campaign to monitor SS433 shortly after its discovery. This campaign led to the discovery of precessing relativistic jets that make rotating corkscrew patterns on the sky. In the 1990s, he actively pursued the x-ray transients discovered and monitored by new satellites such as Rossi X-ray Timing Explorer (RXTE) and Compton Gamma-Ray Observatory (CGRO), emphasizing the connections between the x rays from the accretion disk and the synchrotron jets seen at radio wavelengths. He also was one of the first scientific users of the new Astronomical Imaging Processing System ($AIPS^{++}$) imaging package. The last article Bob published, on the x-ray transient V4641 Sgr, appeared in the *Astrophysical Journal* in December 2000. That article, in which he combined GBI and VLA data with a new imaging algorithm and a substantial extension to the model he developed for SS433, showcased Bob's unique abilities as an observer, software pundit, and theoretician.

It is highly appropriate that a number of conferences held in the fall of 2000 were dedicated to Bob. His death was tragic, but he died as he likely would have wished—extending the limits of his reach and always looking ahead.

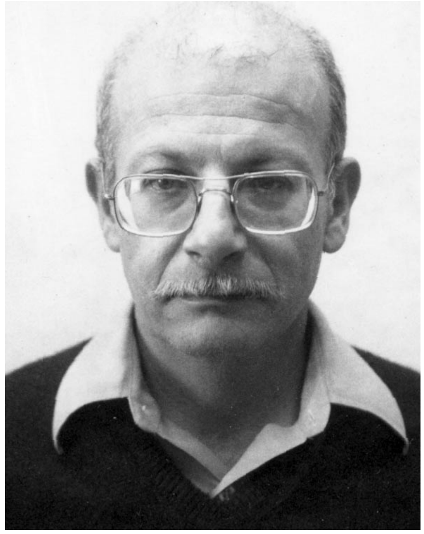
BRUCE BALICK
University of Washington
Seattle

Thomas Emanuel Feuchtwang

Thomas Emanuel Feuchtwang, an emeritus professor of physics at Pennsylvania State University, died 10 August 2000 in Boynton Beach, Florida, following a lengthy battle with Parkinson's disease.

Emanuel's life was exciting, both scientifically speaking and otherwise. Born in Budapest on 21 May 1930, he moved to Palestine and what would subsequently become the State of Israel, whose independence he fought for in 1948. Five years later, he came to the US as a student. He earned all of his degrees in electrical engineering: a BEE from the Georgia Institute of Technology in 1953, an MS from Caltech in 1954, and a PhD in microwave theory from Stanford University in 1959.

The following year, Emanuel joined the University of Illinois at Urbana-Champaign as a postdoctoral fellow in the physics department. His research involved theoretical collaborations with the experimental group on color centers, headed by Charles P. Slichter, and the group on the Mössbauer effect, headed by Hans Frauenfelder. In 1962, he moved to the University of Minnesota, Twin Cities, where he worked with Bill Peria on surface-lattice-dynamical effects in low-energy electron diffraction.



THOMAS EMANUEL FEUCHTWANG

Emanuel came to Penn State as a tenured associate professor in 1965; he remained at the university for the rest of his career. His initial research interests were in electron emission and tunneling phenomena. He developed, in his inimitable style, a rigorous tunneling theory that avoided the transfer Hamiltonian formalism. He also worked extensively on electron spin polarization in field emission and photoemission. While at Penn State, Emanuel held numerous visiting academic and industrial appointments, both nationally and internationally, including the following: Cornell University; Westinghouse Laboratories in Pittsburgh; Tel Aviv University; the Technion–Israel Institute of Technology in Haifa; the University of Hawaii at Honolulu; and Cambridge University.

The major emphasis of Emanuel's research during the latter part of his career was on electronic and atomic properties of surfaces and, in particular, the scanning probe microscopy and spectroscopy that were made possible by the development of the scanning tunneling microscope and its derivatives. Much of this research was related to the issues of what exactly could be learned from these initial experiments with an STM and what potential information might be gleaned from future experiments.

Emanuel was also an accomplished scholar outside of science. He read Western and Near Eastern literature extensively, and was versed in the classical and contemporary histories of the same regions. He spoke English, French, German, and Hebrew and studied Aramaic. He also was a serious biblical scholar.

Emanuel approached many nonscientific problems with the same intensity and persistence that he brought to his research. One of his greatest passions was his unswerving support of the State of Israel. Yet he retained a deep understanding and respect for Arab culture and history.

