APS MEETS IN ST. LOUIS

The American Physical Society will hold its March meeting in St. Louis this year, on 20–24 March. It will be the largest APS gathering of the year, serving as the annual meeting of four APS divisions: biological physics, chemical physics, high-polymer physics and condensed matter physics.

Most of the 379 invited and contributed sessions will be held in the Cervantes Convention Center, located directly across the street from the Sheraton St. Louis, the headquarters hotel for the meeting. Meeting registration will be held on the second floor of the Convention Center, at the following times: Sunday, 19 March, 2–8 pm; Monday and Tuesday, 7 am–5 pm; Wednesday, 7:30 am–5 pm; Thursday, 7:30 am–3 pm; Friday, 7:30 am–noon. Continuing the strong emphasis on condensed matter research that has characterized the March meetings of recent years, this year's meeting will include 36 symposia sponsored by the Division of Condensed Matter Physics, either alone or in cooperation with other APS divisions or topical groups.

Prizes and awards

Thirteen prizes and awards will be given at the ceremonial session on Tuesday afternoon. Winners will deliver their prize lectures at various sessions throughout the week.

John A. Armstrong (IBM) will receive the George E. Pake Prize for his contributions in nonlinear optics and the technology of ultrafast phenomena. The $5000 prize is intended to recognize physicists who pursue their own research in addition to managing research or development in industry. At Harvard, with Nicolaas Bloembergen, Jacques Ducuing and Peter Pershan, Armstrong coauthored one of the seminal papers in nonlinear optical theory. As a postdoctoral fellow, Armstrong was a member of a group led by Bloembergen that developed a theoretical treatment of interacting laser beams in nonlinear media. At IBM Armstrong used a coincidence detector based on second-harmonic generation to make one of the first measurements of the duration of picosecond laser pulses. This method of measurement is still widely used. With Archibald Smith, Armstrong was among the first to observe the change in photon statistics when a single-mode semiconductor laser passes through threshold. Armstrong and his coworkers at IBM have also done multiphoton spectroscopy using autoionizing resonances of atoms.

Armstrong received both his BA (1956) and his doctorate in applied physics (1961) from Harvard. He joined the IBM research staff in 1963. From 1976 to 1980, he was director of the physical sciences department at IBM's research laboratory at Yorktown Heights. In 1981 he became manager of materials and technology development at IBM's East Fishkill laboratory, where work on bipolar technology and associated packaging is carried out. In 1983 Armstrong returned to Yorktown Heights to become director of the semiconductor science and technology department, and in 1986 he was named director of research of IBM. The following year he was elected to his current position as an IBM vice president.

Robert W. Baluffi (MIT) will deliver the David Adler Lecture, on "Observations of Grain-Boundary Phase Transitions," on Wednesday morning. He was chosen for the $1000 lectureship in recognition of his "seminal experimental and analytical contributions, which have clarified our fundamental understanding of the atomic mechanisms of sintering, Kirkendall phenomena, dislocation climb, solid-state diffusion, the production and recovery of radiation damage, grain boundary structure and energetics in metals and ceramics, and his accompanying lucid writing and verbal skills in presenting these investigations."

Baluffi received both his BS (1947) and his ScD in physical metallurgy (1950) from MIT. From 1950 to 1954 he was a senior research engineer for the Sylvania Electric Co. He spent the next ten years at the University of Illinois, Urbana–Champaign, where he became a professor in the department of mining, metallurgy and petroleum engineering. From 1964 to 1978 he was the Francis Norwood Bard Professor in the department of materials science and engineering at Cornell (and department head for the last four of those years). He returned to MIT in 1978 as a professor of materials science.

