

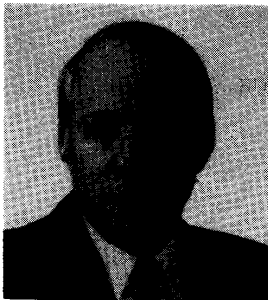
Introduction

DURING the last decade, the field of precision electromagnetic measurements and associated standards has made giant leaps. Discoveries and practical realizations in quantum electronics have brought about a complete change in the definition of units and in our way of implementing basic standards. The quantum Hall effect, the Josephson effect, and the realization of the saturated-absorption stabilizer laser, have made possible new, practical realizations of standards representing the ohm and the volt, and a new definition of the meter in terms of fundamental constants. Coupled to the definition of the second in terms of an oscillation period of the cesium atom, advances have made possible a unification throughout the world of electrical, time, and length units.

CPEM is about implementation of standards to represent these units and all the novel techniques that are used to make practical measurements in science and industry. It is also about recent advances that promise new levels of accuracy and precision. The three foundations of much of our discussions, the Josephson effect, the quantum Hall effect, and the cesium beam clock, have changed our methods and techniques in measurement standards. New avenues which promise unprecedented accuracies have been opened through the demonstration of ion storage and cooling in radio-frequency traps. The significance of these innovations was recognized by the international scientific community and Nobel prizes were awarded to their discoverers, Josephson, von Klitzing, Ramsey, Dehmelt, and Paul. It is a great honor that von Klitzing and Ramsey attended the conference.

The conference had a record participation both in attendance and presentations. These transactions of selected papers are a reflection of the quality of these presentations.

JACQUES VANIER
Conference Chairman



Jacques Vanier (SM'73-F'83) was born in Canada, in 1934. He received the B.A. and B.Sc. degrees in physics from the University of Montreal, Montreal, P.Q., Canada, in 1955 and 1958, and the M.Sc. and Ph.D. degree in physics from McGill University, Montreal, in 1960 and 1963, respectively. His master's thesis was on nuclear quadrupole resonance and its use in the field of precision thermometry. His Ph.D. thesis was on dipole interactions in paramagnetic crystals using paramagnetic resonance.

During the period from 1961 to 1963, he was a lecturer in the Department of Physics at McGill University. During the summers of 1958 and 1960 he worked for the Department of National Defence in the field of semiconductors and microwave electronics. He joined Varian Associates, Beverly, Mass., in 1963. In 1967 he became a member of the Frequency and Time Division of the Hewlett-Packard Company. At both Varian and Hewlett-Packard, his work was oriented mostly toward the application of phenomena involving quantum transitions. In particular he did basic research on atomic frequency standards and developed a thermometer based on NQR, on

which he holds a patent. From 1967 to 1983 he was a Professor at Laval University, P.Q., in the Electrical Engineering Department, where he founded a laboratory oriented toward studies of applications of quantum electronics phenomena. During this period he gave courses on solid state physics, semiconductors, thermodynamics, electromagnetism, and quantum electronics. He joined the National Research Council of Canada in 1983 as a Principal Research Officer. He is now Director General of the Institute for National Measurement Standards at the National Research Council of Canada. He has written and published approximately seventy-five papers in scientific journals and conference proceedings, one book on the use of the density matrix formalism in describing the theory of masers and lasers (Gordon and Breach, Editors). He is the co-author (with C. Audoin) of the book *The Quantum Physics of Atomic Frequency Standards* (Adam Hilger, 1989).

Dr. Vanier is Chairman of Commission A of URSI. He is Chairman of the Executive Committee of the Conference on Precision Electromagnetic Measurements (CPEM) and was Chairman of CPEM '90. He is a Fellow of the Royal Society of Canada and of the American Physical Society. He is a member of the Committee on Scholarships and Fellowships of the Natural Science and Engineering Research Council. He is a Fellow of the IEEE and member of the Administrative Committee of the Instrumentation and Measurement Society. In 1984 he received the IEEE Centennial Medal. He is the initiator and co-founder of the series "Frequency Standards and Metrology Symposium."