

THE PHYSICS DEPARTMENT AT THE UNIVERSITY OF WINDSOR

by Lucjan Krause

EARLY HISTORY

Although the Physics Department, as it is now constituted, was only formed in the late 1950s, physics had been taught at Windsor for a considerably longer time. The present University of Windsor together with its federated Assumption, Canterbury, and Iona Colleges, has grown from roots that existed since 1857 when the (Roman Catholic) Basilian Fathers established, on the banks of the Detroit River, Assumption College devoted to classical, commercial and, later, liberal arts education. During the period 1919-1953 Assumption College was affiliated with Western University which became the University of Western Ontario. In 1956 the College received a university charter to become Assumption University. Because, as a church-affiliated institution, Assumption University was not eligible to receive governmental support, secular Essex College was established to teach sciences, engineering and business administration. In 1962 the whole University was secularized and was incorporated as the University of Windsor.

The first Professor of Science, Rev. W.G. Rogers, C.S.B., B.A., was listed in the 1920 calendar which also specified a first- and a second-year college physics course but without giving any description. It was not until 1947 that physics offerings were extended to seven courses that included optics, mechanics and electricity, and were given by two physicists on the college faculty (Tullio Alessi and F.S. Ruth). This coincided approximately with the construction in 1948 of the Memorial Science Building (erected as a memorial to alumni who fell in the 1939-45 world war), which was to be occupied by the various science departments. In 1953 John Huschilt, our longest-serving (now retired, though still active) faculty member, was appointed to the faculty which included Rev. N.J. Ruth (who was also Dean of Arts and Sciences) and a part-time instructor. The calendar showed 12 physics courses including thermodynamics and atomic physics. The first faculty member with a doctorate was Queenie H. Shirley, who was appointed in 1954. The 1954-55 calendar listed the first offering of a BSc (general) degree program with a Physics major, together with 12 lecture courses taught by two full-time and two part-time faculty members. The year 1957 saw an influx to the faculty of young PhD graduates from the University of Toronto, Ron Aziz who soon afterwards left for the University of

Waterloo, and George Duwalo who was tragically killed in a road accident during the winter of 1958-59. The 1958-59 calendar showed Rev. N.J. Ruth as the first Head of the Physics Department, and also described an honours Chemistry and Physics (four-year) program. The course offerings included 12 honours courses, up to the fourth-year level. The 1959-60 calendar listed six Faculty members, including Lucjan Krause and John Huschilt as Acting Head, though by then, Rev. Ruth had left the Department to devote himself fully to his duties as Dean of Arts and Sciences. In addition to the previously-established honours programs, there was now an MSc program with graduate courses in quantum mechanics and molecular physics. There was also a four-year program in Engineering Physics which was independently established by the Faculty of Applied Science. This was also the time when the first NRC research grant was held in the Department (in the amount of \$1,000 !) brought by Lucjan Krause who came in 1958 from Memorial University of Newfoundland and began research in atomic collisions and atomic fluorescence.

The present University of Windsor together with its federated Assumption, Canterbury, and Iona Colleges, has grown from roots that existed since 1857 when the (Roman Catholic) Basilian Fathers established Assumption College, devoted to classical, commercial and, later, liberal arts education.

THE YEARS OF GROWTH AND DEVELOPMENT

After 1959 the pace of development picked up and during the next three or four years there was a fairly rapid turnover of faculty, resulting from a plan to establish research areas in atomic, nuclear, and solid-state physics and from a general shortage of qualified physicists. During this period, several additional faculty members joined the Department, Edwin Habib, Frank Holuj, Nigel Hedgecock and Arie van Wijngaarden, all graduates of McMaster University, who all remained at Windsor until retirement. Lucjan Krause became Head of Department in 1959 and remained in this position until 1983. In 1959 the Department established a professional machine shop, followed by an electronics shop and a glassblowing shop (shared with other departments).

