Labs) that if one had an intrinsic semimetal in which electron mass and hole mass were sufficiently different and in which their concentrations were sufficiently low, there might appear a "Wigner lattice" of holes, permeated by the electron gas. Abrikosov then speculated that Cooper pairing of the electrons could be caused by their coupling to oscillations of the lattice of holes, with resultant superconductivity.

Very recently A. K. Rajagopal (IBM on leave from Louisiana State University) has argued that Abrikosov's calculations are in error because he fails to consider the effect of Coulomb repulsion of the electrons. Marvin Cohen and his collaborators at the University of California, Berkeley, have done a band-structure calculation that disagrees with the Rusakov model.

Several years ago David Allender, James Bray and John Bardeen (then all at the University of Illinois) developed a theory for excitonic superconductivity for a nonuniform medium consisting of layers or filaments of metal in a semiconductor matrix. Such a medium, they said, might show superconductivity. Geballe told us the copper-chloride anomaly might be due to a microscopic structural rearrangement and charge transfer resulting in fine-scaled conducting domains. This could allow, he believes, for some variant of the Allender–Bray–Bardeen mechanism to become operative. However, Bardeen himself told us he does not think the anomaly is due to the Allender, Bray and Bardeen mechanism. If the effect is real, he told us, he favors a mechanism involving electron–hole pairs, such as that advocated by Rusakov and Abrikosov. In any case, Bardeen thinks that the suggested explanation requires that the proposed "electron–hole" droplets in copper chloride have a much higher concentration of electrons and holes than those in silicon and germanium. The hole lattice, he said, would have to be incommensurate with a copper-chloride lattice and the holes not be self-trapped.

Lefkowitz told us that the mode instabilities (which depend on exciton density) are associated with high transition temperature superconductors. In some earlier experiments, in 1964–65, he had shown that a dielectric anomaly was only observable if one populated the solid (thallium chloride and thallium bromide) with excitons.

James C. Phillips and Eugene Blount (Bell Labs) are skeptical of excitonic superconductivity in copper chloride, noting that it requires a very small band gap between valence and conduction bands, inconsistent with the transparency of the material. They believe that the high electrical conductivity at high pressures may be the result of the reversible chemical reaction: 2 $CuCl \rightleftharpoons Cu + CuCl_2$. They do not offer an explanation of the high diamagnetism, but feel that the irreproducibility and peculiar temporal and temperature oscillations suggest that the ultimate explanation may lie in experimental artifacts.

Other explanations offered to us included piezoelectric charges, caused by squeezing the sample, hence leading to false pyroelectricity, or magnetic transformations.

Chu and Geballe stressed to us that the most important direction at present is to get the experiments under control. "We need better methods of sample preparation and characterization. Once definitive experiments have been done, the appropriate models are bound to follow."

—GBL


**References**

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## Parity nonconservation

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get). The experiment looks at electrons scattered at 4 deg from the beam and with secondary energy of 80% of the primary energy; the momentum transfer, $q^2$, varies from 1 to 1.8 $(\mathrm{GeV}/c)^2$.

Between beam pulses the polarity of the next beam pulse is chosen in a completely random fashion. As Prescott explained to us, by randomizing the reversal one averages out effects produced by periodic fluctuations in the beam.

A new polarized-electron source was developed at SLAC for this experiment based on an approach suggested in 1974 by Edward Garwin (SLAC), Daniel Pierce and Hans-Christian Siegmann (ETH, Zurich). The new source differs in several respects from the atomic-beam source pioneered by the Yale group for use at SLAC in experiments using polarized beams and polarized targets at the same time. With this source, a Yale–SLAC group in 1976 achieved a sensitivity in the measurement of asymmetry of about one part in $10^3$.

The new source consisted of a crystal of gallium arsenide that emits polarized electrons when bombarded with circularly polarized light. Large instantaneous currents are available from the source, up to $4 \times 10^{11}$ electrons per pulse on target. (On occasion, the source produced more polarized electrons than could be accepted by the accelerator.) The average polarization was about 40%. By changing the circular polarization of the light hitting the gallium arsenide, the electron polarization can be reversed, and this change can be made easily and rapidly, with very little change in the properties of the electron beam.

Although the experiment requires an accuracy of 1 in $10^5$ to see the predicted asymmetry, $A$, Prescott explained that the cross sections $\sigma_+$ for positive-helicity electrons and $\sigma_-$ for negative-helicity electrons need not be measured that accurately. Because

$$A = (\sigma_+ - \sigma_-)/(\sigma_+ + \sigma_-)$$

lots of quantities cancel out.

The asymmetry the group finds for deuterium is $(-9.5 \pm 1.6) \times 10^{-5} q^2$ with statistical and systematic uncertainties each about 10%. For hydrogen, with fewer statistics, they find $A = (-9.7 \pm 2.7) \times 10^{-5} q^2$. With deuterium, Prescott noted, one would visualize scattering off six quarks, with equal numbers of up and down. With hydrogen, on the other hand, one has two up and one down quark. Although the asymmetry would be expected to be slightly different for hydrogen in the Weinberg–Salam model, the expected difference is much smaller than the experimental uncertainties.

Several consistency checks were made by the experimenters. For example, they made three different kinds of null measurements.

**PETRA stored its first beam on 15 July,** 6 months ahead of schedule. Gustav-Adolf Voss, project leader, is surrounded by team members celebrating in traditional fashion. Shortly after, a 3-mA beam of electrons was accumulated for two hours and 5-GeV electron–positron collisions were produced at low intensity. By mid-September, the PLUTO detector from DORIS is to be moved into the PETRA beam, and experiments with some luminosity are to begin at 5 GeV in each beam.