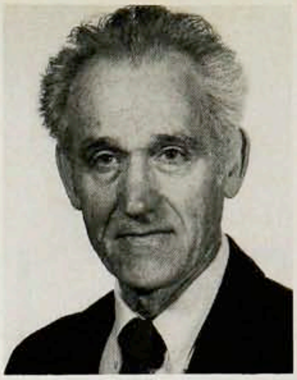
The Division of High-Polymer Physics will present to Frank S. Bates (AT&T Bell Labs) its Dillon Medal, in recognition of his "incisive and original experimental work on polymer phase transitions, especially through the design of model systems." The medal is given each year to a polymer physicist who has been in professional research for ten years or less.

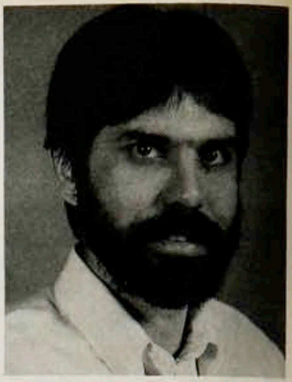
Bates studies the thermodynamics and dynamics of polymer phase behavior to learn about phase behavior in general. Phase transitions in polymers are exceptional targets for investigations because they tend to proceed quite slowly due to the high viscosities of most polymers. Also, because of their large molecular size, polymers exhibit a very small entropy of mixing; this magnifies subtle energetic effects that would be difficult to observe in small-molecule systems.

Bates's current work on polymer isotopes demonstrates one such effect. Theoretically, a liquid mixture of a molecule and one of its isotopes will phase separate as its temperature is lowered, due to the slightly different zero-point energies of the two species. However, to notice this effect in small molecules one must cool the liquid to such low temperatures that most mixtures will have already frozen. In isotopic polymer mixtures the same effect can be obtained at ambient (or higher) temperatures by increasing the polymer size, thereby decreasing the entropy of mixing.

Bates gains information on the topology of ordering phase transitions by studying block copolymers—chemically linked sequences of various types of polymer. Because like poly-


John A. Armstrong


Robert W. Baluffi


Frank S. Bates

mers attract, the different types of polymer in a block copolymer would segregate into separate regions of the container if they were not linked together. Since they cannot segregate entirely, they form ordered microdomains: Sections of a block copolymer that are, say, A type, situate themselves alongside other A-type sections, creating a local abundance of A types.

Bates received a BS in mathematics (1976) from the State University of New York, Albany, and an ScD in chemical engineering (1982) from MIT. Since 1982 he has been a member of the technical staff at Bell Labs. This spring he will join the faculty of the University of Minnesota, Minneapolis–St. Paul, as an associate professor of chemical engineering and materials science.

Peter J. Feibelman (Sandia National Laboratories) will receive the $5000 Davisson–Germer Prize for his "pioneering work in developing the theory of electromagnetic fields at surfaces."

Feibelman began his work on surface fields during the 1970s. Although photoelectric emission was then in wide use as a tool for studying electronic states near surfaces, surface scientists were still using the crude "textbook approximation" to explain the forces associated with a light wave near a surface. Feibelman felt that this approximation, which models the surface of a solid as a step function, was insufficient for predicting microscopic effects.

Feibelman devised a time-dependent generalization of the static theory of simple metal surfaces developed by Walter Kohn (University of California, Santa Barbara) and Norton Lang (IBM). When he embodied his theory in a computer model, he was surprised to find that the electromagnetic fields near surfaces were not merely a smoothed-out version of the textbook fields: Their strength and the way they vary across a surface depend on the degree to which the fields cause electrons to be excited. Feibelman made the novel predictions that the intensity of electric current emitted by an irradiated metal would peak at roughly 80% of its plasma frequency, and that wave motions of surface electrons (surface plasma oscillations) would have the unusual property that their frequency would diminish at shorter wavelengths. Both of these predictions were subsequently verified in experiments by E. W. Plummer and his students Harry Levinson and K. D. Tsuei at the University of Pennsylvania. Using his model of the near-surface field to establish matching conditions, Feibelman also developed a theory of surface reflectance. This theory gave rise to surface analogs of the dielectric function, which revealed a link between a variety of experimental techniques previously thought to be unrelated.

