Optics in Ireland

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We welcome very much this opportunity to present some of Ireland's research in optics in a special section of *Optical Engineering*. Despite its small geographical size, Ireland has a thriving research program in optics stemming partly from its long and distinguished history in the field and in particular from its current active involvement in national, European, and other international programs. The 25 articles in this special section cover a broad range of topics, from astronomy to optoelectronics, from materials to the use of optical techniques for the study of very diverse phenomena. Naturally, Ireland has its national priority research themes and this is reflected in the emphasis of many of the papers. As editors, however, we have tried to show the broad diversity of research in the country, not just in the strategically important areas.

Optics as a discipline goes back a long way in Ireland, not only in research and teaching, but also as a matter of private enterprise. The first major treatise on optics in the English language, *Dioptrica Nova,* was written in 1678 by William Molyneux at Trinity College Dublin. He was incidentally also a philosopher and member of Parliament, an early example of how science and politics can coexist. In the 1700s, Tyndall, a native of Carlow near Dublin and probably the greatest exponent of the demonstration lecture, exhibited total internal reflection with water tanks and water spouts. These demonstrations are still widely used in teaching and popular lectures today. The nineteenth century saw a flourishing of scientific activity with the establishment of the world's largest telescope at Birr Castle in the heart of the country by the Earl of Rosse. This involved polishing of the 6-ft-diam mirror to a very high tolerance with great success, and using the Leviathan (as it was called) scientists discerned the spiral nature of galaxies for the first time. Mary Rosse, the wife of the Earl, was a renowned photographer who used new methods of processing. In the 1850s at Trinity College in Dublin, John Joly, professor of geology, pioneered a new color photographic process that was to have much influence on later techniques. Dunsink Observatory on the outskirts of Dublin was where William Rowan Hamilton held sway for many years. Among his less well known accomplishments was his prediction of conical refraction. Lloyd, also of Trinity College, later observed this effect using aragonite. At this time that most familiar of scientific terms, the *electron,* was coined by Stoney, a graduate of Trinity College and professor of natural philosophy at Galway. The electron, of course, is responsible for all of the optical research reported in this special section. From a totally different perspective, Waterford Crystal in the southern part of the country was experimenting with glass, purifying it to give clarity and perfection to produce their internationally known crystal.

Several popular textbooks and lectures on optics were published, notably by Preston and Lloyd, and Berkeley proposed a theoretical treatment of vision. Closer to our own time, at the turn of this century Fitzgerald in Dublin was developing his theory of contraction and making, with others, the first photoelectric measurements of starlight.

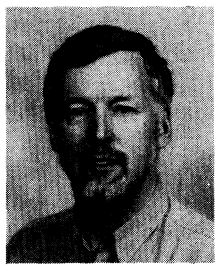
Since the 1960s a whole new generation of researchers has grown up in Ireland and taken the laser as its starting point, with a view toward new phenomena, technology, and applications. Now all universities in the country, north and south, and a good number of technical institutes have active research programs in optics. Dan Bradley, who in the 1960s was a key figure in the development of lasers and the streak camera, contributed significantly to this trend both at Queens University Belfast and at Trinity College Dublin; he is now retired but ever questioning. G. F. Imbusch, Art Schawlow's first graduate student at Stanford, returned as a physics professor in Galway in 1969 and heralded into Ireland several new avenues of modern optics. In the late 1980s the Irish government designated optoelectronics as an area of great strategic importance to the country and established Optronics Ireland to upgrade facilities in the universities, to coordinate research, and to commercialize the research results. This nationally funded program is now trying to transfer technology and provide services to industry, especially to small- to medium-sized enterprises, which cannot afford expensive development costs themselves.

Industrial research is still in its infant state mainly because high technology industry itself only seriously started in Ireland in the 1960s. There is now a strong base of international industry with indigenous industry slowly growing. Signifi-

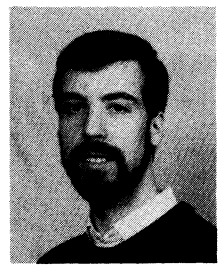
cantly, in 1989, Hitachi established one of its four international R&D labs on the Trinity College campus in advanced computing, one branch of which is optical computing. Since then other companies have set up shop, including Sumitomo, Aster, and Summit.

Most of Ireland's best researchers have overseas experience, having spent substantial time in other European countries or in the United States. As a result they are heavily involved in international collaboration and programs. Most important to Ireland is the European Union (formerly the EC). Since the first EU research Framework Programme was established at the beginning of the 1980s Irish researchers have been ahead of most other European countries in international participation in ESPRIT, RACE, BRITE/EURAM, SCIENCE, etc. In many cases Irish researchers have been the leaders of major projects including several in optics.

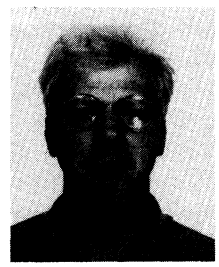
We hope that this special section has something of interest to all readers; the papers are grouped according to topic. As editors we were pleasantly surprised by the level and range of research in the country and by the enthusiasm of researchers for the project. Many thanks to SPIE for suggesting and pushing through the special section.



John Hegarty is a professor of laser physics and head of the Physics Department at Trinity College Dublin. He received his PhD in optical spectroscopy from University College Galway in 1976 after which he worked as a research associate at the University of Wisconsin/Madison in the same field. In 1980 he joined AT&T Bell Labs in Murray Hill where he did some of the first investigations on exciton dynamics and localization in GaAs quantum well structures, as well as applications of optics to telecommunications. In 1986 he returned to Ireland to Trinity College where he is now primarily interested in semiconductor physics and applications, especially semiconductor microcavities, II-VI excitonic effects, optical neural networks, and diode laser applications. He is joint technical director of Optronics Ireland, the Irish national R&D program in optoelectronics.



Noel Mitchell received his BA (1987) and PhD (1993) in experimental physics from Trinity College Dublin. His PhD was in the area of optical switching in semiconductor laser diode amplifiers; other research interests include methods of pulse generation in semiconductor lasers and medical applications of lasers. He is currently employed in the Physics Department at Trinity College Dublin as a conference administrator.



Conleth D. Hussey is the director of the Lightwave Technology Research Centre (LTRC), which, until recently, was attached to the University of Limerick, Ireland, where he held the position of adjunct professor of lightwave technology. The LTRC is now a commercial laboratory extending its activities from a base of research, development, and consultancy in optical fibers and fiber devices, to include the manufacture of devices. Dr. Hussey obtained his BA and BAI from Trinity College Dublin in 1976. After a stint as a software engineer in STC, New Southgate, London, he joined the Department of Applied Mathematics, Australian National University, where he obtained his PhD in 1981. After a year as a lecturer in electronics at the NIHE, Dublin, he joined the Optical Fibre Research Group at the University of Southampton, England, as a lecturer in optical communications, which he left in 1988 to set up his operation in Limerick. His research interests lie in the areas of optical fiber devices and optical waveguide design where he has published many papers and holds a number of patents.