In 1961 we graduated our first MSc, almost simultaneously with our first honours BSc graduate. A PhD program was established in 1962 and the 1962-63 calendar shows eight

L. Krause <f34@uwindsor.ca>, Department of Physics,
University of Windsor, Windsor, Ontario, N9B 3P4

graduate courses and indicates areas of research in atomic, solid-state, and nuclear physics. In 1964 the Department which, until then, had been accommodated in the Memorial Science Building and some post-war huts, moved into a wing of the newly constructed Essex Hall, in which the internal lay-out and services were designed by members of the Department. In 1965 the first PhD in physics was awarded to George Chapman who is now a scientist at the NRC laboratories. From this time on, the Department also begins to show a consistent growth of research activities and a corresponding increase in NRC research grants. In 1963 the Department hosted its first Postdoctorate Fellow, M. Czajkowski from Toruń, Poland, who later returned to become member of the Faculty, and in 1964, the first NRC Postdoctorate Fellow, A.G.A. Rae from Edinburgh. During that year Geza Szamosi, a senior theoretician with an extensive research record, was appointed to the Faculty and the research activities henceforth included relativistic physics, an area which was bolstered by the subsequent appointment of Ed Glass.

The 1960s and early 70s saw a rapid development of graduate studies and research though, as in many universities, the number of graduating honours physicists seldom exceeded ten. Nevertheless, there was rapid growth in numbers of graduate students, postdoctorate fellows and research grants. Research contacts were established with scientists in British, German, Polish, and U.S. universities, leading to useful exchanges of postdoctorate fellows and sabbatical placements.

Particularly close ties were established with several Polish universities, especially with Nicholas Copernicus University in Toruń. About 40 Polish Postdoctorate Fellows and visiting scientists came to the Department over the years, to participate in the research; many of them now occupy senior academic and administrative positions in Poland. In 1970 the local Polish community endowed, at the University of Windsor, the Nicholas Copernicus Scholarships in physics and, since then, two or three scholarships have been awarded each year. Also, nearer to home, there was close interaction with The Research Institute for Engineering Sciences at Wayne State University in Detroit, Michigan, where two of our faculty members had appointments as Visiting Professors.

In 1970 the Department was awarded by the National Research Council a "Negotiated Development Grant" for studies of atomic and molecular interactions. The grant provided \$500,000, a substantial sum in those days, which covered the salaries of three additional Faculty Members over a period of three years, as well as a variety of equipment. The University agreed to maintain these appointments after the initial three-year period, which constituted an expression of trust in the Department's performance and plans for the future. The three appointments included Brian Atkinson, Reinhard Helbing and Bill McConkey; the latter came from Queen's University, Belfast, with his group and nine tons(!) of laboratory equipment. The Department was also significantly strengthened by the appointment of Mordechai Schlesinger (1968) who established a laboratory in condensed matter spectroscopy. In 1969, two atomic and

molecular theoreticians, Bill Baylis and Gordon Drake, joined the Department and established very successful and prolific programs, providing also support to the ongoing experimental work. In 1971 the Department welcomed back Rev. N.J. Ruth, who retired from the position of Dean of Arts and Sciences.

During the 1960s and 1970s the Department became known as a centre for studies of inelastic collisions of excited metal atoms, leading to excitation transfer, disorientation and disalignment. These activities attracted visits from some leading atomic physicists of the day, some of whom collaborated and published jointly with members of the Department. This work later extended to spectroscopic studies of metal excimers and exciplexes, and of van der Waals molecules. The Department grew to 17 Faculty Members, almost all of whom pursued active research programs, either individually or in collaboration; the research was greatly facilitated by the presence of excellent professional machine- and electronics shops which, at their peak, had a staff of six technicians. This growth manifested itself in numbers of publications and increases in research grants and contracts from the NRC (later NSERC) and from government organizations in Canada, USA and Europe. The following is a list of the members of the Department in the middle 1970s (the dates of the initial appointments are shown in brackets; Note: AMO = atomic, molecular and optical physics).