Feibelman graduated from Columbia in 1963 and received his PhD in physics from the University of California, San Diego, in 1967. From 1968 to 1969 he worked as a postdoctoral fellow at the National Center for Scientific Research (CNRS) in Saclay, France. He was a research assistant professor of physics at the University of Illinois, Urbana–Champaign, from 1969 to 1971, and an assistant professor of physics at the State University of New York, Stony Brook, from 1971 to 1974. Since leaving Stony Brook, he has been on the technical staff at Sandia Laboratories in Albuquerque, New Mexico.

Hellmut Fritzsche (University of Chicago) will receive the Oliver E. Buckley Condensed Matter Physics Prize for his "transport studies of impurity band conduction near the metal–insulator transition and his leadership in our understanding of amorphous semiconductors."

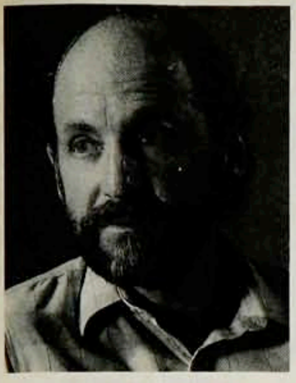
In 1952 Fritzsche pioneered the study of impurity conduction (or "hopping conduction"), a semiconductor phenomenon occurring at temperatures sufficiently low that electrons in the energy wells around impurities do not have enough thermal energy to escape into the conduction band. If the impurities are sufficiently near to one another and the temperature is not *too* low, such an electron will tunnel through to an adjacent impurity site. In the presence of an electric field the electrons will preferentially tunnel against the direction of the field, causing impurity conduction. Fritzsche's work has consisted largely of measuring how impurity conductivity is affected by conditions that are known to affect normal conductivity, such as applied magnetic fields or uniaxial stress.

Fritzsche found that even at effectively zero temperature there is a critical impurity density above which a semiconductor will conduct like a metal. The crossing of this threshold is called the metal–insulator transition. Despite research by many groups over the last 15 years, this transition is still not completely understood.

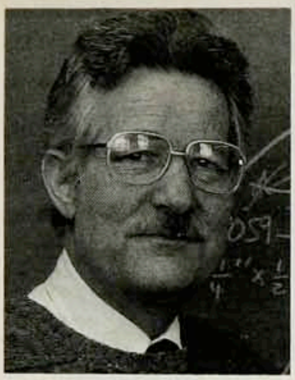
During the past two decades, Fritzsche has investigated the transport properties and defect structure of amorphous semiconductors (see Fritzsche's article in PHYSICS TODAY, October 1984, page 34).

Fritzsche graduated from the University of Göttingen in 1952 and received his PhD in physics from Purdue University in 1954. From 1955 to 1956 he remained at Purdue as an assistant professor. In 1957 he became an assistant professor at the University of Chicago, where he is now a professor of physics.

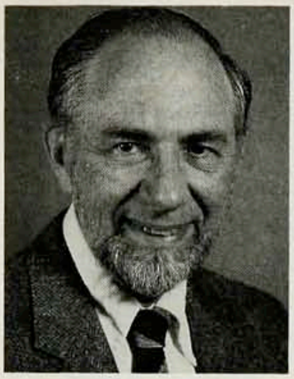
Eugene Helfand (AT&T Bell Labs) will receive the High Polymer Physics Prize for his "pioneering development of statistical mechanical and thermodynamic theories of the structure and properties of block copolymers and polymer interfaces, and the dynamics of conformational changes." In the early 1970s Helfand developed differential equations to describe an inho-



Peter J. Feibelman



Hellmut Fritzsche



Eugene Helfand

mogeneous distribution of polymers, and he found that the interface between immiscible polymers could be much broader than interfaces of smaller-molecule materials. He also investigated microdomains of block copolymers. (See the above description of Bates's work.) Helfand's methods enabled him to calculate the most stable geometries and the energetically optimal distance scales for these microdomains.