Emanuel was a remarkable scientist, who stimulated and was admired by physicists worldwide. He leaves behind, among colleagues and friends, memories of his broad scientific, intellectual, and cultural interests.

MILTON W. COLE
PAUL H. CUTLER
HEINZ K. HENISCH
Pennsylvania State University
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Chanchal Kumar Majumdar

Chanchal Kumar Majumdar, a leading condensed matter theorist in India, died on 20 June 2000 in Calcutta following a heart attack.

Majumdar was born on 11 August 1938 in Calcutta. He grew up during the last years of British rule in the highly nationalistic environment of Calcutta, where science was viewed as the great equalizing pursuit. Inspired by physicists Jagdeesh Chandra Bose, C. Venkata Raman, Satyendra Nath Bose, and Megh Nath Saha, all of whom worked in Calcutta at some point during the first half of the 20th century, many people were attracted to physics. In this environment, Majumdar was an extraordinary student; his record scores in state- and university-level examinations are an academic legend.

Majumdar completed his PhD in theoretical condensed matter physics with Walter Kohn in 1965 at the University of California, San Diego. His thesis was on the effect of interactions on positron annihilation in solids. That same year, he made a significant contribution: the Kohn–Majumdar theorem he formulated in collaboration with Kohn. The theorem proposes the continuity between bound and unbound states of a potential in a many-body continuum, a crucial clue to the orthogonality catastrophe that underlies the physics of the Kondo and Anderson impurity models. In 1966, Majumdar went to the Carnegie Institute of Technology in Pittsburgh for a postdoctoral fellowship. There, stimulated by the presence of James S. Langer and Robert B. Griffiths, he worked on problems in statistical mechanics and exactly solvable models such as the Ising model.

That same year, Majumdar joined the Tata Institute of Fundamental Research (TIFR) in Bombay, India, where he was instrumental in the early growth of condensed matter activity in a largely particle physics environment. He worked on problems ranging from the electronic (band) structure of cerium to exactly solvable spin models. He inculcated the culture of using the optimum mix of numerical and analytical methods to gain insight and obtain hard results. He interacted closely with experimental groups at TIFR on rare-earth magnetism, nuclear spectroscopy, and low-temperature physics. At TIFR, he computed exact eigenfunctions for finite chains and clusters, explored multimagnon bound states, and obtained energy-level spectra numerically. Perhaps the most significant outcome was the Majumdar–Ghosh model he developed with his student Dipan Ghosh in 1969. This model, with additional second neighbor interactions, is exactly solvable for a certain ratio of the coupling constants. It exhibits spontaneous breaking of discrete symmetry, namely lattice translations, and has a gap in its excitation spectrum. Fittingly, recent advances in synthetic materials science have seen real systems (such as copper germanate) that come close to fulfilling the conditions of solvability.

From 1969 to 1970, Majumdar spent a year on leave with Samuel F. Edwards at the University of Manchester in England. There, he wrote a prescient paper on the origin of non-Debye stress relaxation in glassy systems.

With his strong sense of history and commitment, Majumdar returned home to Calcutta in 1975 when he was offered the Palit Professorship at Calcutta University. He was a great teacher, enabling and inspiring a generation of physics graduates, some of whom are now among India's leading physicists. As an example of his intellectual range, he worked with experimental physicists on irradiation effects in high-T_c superconductors, with geologists on the determination of Fe^{2+}/Fe^{3+} ratio in iron minerals from the region and its geological implications, and with engineers of the Haldia Dock Complex (Calcutta Port Trust) on modeling the seasonal and diurnal variations of large vessel navigability up the Hooghly River. In 1976, Majumdar was elected to the Indian Academy of Sciences.

CHANCHAL KUMAR MAJUMDAR

In the last decade of his professional life, Majumdar was involved in creating and fostering the S. N. Bose Centre for Basic Sciences in Calcutta, from its beginnings as an idea to buildings, facilities, people, and an ethos. The center bears the mark of his perfectionism and phenomenal attention to detail, and is emerging as a major resource for physics.

Majumdar was deeply interested in present-day issues and in the history and culture of eastern India. He knew exactly where James Prinsep (who, in the 1830s, deciphered the script written on rocks—edicts Emperor Asoka wrote around 250 BC) lived in the Calcutta area; why a piece of a riverbank was named after him; and the lineage of the great Navya Nyaya logicians from Nadiya in Bengal (starting from the 13th century). His vigor, intellect, broad and deep interests, and infectious enthusiasm attracted many friends, students, and colleagues. They will remember his informality, openness, breadth of interest in physics, and, above all, his great integrity in relationships.

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