Introduction to the Special Issue on Picosecond Phenomena

ULTRASHORT light pulses have played an important role in quantum electronics research for almost two decades. The potential that optical bandwidths provide for ultrahigh-speed scientific measurement, communication, and signal processing was certainly recognized in the earliest days of laser development. Just how this potential would be realized was not so readily apparent. Nor was the variety and extent of today's picosecond and subpicosecond technology so easily envisioned.

Since 1965, when passive mode locking of the Nd:glass laser first yielded pulses of about 10 ps in duration, the technological and scientific advances in the field have been remarkable. Pulse durations have been pushed well into the subpicosecond regime, with a dramatic new record of 30 fs even being established since the first announcement of this Special Issue. Higher pulse repetition rates have dramatically improved the sensitivity and reliability of measurement. Extended wavelength coverage and a variety of novel measurement techniques have opened new areas of application. Commercially available picosecond equipment is finding its way into an ever increasing number of research laboratories.

Applications for ultrashort pulse technology are found in diverse areas of physics, electronics, and biology; and there has always been very important interaction between the different disciplines. This interaction remains crucial. A rapidly advancing technology continues to expand the possibilities for scientific discovery, and a better understanding of ultrafast processes in materials is still needed for the invention of new picosecond devices and the refinement of measurement techniques.

It could not be the intent of this Special Issue to provide a comprehensive overview of either the state of the art or the complete range of current research activity in the field of picosecond phenomena. It was simply to provide an easily identifiable forum for recent research results and thereby to support the synergism between basic study and technological advance that continues to be so important. The response has been gratifying. Submitted papers cover topics ranging from femtosecond pulse generation to X-ray streak cameras to high-speed semiconductor devices to ultrafast processes in liquids. For your reading pleasure, they have been organized into four sections:

1) Ultrashort Pulse Generation and Propagation
2) Picosecond Spectroscopic Techniques
3) Picosecond Optoelectronics
4) Applications of Ultrashort Pulses.

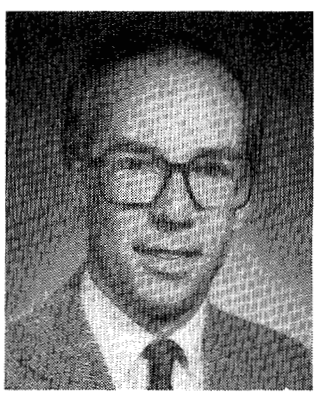
The number of papers in each of these sections is a reflection of the natural response to the announcement of the issue rather than that of any editorial influence. The issue as a whole is a credit to the individual authors as well as an indication of the vitality of the field. It further demonstrates that the IEEE JOURNAL OF QUANTUM ELECTRONICS can continue to be an important forum for research into picosecond and subpicosecond phenomena.

I would like to add my personal thanks to all those who submitted papers and to the even greater number of colleagues who served as reviewers.

DEDICATION

This SPECIAL ISSUE ON PICOSECOND PHENOMENA is dedicated to Stanley L. Shapiro, friend, colleague, and pioneer in the field of picosecond phenomena. His recent, untimely death has saddened all of us who knew him.

ERICH P. IPPEN
Guest Editor



Erich P. Ippen (S'66–M'69–SM'81) was born in Fountain Hill, PA, on March 29, 1940. He received the S.B. degree in electrical engineering from the Massachusetts Institute of Technology, Cambridge, in 1962, and the M.S. and Ph.D. degrees in the same field from the University of California, Berkeley, in 1965 and 1968, respectively.

From 1968 to 1980 he was with Bell Laboratories, Holmdel, NJ. Since 1980 he has been Professor of Electrical Engineering at the Massachusetts Institute of Technology. His research interests have included nonlinear interactions in optical fibers, dye lasers, semiconductor diode lasers, subpicosecond optical techniques, and studies of ultrafast processes. In these areas he has published more than 70 journal articles and book chapters, and has obtained more than seven patents.

Professor Ippen has served on numerous conference organizing and program committees. He is a member of the IEEE Quantum Electronics and Applications Society Administrative Committee and an Associate Editor of *Optics Letters*. With C. V. Shank, he has received the 1981 R. W. Wood Prize of the Optical Society of America and the 1982 Edward Longstreth Medal of the Franklin Institute for demonstration and utilization of subpicosecond optical pulses. He is a Fellow of the Optical Society of America, and a member of the American Physical Society, Sigma Xi, and Eta Kappa Nu.