "second generation" crystallographers present. He then described the experiments by Laue and his co-workers in which the first x-ray diffraction photographs were obtained, and the excitement which the publication of the results produced in various laboratories in Britain, particularly at Leeds, where Professor Bragg's father, W. H. Bragg, was then engaged in research on x-rays. Their working out of the first structures to be established, those of sodium chloride, potassium chloride, and diamond, and the difficulties with their apparatus were described with interesting detail.

Professor Laue then spoke briefly in German. He explained that in his opinion, although the initial work was done in Germany, the reason why so little work was done there on crystal structures was that the Germans were interested only in principles. The English, he pointed out, were interested in models and the use of the principles. He expressed the hope that Germans would adopt this attitude, not only in science, but also in the fields of culture and politics, so that there might be more harmonious relations between the two countries.

In the second paper, "Growth and Scope of X-ray Crystal Analysis", Professor J. D. Bernal, Birbeck College, London, recalled his early work in crystal structure analysis, and also attempted to predict what the field might be like in the future. He noted that, in as much as some previous predictions he made six years ago had not yet come to pass, he might just as well still make use of them. Professor Bernal foresaw great strides in methods, largely because of the rather high proportion of papers on methods which appear in *Acta Crystallographica*. He looked for great improvements in x-ray tubes and in methods for recording diffraction patterns; on the other hand, methods for the solving of structures will also be extended, including extension of the so-called "direct methods", and perhaps the day will arrive when every worker in the field will have his own handy X-RAC on his desk. The importance of crystal structures to the chemist was emphasized, especially in the fields of stereochemistry and proteins.

Dr. Dorothy Hodgkin, University Museum, Oxford, then discussed, in the third paper, "Chemical Problems", some of the difficulties which crystallography had presented to the chemist. When she first started in structure work, there was the widespread opinion that x-ray analysis' main role would be merely to verify established principles; this has since been found to be

quite wrong, she said, as more problems were being posed than were being settled. Among these are the invariant spatial configuration of the tartrate ion, for which there is at present no theoretical stereochemical explanation, the comparison of the structures of the oxalate ion and oxalic acid, the unexpected structure of arsenobenzene, which was found to contain a six-membered ion of arsenic atoms, and the still unconventional boron hydride structures. Dr. Hodgkin also described briefly the progress on the structure of vitamin B12, which is far more complex than any solved structure. Certain details of it have been established, but considerably more work remains to be done before the desired degree of clarification can be effected.

"X-Ray Analysis and the Metallic State", by Professor G. V. Raynor, University of Birmingham, was the fourth paper. Professor Raynor traced the importance of x-ray diffraction in the study of metals and alloys. He covered in some detail the history of the studies of the metallic state, and how some theories, such as that of the Brillouin zone, which were originally based on results of work with simple alloys, have withstood tests on more complicated systems recently examined. Professor Raynor called attention to recent studies designed to settle the question of valency in metals, and remarked that an additional increase in accuracy of measurements of electron density would doubtless lead to a much fuller understanding of this interesting question.

The final paper of the conference, "The Application of X-Ray Analysis to Protein Structure", was presented by Professor Bragg. This paper, as Professor Bragg pointed out, represented quite a change in scope compared with the first four, as he intended to discuss only one projection of one crystal. He then described the work which has been done so far on the structure of hemoglobin. It might seem that the location of thousands of atoms was beyond the reach of x-ray analysis, but the crystals fortunately have properties which enable the direct evaluation of part of the molecular transform, and hence the electron density. These properties, viz., the stepwise changes in the lattice constants with water content and pH, and the inclusion of salts in the crystals, are being studied in great detail, and have so far enabled the determination of the dimensions of the molecule and, moreover, have given strong indications of exact shape of the transform in one zone. Much additional work remains to be done, but as Professor Bragg remarked at the beginning of his talk, this work may be likened to the voyage of Jason to obtain the Golden Fleece: the difficulties are tremendous, but the prize is rich.

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Calorimetry

7th Annual Conference at NBS

Recent developments and modifications in precision calorimetric equipment and techniques were discussed at the Seventh Annual Calorimetry Conference, held at