Norbert Ruth (1952)
 John Huschilt (particle physics, theoretical) (1953)
 Lucjan Krause (AMO, experimental) (1958)
 Ed Habib (nuclear, experimental) (1959)
 Nigel Hedgecock (condensed matter, experimental) (1959)
 Frank Holuj (condensed matter, experimental) (1961)
 Arie van Wijngaarden (AMO, experimental) (1961)
 Geza Szamosi (relativistic, theoretical) (1964)
 Hisashi Ogata (nuclear, theoretical) (1965)
 Mieczysław Czajkowski (AMO, experimental) (1967)
 Mordechai Schlesinger (condensed matter, theory & experiment) (1968)
 Bill Baylis (AMO, particle physics, theoretical) (1969)
 Gordon Drake (AMO, theoretical) (1969)
 Bill McConkey (AMO, experimental) (1970)
 Brian Atkinson (AMO, experimental) (1972)
 Reinhard Helbing (AMO, experimental) (1972)
 Ed Glass (relativistic, theoretical) (1974)

An important result of this development was a corresponding growth of undergraduate and graduate course offerings. The graduate courses included, in addition to the usual "core", courses in areas related to the ongoing research programs. There was an undergraduate program in honours physics which required both theoretical and laboratory courses. The department also attempted to establish BSc programs in biophysics and in applied physics which were discontinued for lack of interest at that time. However, there were very successful offerings for non-physicists, some of which were probably, at the time, unique among Canadian universities, such as: "physics and society," and "astronomy and space science", which are still thriving today, and a course in acoustics of music.



Fig. 1 Meeting of the Division of Atomic and Molecular Physics of CAP October 17, 1980.

During this period and also more recently, the Department hosted several national and international conferences: the Fourth International Conference on Spectral Line Shapes (1978), the inaugural joint conference of the Divisions of Atomic and Molecular (and Optical) Physics of the CAP and APS (1989), the CAP Congress (1992), the 16th International Conference on Atomic Physics, which was held in Canada for the first time (1998), and others, each traditionally accompanied by a chamber music concert. There were also numerous postdoctorate fellows and visiting scientists in the Department, of whom over 100 came for one- or two-year visits, some returning for a second or even a third stay. Figure 1 shows a group photograph of the participants in the 1980 conference of the Division of Atomic and Molecular Physics of the C.A.P., which took place in our Department.

The activities of the Department were managed by Lucjan Krause from 1959 until 1983, who was followed by Mordechay Schlesinger (1983-93), Bill Baylis (1993-96) and Gordon Drake (1996 to the present); their pictures, taken at the times of their tenure, are shown in



Fig. 2 Lucjan Krause, Head of Dept. 1959-83.



Fig. 3 Mordechay Schlesinger, Head of Dept. 1983-93.



Fig. 4 Bill Baylis, Head of Dept. 1993-96.

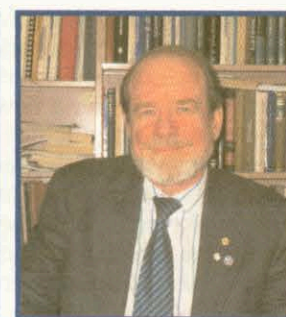


Fig. 5 Gordon Drake, Chairman of Department 1996-

Figs. 2-5. They all saw the Department go through the various phases of expansion, consolidation, "rationalization" and the most recent reorientation and resurgence.

TOWARDS THE TURN OF THE CENTURY

In 1988 Geza Szamosi retired but the resulting vacancy was not filled. At the time, the University was having serious financial and organizational problems, as were all Ontario universities. Accordingly, it was decided that academic units which could not show satisfactory levels of undergraduate enrolments would be "rationalized". The physics undergraduate enrolments have never been large and in the 1980s and 1990s the Department was graduating only a few honours physicists per year. Also, in 1970, the

Engineering Faculty withdrew their students from the traditional first year physics courses and, although the other service courses (including those for non-scientists) were well attended, the University administration decided that these activities should be carried out with a smaller Department. This rationalization process which affected not only the Physics Department but other departments and faculties as well, continued over the next several years, as Faculty members retired, and in 1999 the Department consisted of just six full-time Faculty members. Although research and graduate studies continued at an undiminished pace and with the participation of the Professors Emeriti who continued receiving significant NSERC (and other) research grants, the number of course offerings had to be curtailed, though the undergraduate and graduate core courses were maintained.

The Department was also able to arrange for some cross- and adjunct appointments which helped to maintain research activities.

