which Madansky maintained an interest.

Madansky served as department chairman from 1965 to 1968; during that period, Hopkins started its now-thriving astrophysics program. In addition to his work at Hopkins, Madansky spent many summers conducting research at SLAC. He was also a scientist at the Relativistic Heavy Ion Collider (RHIC) at Brookhaven National Laboratory (BNL), where he was a member of the Solenoid Tracker at RHIC (STAR) collaboration.

In 1980, in his work at the BEVALAC at Lawrence Berkeley Laboratory, Madansky used the power of highly segmented arrays of almost 4π solid-angle detectors in heavy-ion physics to characterize central collisions. With this equipment, he made the first measurements of neutral pion production with Tim Hallman, his graduate student at the time. Madansky energetically advocated dilepton measurement as the signal of the early hard-scattering stage of collisions. This measurement was first implemented at the BEVALAC in the early 1980s and now incorporated in the HADES experiment at GSI, a heavy-ion research center in Darmstadt, Germany, and the PHENIX experiment at the RHIC.

In 1989, Madansky also pioneered another unique research technique in relativistic heavy-ion collisions at the BNL Alternating Gradient Synchrotron (AGS): the use of lambda polarization as a probe of the origin of strangeness production, which is thought to be a sensitive indicator of the possible transition in heavy-ion collisions from hot hadronic matter to a deconfined quark–gluon plasma. Madansky, who was always fond of polarization as a unique tool in particle and nuclear physics, was the first to make feasibility measurements to test the possibility of making this measurement, and in fact, he measured the first lambdas observed in relativistic heavy-ion collisions at the AGS.

In the early 1990s, Madansky was a major force behind the addition of the electromagnetic spectrometer in STAR for the study of spin physics with polarized proton beams. This concluded his study of polarization phenomena, which began with his efforts to produce polarized proton beams in the 1960s.

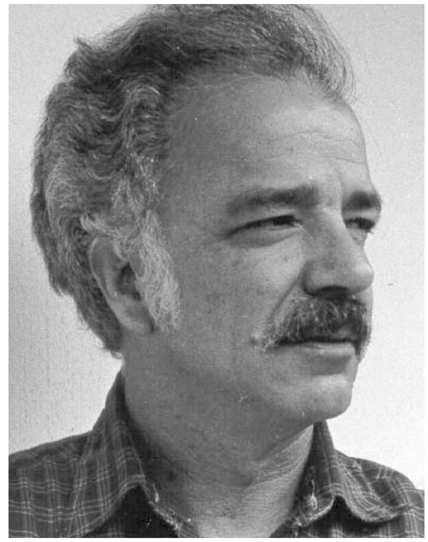
His long-term interest was in the development of experimental methods, especially particle detectors. As early as the 1940s, he worked on parallel plate detectors, the precursors of the spark chambers of the 1960s.

Popular with faculty and students, Madansky was instrumental in hiring many of the leading staff members of the department. A man of vision who started a number of the department's programs, he passed on his knowledge by describing the latest results and challenging listeners to think about the questions those results raised. He was one of the most intuitive of physicists in a number of fields—a true generalist. He would ask colleagues about their current work and ideas and suggest additional research. Although he frequently provided seminal ideas, he would be reticent about being part of the publications that incorporated those ideas.

Madansky was a good conversationalist and a highly cultured man who enjoyed the arts. He was an amateur painter and often spent free time at art museums. He attended plays and the opera, particularly enjoying the music of Verdi and Puccini. He will be sorely missed by us all.

Yung K. Lee
Thomas Fulton
Gordon Feldman
The Johns Hopkins University
Baltimore, Maryland

Virgilio Beltrán-López



Virgilio Beltrán-López

Virgilio Beltrán-López, Distinguished Professor Emeritus of physics with the Institute for Nuclear Sciences at the National Autonomous University of Mexico (UNAM) in Mexico City, died on 26 May 2000 after a long struggle with cancer.

Born on 2 March 1932 in Puebla, Mexico, Virgilio obtained bachelor's degrees in both physics and engineering at the University of Puebla in 1955, a master's degree in philosophy from Lehigh University in 1957, and a PhD in physics from Yale University in 1961.

Virgilio was a leading member in the group of young scientists who rode the crest of the mid-20th-century wave of enthusiasm for physics. Having been prepared by his undergraduate professors at Puebla, he attacked graduate school with energetic devotion. Only four years after having come to Yale to work under the direction of Vernon Hughes, Virgilio presented a thesis that included two experiments, either of which would have sufficed for a doctoral dissertation. The first experiment established an upper bound for the anisotropy of inertial mass, a result deemed important enough to modern cosmology to be included in the collection, *The Physical Review: The First Hundred Years* (AIP Press, 1995). The second experiment, a study of the microwave Zeeman spectrum of atomic chlorine, began Virgilio's lifelong engagement with experimental and theoretical studies of atomic magnetism.

After he finished his doctoral degree, Virgilio returned to Mexico in 1962, joining the staff of the UNAM Physics Institute. He initiated and directed an ambitious program in experimental and theoretical research and taught courses in advanced physics. He made a huge impact on physics education at the secondary level through 15 textbooks he either wrote or coauthored. In 1985, he became a professor at UNAM's Institute for Nuclear Sciences.

