ing a three-dimensional structural phase transition.

When the temperature was lowered further, modulation along the a direction slowly increased until, at 38 K, it abruptly locked in at four times the original periodicity. At still lower temperatures, the experimenters saw no further change in structure.

The Brookhaven–Orsay–Penn team used both deuterated and protonated (with hydrogen) samples. Shapiro notes that deuterated samples give better visibility and much less background. Although their elastic scattering measurements were done with small, single crystals, their inelastic measurements were done by assembling 17 crystals in an array to increase the effective size.

Oak Ridge. At the San Juan conference Herbert Mook reported on neutron inelastic-scattering measurements that he did on crystals grown by Charles Watson Jr at Oak Ridge. Most of the data show flat, dispersionless phonon modes that are probably characteristic of intramolecular vibrations. However, Mook also sees two propagating modes—a longitudinal acoustic mode and a transverse acoustic mode. In addition to these modes, Mook says he sees a giant Kohn anomaly that appears to stem from the longitudinal mode. A Kohn anomaly is a very strong electron–phonon interaction—so strong that it can drive the phonon modes soft.

Mook finds that the phonon mode is driven soft by the electrons at a wave vector equal to 2.95 $Å^{-1}$, in good agreement with the superlattice period observed at room temperatures. According to Mook, this Kohn anomaly appears at room temperature and as the temperature is lowered to 55 K, it sharpens and becomes more easily observable.

The Brookhaven team does not see the Kohn anomaly at room temperature, and they are convinced that there are discrepancies in many aspects of the phonon spectra reported by the two groups. However, says Shirane, they clearly see an anomaly develop in the phonon spectra at low temperatures, which can be interpreted as the Kohn anomaly. The neutron scattering from the Kohn anomaly is very weak, Mook told us, and he would not expect it to be visible at room temperature with the small sample used in the Brookhaven measurements.

Mook used 250 protonated samples and arranged them in grooved aluminum plates to increase the effective size.

Theory. From the early days of TTF–TCNQ some theorists, notably John Bardeen (University of Illinois) suggested that TTF–TCNQ was exhibiting fluctuations corresponding to so-called "Fröhlich superconductivity." As James Bray (General Electric) explained to us, in this picture the charge-density wave fluctuations move through the crystal, thus enhancing the conductivity. It is not true superconductivity. According to Michael Rice (Xerox Research Center, Webster, N.Y.), although not true superconductivity, this represents the only example yet found in nature of a collective electron transport mechanism that is different from pairing superconductivity. Calculations of David Allender, Bray and Bardeen, based on mean-field theory, indicated that the Fröhlich effect is too small to account for the experimental results. The idea still has its advocates.

It had been pointed out that fluctuations in one-dimensional systems can be much larger than those from mean-field theory. Subsequently a Bell group said that in general, fluctuations of the Fröhlich type seem to reduce the conductivity rather than increase it, in the kind of simple one-chain model in which all the calculations so far have been carried out. Philip Anderson told us that the question of the increasing conductivity at low temperatures is still rather a mystery.

Two alternative points of view were presented at the San Juan conference. James Krumhansl (Cornell) suggested that there are charged domain walls on the chain that slide along it, maintaining approximately their size and length and contributing to the current. The charged domain walls arise from localized compressions or rarefactions in the local condensed electron density, n_s, and they separate segments of chain having uniform n_s. This model of mobile charged domain walls is based on some very recent work by Michael J. Rice, A. R. Bishop, Krumhansl and S. E. Trullinger (Cornell), and is closely related to the soliton model of domains in one dimension recently introduced by Krumhansl and J. Robert Schrieffer (Penn).

James C. Phillips (Bell Labs), discussed at the meeting his so-called "hopscotch model," which pictures an electron running along a chain in the metallic region. Where the region stops, and the semiconducting region begins, the electron hops to the next chain—for example, from TTF to TCNQ and back to TTF, thereby avoiding the insulating segments. In a liquid–gas transition, two phases can coexist because of a fixed-volume constraint. In Phillips's model, the coexistence of semiconducting and metallic phases along one chain arises because of constraints produced by inter-chain elastic interactions. Such interactions produce periodic insulating and conducting domains that undergo lateral ordering near 60 K. —GBL

References

1. I. F. Shchegolev, Physica Status Solidi A12, 9 (1972).
2. F. Denoyer, R. Comès, A. F. Garito, A. J. Heeger, Phys. Rev. Lett. 35, 445 (1975).
3. S. Kagoshima, A. Anzai, K. Kajimura, T. Ishiguro, J. Phys. Soc. Japan 39, 1143 (1975).
4. R. Comès, S. M. Shapiro, G. Shirane, A. F. Garito, A. J. Heeger, Phys. Rev. Lett. 35, 1518 (1975).

ORNL Heavy-Ion Lab due to start in 1979

A new users group for prospective participants in research utilizing Oak Ridge National Laboratory's Heavy Ion Laboratory met recently to elect officers and adopt a charter. Meanwhile, an $8-million contract for the construction of the Pelletron-type 25-MV tandem accelerator has been awarded the National Electrostatics Corp.

Scheduled for completion in 1979, the accelerator will be the largest to employ a "folded" design, with low- and high-acceleration tubes housed inside a single vertically mounted structure (see PHYSICS TODAY, June 1974, page 20). In combination with the present Oak Ridge Isochronous Cyclotron, the accelerator will raise the mass limit for elements capable of being accelerated to energies sufficient for nuclear reactions from 35 to 150. Site preparation is under way, with building construction expected to commence in March of 1976.

The $18-million laboratory is to serve as a national resource for research in nuclear chemistry, reactions, and structure; atomic, solid state, and health physics; biophysics, and materials damage. Users from Oak Ridge, other laboratories, and the academic world will have equal access to the facility.

Users group members, representing over 500 US and foreign researchers, selected the following six-member Executive Committee at their first meeting: Marshall Blann, University of Rochester; John Rasmussen, University of California at Berkeley; John Fox, Florida State University; Edward Zganjar, Louisiana State University; and Sheldon Datz and James Ford, Oak Ridge. According to James Ball, project director, Eugene Eichler of Oak Ridge will act as liaison officer between users and Heavy Ion Laboratory personnel.

in brief

ERDA has awarded a $3.5-million contract to AVCO Everett Research Laboratory, Everett, Mass., to establish the engineering feasibility of coal-fueled magnetohydrodynamic systems for use in producing electricity directly from coal. □