Prolusione

DI

F. G. FUMI

Direttore del Corso

This year the International Summer School of the Italian Physical Society is devoted to solid State Physics. The term Solid State Physics in its present connotation was perhaps not adopted till the period of the second world war, and the field it covers is actually very vast, and may appear rather indefinite to an outsider. Indeed one hears that solid state physicists concern themselves with the study of the interactions between electrons, and electrons and phonons in crystalline lattices, problems which have a real taste of theoretical physics, but also with the study of luminescent materials, a field which has almost the sound of technological research. One hears that Solid State Physics includes such widely different branches as superconductivity, semiconductors, the plastic behaviour of metals, radiation damage, ferroelectricity, ferromagnetism. One hears also that Solid State Physics is of very direct use to engineers to develop new materials, and to induce new properties in old materials. This broadness and heterogeneity of the subject prevents, I fear, people outside the field from having a clear idea of what Solid State Physics really is.

In effect, I feel it is only possible to say tautologically that Solid State Physics is the study of the physical properties of solids, particularly of the special properties exhibited by atoms and molecules because of their association and regular periodic arrangement in crystals. The basic unifying feature of Solid State Physics is really represented by the Bravais symmetry of the assembly of atoms in crystalline solids: it is this symmetry which determines, on the one hand, the form of electronic wave functions in solids and the types of atomic vibrations, and, on the other hand, restricts to a few categories the possible types of imperfections in solids. It is the regularity of the crystalline array which makes possible the study of such complicated systems as solids really are, in the same way that the lack of this regularity makes the study of liquids

a more difficult endeavour. Naturally, among the many properties of solids, those tend to be preferred which can be discussed in terms of simple, concrete models, which certainly simplify the real problem a great deal, but include its essential elements. This modellistic character of Solid State Physics is perhaps its most noteworthy feature.

My aim in planning this Summer Course has been to give a broad outline of the different modern aspects of Solid State Physics, to illustrate how they all actually link together. I focused my attention, on the one hand, on the more theoretical aspects, the quantum theory of solids, and, on the other hand, on the imperfection-determined properties of solids, which are receiving such world-wide attention. The field of semiconductors, the third main line of the course, can in some ways be envisaged as a cross-product of the other two, but it really has an individuality of its own. The major field of Solid State Physics which was consciously left out of the program is the field of magnetic properties of solids which received detailed attention in the very successful course that Prof. GIULOTTO organized at Varenna last summer.

On the quantum theory of solids, we shall have six series of lectures various and one seminar. Prof. BROOKS will deal in his seven lectures with the basic concepts of energy bands in solids, and with the approximational techniques to deal with the problem of cohesion in solids. Prof. DEXTER will treat the optical properties of solids, dealing in particular with recent views on the exciton. Prof. FRIEDEL will discuss metallic alloys in the light of quantum theory. Prof. MOTT will examine the problem of the transition from the insulating to the conducting state in a solid. Prof. PINES will devote five lectures to a presentation of the method of collective coordinates that he and Prof. BOHM developed a few years ago, illustrating applications of it to the study of electron-electron and electron-phonon interactions in solids. The electron-phonon interactions will then be discussed in more detail by Dr. SCHRIEFFER in his seminar on the recent Bardeen-Cooper-Schrieffer theory of superconductivity. Finally Prof. ZIMAN will discuss in three lectures the effect of lattice imperfections on the thermal and electrical conductivity of solids.

On lattice imperfections specifically, we will have seven series of lectures various and eight seminars. Prof. FRANK will illustrate the basic concepts of dislocation theory, while Prof. SEITZ will treat point imperfections and their role in the physics of solids in general. Prof. GUINIER will illustrate the type of information that X-ray techniques can give on the presence of lattice imperfections. Prof. HILSCH will speak on the recent Göttingen work on thin films, and Prof. PICK will discuss classical and recent work on the most important types of colour centres. Prof. SMOLUCHOWSKI will present the recent ideas on the yet somewhat puzzling, and certainly involved, pheno-

menon of radiation damage. Finally Prof. ZENER will illustrate various applications of the anelastic techniques that he has brought into Solid State Physics with such success. The titles of the individual seminars on imperfections are, I feel, self-explanatory.

Concerning semiconductors, I should first say how sorry we all are that Dr. SHOCKLEY, Nobel Prize winner, who was scheduled to give a group of five lectures on transistor physics, could not be with us owing to urgent needs of his industrial laboratory in California. However, we are fortunate to have here Prof. FAN who will give a group of seven introductory lectures on the bulk properties of valence semiconductors. Prof. BUSCH will then discuss the recent work on the new types of semiconducting compounds, such as InSb, and Prof. KOHN will treat the important problem of impurity levels in semiconductors. Dr. AIGRAIN and Dr. MADELUNG will also give two seminars.

The program as it stands probably looks rather formidable, but I have strong hopes that the relaxing atmosphere of Lake Como, and the friendliness and informality that I am sure will permeate our meetings will help us to survive it.

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Per concludere, sono certo di esprimere il pensiero di tutti i partecipanti al corso porgendo il più sentito ringraziamento all'Ente Villa Monastero e al suo Presidente avv. BOSISIO per l'ospitalità concessaci, e un particolare ringraziamento alla Società Italiana di Fisica, specie nella persona del suo instancabile Presidente prof. POLVANI, per aver deciso di dedicare questo 5° Corso della Scuola Internazionale di Fisica all'argomento che appassiona tutti noi, e con noi varie migliaia di fisici in tutto il mondo: la Fisica dei solidi.

1. Mrs. Peder
2. M. Rumignani
3. R. Howard
4. A. Rzhanov
5. E. Germagnoli
6. Mrs. Howard
7. G. Pikus
8. W. Kohn
9. E. Boesman
10. C. Zener
11. H. Samelson
12. D. H. Niblett
13. R. Smoluchowski
14. R. Peder

15. W. D. Twose
16. H. Brooks
17. I. Barducci
18. A. Manfrino
19. F. Setz
20. W. J. Noble
21. Ph. Choquard
22. N. F. Mott
23. M. Sutczynski
24. L. Heßin
25. Mrs. Pratt
26. W. Balensperger
27. J. Wucher
28. B. B. Goodman

29. F. C. Frank
30. G. V. Kidson
31. A. E. de Vroomen
32. C. M. van Baal
33. S. C. Jain
34. H. Y. Fan
35. F. P. Naor
36. G. Biorci
37. L. Balierin
38. E. Braun
39. G. W. Pratt
40. D. Pines
41. M. Oddo
42. A. C. Moor

43. L. Koch
44. A. F. Brown
45. E. Daniel
46. M. Matyas
47. O. Madelung
48. F. A. Levi
49. M. Fujimoto
50. M. Asente
51. R. Colombo
52. G. Bonto
53. L. Passan
54. F. Luty
55. A. Zureth
56. W. Gebhardt

57. D. M. Edwards
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65. A. J. E. Foreman
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67. D. Aboav
68. A. Paoletti
69. P. Giacometti
70. B. Vittoz

71. D. Dautreppe
72. Mrs. Dautreppe
73. Mrs. Frank
74. Mrs. Fumi
75. F. G. Fumi
76. A. Ascoli
77. G. Polvani
78. A. Carlvano
79. A. Federighi
80. Mrs. Zener
81. N. Nilsson
82. Mrs. Fan

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