1996 saw the appointment of Roman Maev (Fig. 6) who transferred to the Department from the Engineering Faculty and brought with him his research program in physical acoustics and ultrasonic characterization of materials, which subsequently received extensive support from the Chrysler (now DaimlerChrysler) Company. This very successful research grew in size and scope, and was recognized by NSERC which, in 2001, established in the Department an Industrial Research Chair in Applied Solid State Physics and Material Characterization, with Roman Maev as the incumbent. The award of the Industrial Research Chair allowed new junior Faculty appointments to be made, which further strengthened the group. The first of these was the appointment of Elena Maeva in 2001 (Fig. 7). The group now carries out research in physical acoustics and on acoustic microscopy-based procedures and devices. The investigations include bulk and subsurface properties of various solids. Surface-acoustical wave techniques are also used for the detection of micro-defects in metals and joints and for material characterization. In addition, the group has begun work in the areas of biomedical ultrasound and ultrasonic characterization of biological tissues, with emphasis on breast cancer diagnostics. In 2001 the group hosted the 26th International Conference on Acoustic Imaging, the first time this conference was held in Canada, and in 2002 Roman Maev received the Canada Innovation Summit 2002 Award. It appeared that the fortunes of the Physics Department were taking a turn for the better, also bearing in mind the successful experimental and theoretical work of Mordechai Schlesinger on studies of single crystals, thin films, artificially layered materials, electro-deposition, and applications of the Unitary Group Approach, supported by contracts from the General Motors Company, which appointed him G.M. Academic Research Fellow.

It was, however, necessary to address, in some creative manner, the problem of undergraduate physics enrollments which were very low and constituted a barrier against a resurgence of the Department. Accordingly, a plan was developed to offer a new program of studies in Physics and High Technology which would be available to high school graduates with high grades in science and mathematics, and could also be pursued in a co-operative program. The first full intake arrived in the year 2001 and it appears that the program, which also includes some engineering and business courses, is considered attractive, as in the initial and in each subsequent year between 15 and 20 students entered it, with the first cohort due to graduate in 2005.

Near the turn of the century, the academic environment at the University of Windsor improved as enrollments grew



Fig. 6 Roman Maev



Fig. 7 Elena Maeva



Fig. 8 Tim Reddish



Fig. 9 Władysław Kędziński

and more funds became available.

The University became more supportive of research and academic excellence in general, and designated a small number of undergraduate programs as "banner programs", among them the Physics and High Technology degree program. This made possible a number of new excellent appointments to be made in the Department. In 2002 Tim Reddish (Fig. 8), an established experimental atomic physicist came from the university of Newcastle-on-Tyne in England, and Władysław Kędziński (Fig. 9), an AMO experimenter who had been a Research Associate with us for many years, was appointed to the faculty, and is collaborating with Bill McConkey and Roman Maev. These appointments gave additional lift to the AMO research in the Department. Bill McConkey's group now uses a variety of electron- and laser-spectroscopic techniques to study trapping and fluorescence of atoms, dissociation of molecules and clusters, and the spectroscopy of unstable molecules. Tim Reddish has developed a toroidal spectrometer for photoionization studies using synchrotron radiation provided by accelerators in the U.K., France and Japan, and plans to use the synchrotron which is being commissioned in Saskatoon. This is a valuable addition to the ongoing experimental AMO work, which includes the experiments of Mieczysław Czajkowski on laser spectroscopy of van der Waals molecules and of Brian Atkinson on the spectroscopy of excimer molecules and clusters using time-of-flight mass analysis.

Eugene Kim (Fig. 10), a theoretician in condensed matter systems came in 2003 as holder of the SHARCNET Chair, and Chitra Rangan (Fig. 11), a theorist specializing in quantum control and quantum computing, arrived in 2004.

