

necessary in setting up the shell model. He described scattering experiments with polarized neutrons of energies up to about 1 Mev which showed definite left-right asymmetries, thus demonstrating the existence of a spin-orbit effect. The asymmetry was greatest for nuclei around $A = 100$, where there is a p -wave resonance in the optical model. Using the optical model with a square well and a spin-orbit term, it has not been possible to reconcile the observed asymmetries with the total cross section data. It remains to be seen whether or not the very flexible optical model can be made to fit both sets of data in the future.

The final session of the conference was devoted to the study of neutron capture gamma-rays and here some very refined data have been accumulated using the high-resolution spectrometers at Chalk River and at Moscow. Information was presented about the type of radiation observed and the shape of the spectra, and the variation of these factors with atomic weight. Detailed decay schemes were proposed, the direct capture of neutrons by light nuclides was demonstrated, and the existence of rotational bands in heavy even-even nuclides was confirmed. The Yale Group provided information on gamma-rays from resonant neutron capture and Dr. G. Trumpy described an ingenious method used by the Norwegian Group in which polarized neutrons bombard unpolarized nuclei, and the circular polarization of the resulting capture gamma-rays throws

light on the spins of the resulting states in the compound nucleus. The final paper of the conference was on photoneutron spectra and was given by the MIT Group who claimed to observe a high-energy component in the energy distribution of the ejected neutrons, corresponding to yet another direct interaction process.

THE conference had its share of social events with a cocktail party, a banquet, and the boat trip which has now become something of a tradition at International Conferences. This time the boat trip was around Manhattan Island and all those who attended were rewarded with a magnificent impression of the New York skyline from all possible angles both in the afternoon sunshine and after dark. Perhaps the most important aspect of any really international conference is the wonderful opportunity which is presented for physicists from all parts of the world to meet and get to know each other informally on these social occasions and to reassure themselves that physics is indeed an international discipline. A suitable closing thought for this account might be the remark made by Dr. Darrow in his after-dinner speech at the banquet in which he was questioning whether or not there are too many conferences nowadays. He said that we shall all know very well when there are too many conferences, because when that happens, physicists will stop attending them!

Solid State at Varenna

A review of a summer conference at the Villa Monastero, on the shore of Lake Como in Italy. The author is professor of physics at the Carnegie Institute of Technology.

By R. Smoluchowski



The Villa Monastero—available for scientific and cultural purposes.

IN 1160 there was a war between the towns of Milano and of Como in the part of Europe which is now Italy. Though the war had no earth-shaking results, it had some aftereffects which now, several centuries later, have most agreeable consequences for physicists. The story is as follows: Near Como, which lies on the beautiful Lake of Como, there was a Benedictine cloister on a small island Isola Comacina. Scared by the catastrophic defeat of Como at the hands of the Milanese, the monks fled across the lake to a tiny village, Varenna, perched on its steep easterly shores. There they established their headquarters and some 300 years later, in 1484, built a new splendid monastery. The monastery grew and became very rich and powerful in the sixteenth century. In fact, it grew so strong that it had to

be suppressed by the Pope, closed up, and the whole estate sold. The place became, in turn, the property of various rich Italian and German families who embellished and enriched it until in 1925 it was acquired as "Villa Monastero" by Dr. DeMarchi from Milano, the same town which nearly eight centuries earlier had caused indirectly the monastery to be established in Varenna in the first place. In 1938, Dr. DeMarchi, who was greatly interested in science, willed the villa and another one in Pallanza on Lake Maggiore to the Italian State to use it for scientific purposes. The villa in Pallanza became an "Institute of Hydrobiology", while the Villa Monastero remained unused for years.

In the early 1950's, a private group of various individuals, banks, and industries was organized with the purpose of making the Villa Monastero available for scientific and cultural purposes. The first use of it was made in the Summer of 1953 when the first School of Cosmic-Ray Physics was organized there by the Italian Physical Society. From then on, every year a number of conferences and "schools" of various caliber and size were held there. The subjects cover the whole range: economics, administration, biometrics, topology, etruscology, mountain climbing, speleology, chemistry, and of course physics. In toto, there were 38 meetings held in the five years of existence of the Villa Monastero as a cultural center. The second school of physics in 1954 dealt with elementary particles, next in 1955 with low-energy nuclear processes, next in 1956 with various kinds of magnetic resonances, and finally the last one, the fifth, in 1957 dealt with solid-state physics. The present note is a report on this meeting.

The physics meetings at Varenna are called "schools" because there is a definite distinction—and even a "segregation" in nonscientific life—between the students and the professors ("docenti") and because the program includes a solid backbone of systematic series of lectures on advanced graduate level which provide coherency for the other shorter specialized courses and for the seminars. Besides students and professors, there is also a group of auditors ("uditori") who are active research physicists with PhD's. At the particular meeting this year, there were 25 professors, 28 auditors (four of them from Eastern Europe), and over 40 students. This school-like character of the meeting, which lasted three weeks, in no way detracted from an atmosphere of a typical scientific conference at which most recent scientific achievements are reported and news (and personnel gossip) exchanged. The superb location right on the lake with a mile-long—though less than 50 yards wide—park, the wonderful Italian climate, and the everywhere apparent relaxed attitude towards life in general greatly contributed to a fruitful exchange of ideas. The Villa Monastero itself provides mainly a grandiose marble hall suitable for lectures, rooms for the various necessary offices, and a few rooms in which distinguished lecturers are housed. Some of these look like typical "period rooms" in museums and are really most impressive and presumably full of ghosts. The majority of those attending the conference were housed



Lecturers H. Brooks (quantum theory of cohesion in solids), H. Y. Fan (bulk properties of valence semiconductors), and C. Zener (anelasticity of solids).