Helfand also resolved the paradox that certain rotational transitions of carbon–carbon bonds were observed to occur almost as rapidly in polymers as in small molecules, even though such transitions seemed to necessitate impossibly sudden displacements of large sections of the polymer. He showed that if the rotation was accompanied by distortion of neighboring degrees of freedom (especially counterrotation of second-neighbor bonds), the rapid transition rate could be achieved, and he verified, by carrying out one of the first Brownian dynamics computer simulations, that the predicted motion did indeed occur. Helfand received a BS from the Polytechnic Institute of Brooklyn in 1955 and a PhD in chemistry from Yale in 1958. He joined Bell Labs in 1958, and in 1983 was named a Distinguished Member of the Technical Staff.

Charles Kao (Chinese University of Hong Kong), J. B. MacChesney (AT&T Bell Labs) and Robert D. Maurer (Corning Glass Works) will share the $5000 International Prize for New Materials. Each of the recipients has contributed a major development in materials research that has made possible the production of practical low-loss optical fibers. In the early 1960s, many laboratories were interested in exploiting the immense bandwidths and information-carrying potential of optical-frequency communication, but no one knew of a practical way to send optical signals over long distances. In 1966, with his colleague George Hockham, Kao published a paper arguing that "a fiber of glassy material . . . represents a possible practical waveguide with important potential as a new form of communication medium." In the same paper they reported a measured power attenuation of less than 200 dB/km in a sample of fused quartz, a type of silica. They predicted that sufficient purification of the silica would result in an attenuation of less than 20 dB/km, a figure that was considered practical for optical communications. Kao's work precipitated much serious research on optical fibers.

Maurer and his colleagues were among the first to create fibers of silica glass, by a method that has come to be called the soot process. In trying to make fibers of silica, one faced two main problems: The very high melting temperature of silica made it difficult to draw into fibers; and, because pure silica has one of the lowest indices of refraction of any glass, one could not easily find a slightly less refractive substance to use as a sheath for the fiber, to prevent leakage. The soot process solved both of these difficulties.

In the soot process, a dust (or "soot") of silica is deposited onto a rod, and the rod is then heated until the silica melts and forms a tube. When the rod is cooled and removed, the freestanding tube of silica is once again heated and collapses into a fiber under surface pressure. To tackle the problem of providing a sheath for the fibers, Maurer tried doping the silica in the core with an element that would raise its refractive index slightly and using pure (or less heavily doped) silica for the sheath. In 1970, Maurer and colleagues produced a fiber with an attenuation of less than 20 dB/km for 0.63-μm light.

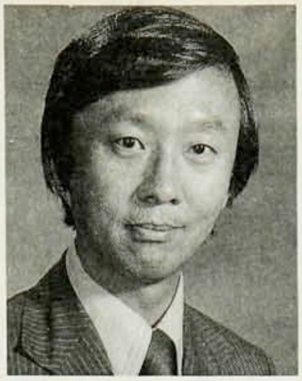
The soot process is one of two methods for making optical fibers that are now in wide use in the US. The other, the modified chemical vapor deposition method, was developed by MacChesney and coworkers at Bell Labs. The main difference between MCVD and the original soot process is that in the soot process silica dust is deposited on the outside of a solid cylinder whereas in MCVD the dust is deposited on the inside of a tube in which reactive gas is flowing. When it was developed, the MCVD method had the advantage that heating was done with a torch outside the tube rather than with a direct flame; this reduced the amount of water in the fiber and thereby lowered its attenuation.

Kao received both his BSc (1957) and PhD (1965) in electrical engineering from the University of London. He started at ITT in 1957 as an engineer, and in 1960 he joined ITT's Standard Telecommunications Laboratories Ltd, where he rose from research scientist to research manager. During 1970–1974, he was a reader and then chair professor of electronics at the Chinese University of Hong Kong. In 1974 he rejoined ITT as chief scientist at the Electro-optical Products Division in Roanoke, Virginia. In 1982 ITT named Kao its first ITT Executive Scientist, and in 1986 made him corporate director of research. In 1987 Kao became vice chancellor of the Chinese University of Hong Kong, which is the title he currently holds.

