Foreword
Special Issue on Lasers for Fusion

LASER fusion has been one of the prime constituents of quantum electronics for over a decade now. As such, it has been the principal force behind the development of high peak power laser systems, particularly neodymium glass and CO_2 lasers, these being currently used in fusion investigations at power levels in excess of 20 terawatts (TW). However, the impact of this endeavor on progress in quantum electronics has been more pervasive than can be measured simply in terms of peak power capability. It has been a major impetus in the search for new, and potentially efficient, laser media and has forced the pace in our understanding of the effects of high-power radiation on optical materials. New concepts in laser systems design and new standards in systems technology and performance have been established which have found wide acceptance in broad areas of quantum electronics. In addition, several technologies, particularly those dependent on ultrashort pulse generation and detection, have benefited markedly from the demands made upon them by the worldwide effort in laser fusion.

In creating a Special Issue of the IEEE JOURNAL OF QUANTUM ELECTRONICS devoted to the general subject area of lasers for fusion, the editorship wished to recognize these developments. In particular, it was hoped that this issue would provide not only an opportunity for the review of major systems and principal areas of investigation in this field, but would also encourage papers on specific technical issues, devices, and techniques which in many cases do not receive broad publication. To a large degree this intent has been achieved. The issue contains a balanced perspective on the major laser-fusion facilities at present operating throughout the world and a representative selection of papers addressing the technologies which contribute to them. Invited papers deal with the important issues of laser light propagation through complex amplifier systems and laser-induced damage in optical components. Several contributions discuss the technologies of iodine and hydrogen-fluoride lasers, and a number of papers describe in detail the progress which has been made in assessing the potential of rare gas halide lasers. In addition, there are a number of papers which point to future efficient systems capable of high-power output.

After such a prolonged period of intense activity, the laser-fusion field has achieved a measure of maturity. Nonetheless, with continued advances in technology and an increasing interest in short wavelength driver systems, its future progress will advance, without doubt, with as much momentum as it has had up to this time. In providing an in-depth view of the current state of laser technology associated with laser fusion, having current and archival value to both specialists and the readership at large, it is hoped that this issue will also serve as a benchmark by which future progress can be assessed.

In assembling the contributions for this issue, the editor has benefited from the invaluable advice and assistance of a large number of workers in the field, particularly Dr. John Holzrichter of the Lawrence Livermore National Laboratory, Dr. John Soures of the Laboratory for Laser Energetics of the University of Rochester, and Dr. Tom Stratton of the Los Alamos National Laboratory. In addition, the rapid processing and the compilation of the large number of papers in this issue would not have been possible without the untiring secretarial support of Ms. Linda Boyle and Mrs. Clai Jorgensen, and the continued helpful advice of Mrs. Beverly Surprenant.

MARTIN RICHARDSON
Guest Editor

Martin Richardson (M'71–SM'81) was born in England in 1941. He received the B.Sc. (ARCS) degree from the Imperial College of Science and Technology, London, England, in 1964, and the Ph.D. degree from the University of London, London, England, in 1967, for work performed in the areas of high-power lasers, nonlinear optics, and laser-plasma interactions carried out at the Culham Laboratory, UKAEA.

In 1967 he joined the National Research Council of Canada, Ottawa, Ontario, Canada, initially as a Post-Doctoral Fellow, where his studies concentrated on laser-produced plasmas, high-power laser development, and picosecond pulse generation and detection. Since 1969 he has been a Staff Scientist at the National Research Council. During this time he has been involved in research programs on high-power gas laser technology, picosecond pulse development, ultrafast streak camera development, multiphoton molecular dissociation, and laser-produced plasmas. In 1974 he spent several months at the Lebedev Institute, Moscow, U.S.S.R., involved in the development of picosecond streak cameras. Since 1974 his interests have principally resided in the laser-fusion area, particularly in the physics of laser-plasma interaction processes and, more recently, in experimental investigations of directly driven target implosions. He is currently with the Laboratory for Laser Energetics, University of Rochester, Rochester, NY, where he is involved in laser-fusion experiments at both 1.06 and 0.35 μm.

Dr. Richardson is an Associate Editor of the IEEE JOURNAL OF QUANTUM ELECTRONICS, was the recipient of the 1976 Schardin Medal, and is a member of the IEEE Nuclear and Plasma Sciences Society Executive Committee on Plasma Science and Applications. He is a member of the American Physical Society, the Optical Society of America, and the Canadian Association of Physicists.