N. F. Mott gave a group of lectures on the nature of the metallic state.



Professor Fumi, "spiritus movens" of the conference, and President Polvani of the Italian Physical Society who was a frequent visitor.



... the everywhere apparent relaxed attitude towards life. . . . Mrs. Fumi, F. C. Frank, F. Seitz, C. Zener.

in several nearby hotels in the town itself. Actually it was somewhat of a miracle that all the participants of the conference survived it: The one and only street between Villa Monastero and the rest of the town is a main highway in places not more than 12 feet wide with no sidewalks. It was a "touch and go" proposition whether one would reach safely the other end or be "clipped" by an enormous truck zooming with the characteristic local bravura and speed.

The five 50-minute lectures per day were divided into two sessions: three in the morning and two between 5 and 7 P.M. This gave ample opportunity for the traditional siesta after lunch, a swim or a hike depending upon constitutional and national differences. There was a group of five speakers who gave the basic introductory background of the theory of solids: H. Brooks lectured on "Quantum Theory of Cohesion in Solids" and went into considerable detail of the various approximate methods and of their more recent refinements. N. F. Mott gave a group of lectures on the "Nature of the Metallic State" in which he analyzed the transition from valence to metallic binding. F. Seitz gave a series of lectures on "Point Imperfections in Solids" in which he covered the fundamental aspects of the theory of this kind of defects in metals and ionic crystals and discussed the experimental evidence. F. C. Frank exposed the audience to the intricacies of "Dislocations and Metal Physics" using numerous recent experimental evidence for the various theoretical models. Finally, H. Y. Fan gave a very complete presentation of the "Bulk Properties of Valence Semiconductors" dwelling particularly on optical properties of these materials. Specialized courses were as follows: D. L. Dexter, "Optical Properties of Solids" such as semiconductors and ionic crystals; J. Friedel, "Theory of Metallic Alloys", covering the various approximations of the calculations of the screening potential; W. Kohn, "Impurity Levels in Semiconductors", discussing much of his own recent results in this field; D. Pines, "Field Theory and Solid-State Problems", in which he summarized the plasma theory and also Bardeen's recent theory of superconductivity; J. M. Ziman, "Transport Phenomena in Solids", such as thermal and electrical conductivity and the influence of various types of lattice defects upon them; A. Guinier, "X-Rays and Lattice Defects", showing what can be learned about perfection of crystals from x-ray investigations; R. Hilsch, "Lattice Defects in Thin Films", describing mostly the recent work at Göttingen on metallic and ionic films deposited at low temperatures; H. Pick, "Color Centers in Ionic Crystals", the experimental facts and theory including Pekar's work; R. Smoluchowski, "Radiation Effects in Solids", their basic theory and recent observations on metals, alkali halides, and semiconductors; C. Zener, "Anelasticity of Solids", a field to which he contributed so much both experimentally and theoretically, including possible electronic effects; G. Busch, "Semiconducting Alloys", in which he gave a systematic survey of their properties with particular interest in the thermal conductivity.

Finally, there was a group of seminars: S. Amelinckx, "Dislocations in Ionic Crystals", describing his "decoration" technique and its spectacular results; F. C. Brown, "Mobility of Electrons in the Silver Halides", with special accent on recent work on photoconductivity effects in these crystals; Y. Haven, "Dielectric Losses in Ionic Solids", dealing in particular with associated vacancies in Ca-doped NaCl; W. Känzig, "Paramagnetic Studies of Color Centers", in particular, diatomic centers and their resonance spectra; A. B. Lidiard, "Correlation Effects in Diffusion in Solids", in which the influence of correlation of successive jumps of atoms on the diffusion coefficient was discussed; A. Seeger, "Advanced Topics in Dislocation Theory", such as theory of internal damping peaks at low temperatures and role of kinks in motion of dislocations; H. G. van Bueren, "Dislocations and Plastic Flow in Ge and Si" in which, among others, the presence and absence of broken bonds and role of jogs as sinks and sources of point defects were discussed; P. Aigrain, "Recombination Processes in Semiconductors", including radiative and nonradiative processes and Auger effects; O. Madelung, "Semiconductors with High-Galvanomagnetic Effects", in which he discussed the recent work at Erlangen on compounds with particularly low effective masses.

The "spiritus movens" of the school was of course Professor F. Fumi who put an enormous amount of most successful effort into its planning, running, and "concluding". The latter part of the work should not be underestimated inasmuch as the texts of the lectures are to appear as a special volume of *Nuovo Cimento*. Since very few speakers complied with the request to have their manuscripts ready before the conference, each lecturer had three students assigned to him who took copious notes. On the basis of these notes and a tape recorder, within a few days, each talk was distributed in mimeographed form. The threat to publish it without alterations speeded up greatly the preparation of final manuscripts, while the playing back of the tape was a hair-raising experience for some speakers, especially those who thought they had not much of a foreign accent in their English. Professor Fumi, with the excellent help of Mrs. Fumi, managed the whole machinery of the conference and with unbelievable patience attended to all problems, whether linguistic, scientific, or medical.

Professor G. Polvani, president of the Italian Physical Society, the originator and ardent supporter of all the "schools of physics" at Varenna, was a frequent visitor to the conference and to some of the various nonscientific events. Among the latter, one should mention the visit and dinner at the Moto Guzzi motorcycle factory with a group of dancers in local period costumes depicting personalities of the works of Alessandro Manzoni the local poet of the Risorgimento, a chamber music concert by an excellent quartet from Milano, a reception by the town of Varenna with spectacular fireworks on the lake, and a bus trip to St. Moritz. There is little doubt in the mind of this observer that it was one of the most successful and pleasant conferences he has ever attended.