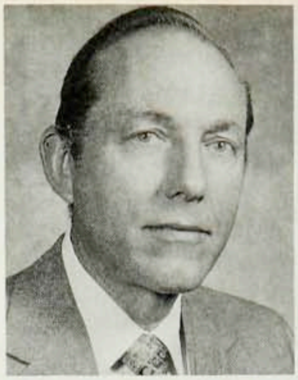
Maurer received a BS from the University of Arkansas in 1948 and a PhD from MIT in 1951. He joined Corning Glass Works as a physicist in 1952, became manager of applied physics research in 1963, and was made manager of special projects in 1976. In 1978 he was made a research fellow at Corning.

MacChesney received a BA from Bowdoin College in 1951, and after serving in the US Army, received a PhD from Pennsylvania State University. In 1959 he joined Bell Labs, where he is now a fellow.

The Division of Atomic, Molecular

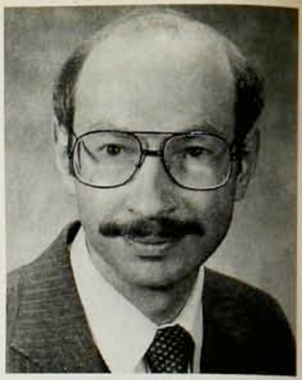


Charles Kao



Robert D. Maurer

J. B. MacChesney



Stephen R. Leone

and Optical Physics will present its $5000 Herbert P. Broida Prize to Stephen R. Leone (Joint Institute for Laboratory Astrophysics) in recognition of his "outstanding contributions to our understanding of the reaction dynamics of excited state, radical and ionic species" (see Leone's article in *Physics News in 1984*, PHYSICS TODAY, January 1985, page S-15). The principal theme of Leone's work has been state-resolved reaction dynamics.

In one type of experiment, he uses a laser to overpopulate a particular excited state in a reactant, then studies the reactant to determine whether reaction rates are affected by the overpopulation. He also uses lasers to induce fluorescence from rotational and vibrational transitions in a reaction product in order to study the product's state distribution.

In trying to understand the dynamics of chemical reactions, Leone has had to study energy transport processes and the breaking of chemical bonds. For example, he has measured the effects of alignment on energy transfer events by preparing an excited species so that its p orbitals are aligned along a particular direction and then observing the changing rate of energy transfer as he varies the angle at which some reactant approaches the p orbitals of the excited species.

Recently Leone has been working on collisions with surfaces, epitaxial growth and etching, and photofragmentation. He also conducts laser measurements of the Doppler shifts of low-concentration ions in a sea of neutrals as the ions accelerate under a constant electric field; these measurements constitute some of the first observational checks of the well-developed theory of ion mobility and drift.

Leone received his BA from Northwestern University in 1970 and his PhD in chemistry from the University of California, Berkeley, in 1974. From 1974 to 1976 he was an assistant professor of chemistry at the University of Southern California, and for the next 12 years he worked as a physicist at the National Bureau of Standards. He is now a lecturer in physics at the University of Colorado, Boulder.

The first Julius Edgar Lilienfeld Prize will go to N. David Mermin (Cornell). The $12 000 prize, established last year to recognize outstanding contributions to physics by someone skilled in lecturing to nonspecialists, obliges its recipient to give three lectures in his research area (see PHYSICS TODAY, May 1988, page 87). Mermin will give the first of these lectures, "Can You Help the Mets by Watching on TV: Metaphysical Consequences of Photon Correlation Experiments," on Tuesday afternoon.