Virgilio was an active member of the first generation of physics professors at the National Polytechnical Institute, which recognized the importance of establishing research centers beyond the universities located in Mexico City. Following this path, in 1964, Virgilio became director of the school of sciences at the University of Puebla, where he gathered a group of colleagues who quickly became internationally recognized for their work in statistical mechanics. At Puebla, he also did spectroscopy at low magnetic fields using the methods of optical pumping and free precession. He was director until 1965; he then worked as head of a research laboratory at the Nuclear Center (a government-based research institution) and as a consultant with the Mexican Petroleum Institute.

Motivated by opportunities to undertake more ambitious experiments, Virgilio returned to UNAM in

1972 to accept a half-time teaching position. He became a full-time professor in 1985. Over the years, the laboratories with which he was associated produced an astonishing variety of experiments that included electron resonance studies of gas-phase atoms, paramagnetic resonance spectroscopy of disordered materials, Mössbauer spectroscopy of solids, atomic beam studies of gas kinetics, and laser magnetic resonance studies of simple atoms that extended into the far infrared. Simultaneously, Virgilio and his students and collaborators were actively engaged in the related theory, particularly in the use of self-consistent field theory to calculate atomic magnetic moments and in the use of analytic and Monte Carlo modeling to analyze spin resonance spectra of disordered materials. Many researchers worldwide sought his expertise.

Considering his level of engagement in advanced research, Virgilio was remarkably active in teaching at all levels; he held his last class just a few weeks before his death. His four one-semester introductory courses for physics majors at UNAM were notable for their use of experiments that related specifically to the needs and resources of Mexico. Many of his former students are now in academic and research positions throughout Mexico. Moreover, he was also the leading author of numerous textbooks written for Mexican students in the secondary schools and in the early years of college. In those books, he stressed the importance of observation, using, for example, many experiments of his own design that could be conducted using local resources. He also made important contributions to the public understanding of science through his popular articles and his book *To Catch a Photon* (Fondo de Cultera Economica, 1992).

In 1991, the Sociedad Mexicana de Física awarded him the Academic Medal for his contributions to the development of physics in Mexico.

A warm and humane man who cultivated the friendship of his colleagues, Virgilio fought to establish an attitude of tolerance everywhere in Mexico, especially in his beloved UNAM. He will be missed by all who knew him.

JOSE JIMÉNEZ-MIER
EUGENIO LEY-KOO
National Autonomous University of Mexico
Mexico City
JENS ZORN
University of Michigan, Ann Arbor ■

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in 1982, experiments were reported[2] in which pulses passed through an absorbing medium with little distortion and with a group velocity that "exceeds 3×10^{10} cm/s, equals $\pm\infty$, or becomes negative." During the 1990s, Raymond Chiao, Paul Kwiat, and Aephraim Steinberg studied faster-than-*c* effects in the tunneling of single-photon wavepackets.[3] Their experiments answered longstanding, subtle questions about how long it takes for a particle to tunnel across a barrier.

The experiments by L. J. Wang and colleagues,[4] which attracted much of the recent publicity, demonstrate that the peak of the exit pulse can emerge from an amplifying medium before the original peak enters it, and this can occur with essentially no amplification, absorption, or pulse distortion.

Rolf Landauer, Thierry Martin, and others discussed related phenomena in the early 1990s for particular types of wavepackets, and Gerhard Diener[5] in 1996 presented an especially clear analysis and proof that causality is preserved. While the possibility of reconstructing the complete pulse from an infinitesimally small tail might be regarded as an old story, it is certainly worthy of further study, especially in connection with quantum noise. I suspect that many physicists would agree with Landauer's comments[6] that "the easy explanation [that the whole transmitted wave comes from the front end of the much larger incident wave] is unsatisfying," and that "our understanding of this is not what it deserves to be."

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PETER W. MILONNI
(pwm@t4.lanl.gov)
Los Alamos National Laboratory
Los Alamos, New Mexico

Origin of 21-Micron Emission Feature Is a Mystery

The proposed identification of the mysterious emission feature at 21 microns with titanium carbide nanoclusters (PHYSICS TODAY, June 2000, page 21) is certainly a major news item in astrochemistry. However, no mention was made of the feature's initial discovery or of the 10 years of intensive research into this problem by astronomers and laboratory spectroscopists. Since 1989, when the 21-micron emission feature was discovered in four protoplanetary nebulae observed with the Infrared Astronomical Satellite,[1] many carriers, including large polycyclic aromatic hydrocarbon clusters, hydrogenated amorphous carbon grains, hydrogenated fullerenes, and nanodiamonds, have been proposed. These earlier suggestions were based in part on the great abundance of carbon observed in all of the nebulae that exhibited this emission feature.

The recent precise measurements of the feature's central wavelength (20.1 microns) and line profile based on observations by the Infrared Space Observatory[2] preceded the laboratory identification and made a definite identification possible.

Contrary to the impression given by the article that there are only two such objects, we have found 12 objects showing this emission feature, all belonging to a new class of celestial objects called proto-planetary nebulae. Why the 21-micron emission feature would be limited to such a short phase (a few thousand years) of stellar evolution is not understood.

Although the laboratory spectroscopy of titanium carbide clusters is a significant piece of work, it may not represent the final solution to the 21-micron feature mystery. A recent study has suggested that the feature can originate from out-of-plane bending modes of carbon rings with one carbon atom replaced by oxygen.[3] Since the stretching and bending modes of aromatic hydrocarbons are commonly observed in proto-planetary nebulae, this suggestion is not unreasonable. Whatever the carrier of the 21-micron feature turns out to be, large-scale molecular synthesis leading to the formation of large organic molecules certainly can take place efficiently even in the low-density circumstel-