In 1966 Mermin and Herbert Wagner proved their theorem, now well known, stating the absence of long-range order in one- and two-dimensional systems. Following the work of Pierre Hohenberg, Mermin and Wagner derived a rigorous upper bound on magnetization as a function of applied magnetic field for two-dimensional ferromagnetic systems. Their result shows that the magnetization vanishes as the magnitude of the applied field approaches zero.

With Tin Lun Ho, Mermin derived the Mermin–Ho Relation, the analog for the A phase of He^3 of the London equation for superconductors, embodying important connections between supercurrents and textures. The Mermin–Ho Relation shows that there are more ways for supercurrents to decay in He^3-A than in conventional superfluids.

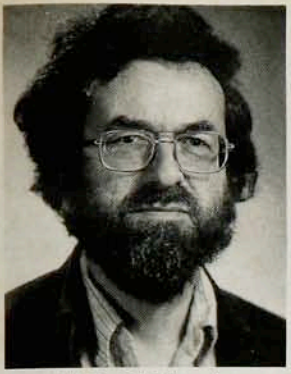
Mermin's recent work with Daniel Rokhsar and David Wright has produced a classification scheme for quasicrystals that uses results of number theory originally developed because of their relevance to Fermat's last theorem. Also in the last several years, Mermin has become interested in problems such as the Einstein–Podolsky–Rosen paradox, in which quantum mechanics seems to violate locality. Here Mermin has put most of his efforts into tutorial articles and discussions of philosophy, trying to distill the important physical arguments out of the quantum formalism.

Mermin is known as an excellent communicator of physics. He wrote, with Neil Ashcroft, the classic text *Solid State Physics* (Saunders, Philadelphia, 1976) and is the author of an intuitive guide to special relativity, *Space and Time in Special Relativity* (Waveland, Chicago, 1989; originally published in 1968).

At the beginning of his research career, Mermin remembers, his first few lectures were "incredibly technical." He soon realized that his audiences were not only missing his point but were also quite bored. Mermin decided to "work very hard on precisely the opposite [of what he was then doing], only giving a talk if I could make it interesting." When Mermin prepares a lecture, he looks for a fairly small point that can be well communicated in the allowed time, rather than trying to embrace a huge body of work.

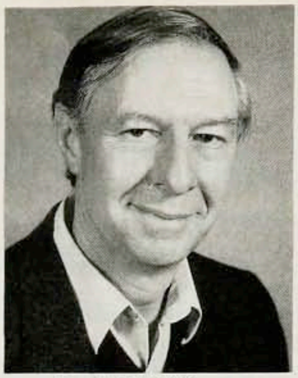
Mermin received an AB in mathematics (1956) and a PhD in physics (1961), both from Harvard. After three years as a postdoctoral fellow, he went to Cornell University as an assistant professor. Since 1972 Mermin has been a professor of physics at Cornell, and since 1984 he has served as director of the university's laboratory of atomic and solid-state physics.

Cherry A. Murray (AT&T Bell Labs) will receive the Maria Goeppert-Mayer Award for her experimental discovery of "two stage" melting in two-dimensional arrays of polystyrene spheres, for elucidating the role of topological defects in this phenomenon and for "pointing out the connection between her discovery and recent theories of melting in two dimensions." The $2000 award (and an additional travel allowance for lectures at four institutions) is given each year to recognize achievements


N. David Mermin


Cherry A. Murray


Richard J. Saykally


Frank H. Stillinger

by a woman physicist in the early years of her career.

In her experiments highly charged polystyrene spheres 3000 Å in diameter are suspended colloidally in water and held between two glass plates. The setup provides Murray with a canonical two-dimensional lattice subject to Brownian motion at room temperature. The density of the spheres in two dimensions is varied in order to study melting transitions peculiar to two-dimensional systems, namely, the two transitions that occur when dislocation pairs and disclination pairs, respectively, become unbound. Murray's observations are confirming the basic two-stage picture predicted in the 1970s by Michael Kosterlitz, David Thouless, Bertrand Halperin, David Nelson and Peter Young, but she may be able to observe some phenomena that are hard to predict theoretically; in particular, she is looking at the motions of individual particles in the middle, hexatic, phase.

Murray received both her BS (1973) and her PhD (1978) in physics from MIT. She joined Bell Labs in 1978 as a member of the technical staff in the Physical Research Laboratory. In 1987 she became head of the Solid State and Low Temperature Physics Research Laboratory.

Richard J. Saykally (University of California, Berkeley) will receive the Earl K. Plyler Prize for "the creation of new infrared techniques, and their use to expand infrared spectroscopy to many of the chemically most important molecular ions." The $5000 prize is given each year in recognition of work in molecular spectroscopy.

Developed by Saykally and his research group in 1982, the technique of velocity-modulation laser spectroscopy is now widely used for investigating spectra of molecular ions. In this method, the rarefied ions in an electrical discharge plasma are Doppler shifted into and out of resonance with a tunable infrared laser as the electric field of the plasma is made to oscillate rapidly. Phase-sensitive detection of the absorbed laser power is therefore ion-selective, allowing one to measure the absorption spectra of various rotational and vibrational transitions of the ions.

Saykally's group is currently developing a new method, called direct laser absorption spectroscopy of fast ion beams, which Saykally expects to replace velocity modulation as the most powerful means of investigating the spectra of ions. Saykally has also developed a new way to study intermolecular forces at a greatly enhanced level of detail, namely, by measuring the vibrational motions of van der Waals bonds in weakly bound complexes. For this he uses tunable far-infrared laser absorption spectroscopy on supersonic jets of the molecular complexes.

Saykally received his BS from the University of Wisconsin, Eau Claire, in 1970 and his PhD in chemistry from the University of Wisconsin, Madison, in 1977. He had a research fellowship at the National Bureau of Standards for two years before becoming an assistant professor in the chemistry department of the University of California, Berkeley, in 1979. He was named associate professor in 1983, and became a full professor in 1986.

Frank H. Stillinger (AT&T Bell Labs) will receive the $10 000 Irving Langmuir Prize in Chemical Physics for his "pioneering contributions to statistical mechanics theory" and his critical application of this theory to "advance our understanding of the nature of water, aqueous solutions and liquids."

Stillinger's major contribution to the current understanding of liquids was the introduction of the "inherent structure theory." The theory holds that once the thermal motions in a liquid have been factored out, an inherent short-range structure remains. This structure is material-specific and temperature independent.

If cooled slowly, most liquids will crystallize before their inherent structure becomes observable. However, in supercooled, very pure liquids and in extremely viscous liquids, such as glass, one can reach the point of negligible thermal fluctuations without allowing the sample to nucleate and crystallize. The liquid then exhibits its inherent structure.

Stillinger introduced his theory in 1982, long after experimenters had noticed unusual behavior in supercooled liquids. For instance, as supercooled water is cooled to its stability limit (around −38 °C), it expands at an accelerating rate and its viscosity increases. Both of these phenomena are explainable by the inherent-structure approach.

Stillinger received a BS in chemistry from the University of Rochester in 1955 and a PhD in theoretical chemistry from Yale in 1958. He became a member of the technical staff at Bell Labs in 1959, and was head of the Chemical Physics Research Department from 1976 to 1978. In 1982, he was given the title of Distinguished Member of the Technical Staff.

APS Show and other Services

AIP will manage a job placement center and an equipment exhibit for the meeting. The equipment exhibit will be held in Exhibition Hall C, in the Cervantes Convention Center, at the following times: Tuesday, 21 March, noon–6 pm; Wednesday, 10 am–5 pm; and Thursday, 10 am–3 pm. The placement center, located in room 123 of the convention center, will be open Monday through Thursday from 9 am to 5 pm, and Friday from 9 am to noon.

The AIP public information division will operate a newsroom in the Sheraton on behalf of APS; it will be open from 8:30 am to 5 pm on Monday and Tuesday, and from 8:30 am to noon on Wednesday.

—Matthew Siegel ■