Eugene's interests lie in the theoretical treatments of collective and emergent phenomena in condensed matter systems, and Chitra's research focuses on the coherent manipulation of quantum



Fig. 10 Eugene Kim



Fig. 11 Chitra Rangan

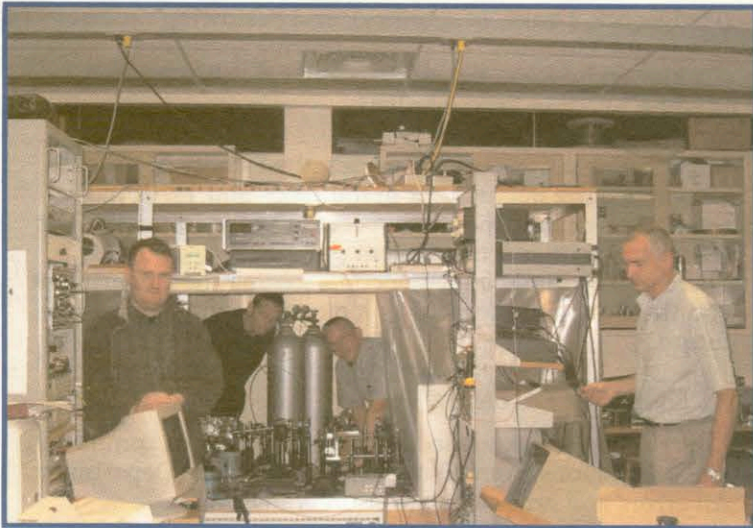


Fig. 12 A laboratory in the Electron Spectroscopy Group, showing a magneto-optical trap for Cs atoms. From left to right: D. Seccombe (P.D.F.), M. Łukomski (P.D.F.), Bill McConkey, W. Kędzierski.

information in possible quantum computer systems. These new research areas constitute a valuable addition to the previously existing theoretical research of Gordon Drake and Bill Baylis. Gordon is developing theoretical tools to probe properties of atoms by combining his high-precision theoretical techniques with high-precision measurements carried out elsewhere, collaborating with experimental groups around the world. Bill is working with geometric (Clifford) algebras, using para-vectors as a covariant framework for relativistic physics, electrodynamics, quantum theory, and particle physics.

At the time of writing, the Department has a full-time faculty of nine plus several active Professors Emeriti, and there are 10 postdoctorate fellows and about 25 graduate students. There are strong research groups in AMO physics and condensed matter physics (both basic and applied), and there is good coverage of both theory and experimental work. Figures 12 and 13 show pictures of research laboratories in AMO physics and Applied Solid State Physics. A steady stream of undergraduate physics students is progressing through the program of studies, many of whom have the opportunity to participate in the research activities in the Department. There is now a solid base of undergraduate enrolments in the physics courses, enhanced by the recent request from the Engineering Faculty for the provision of a first-year physics course for their students.

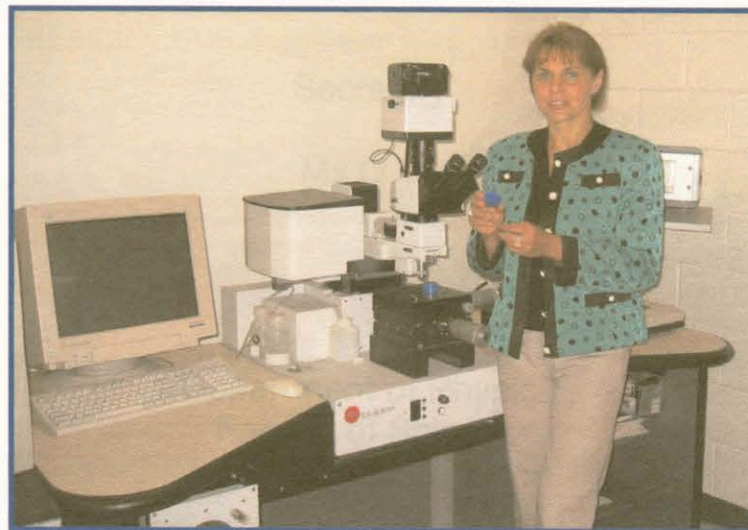


Fig. 13 A laboratory in the Applied Solid State and Material Characterization group, showing an acoustic microscope with Elena Maeva.

The research receives sustainable financial support from NSERC, CFI, Canadian Institute for Photonics Innovations, SHARCNET and from the automotive industry which supports the work in applied areas, as do the Canadian Institutes of Health Research. The Department has embarked on a new and promising phase of redevelopment in both teaching and research, boding good prospects of continuing success.

TAKING STOCK

When some forty-five years ago the initial plans for the development of the Physics Department were being formulated, the University of Windsor was a small undergraduate institution which offered a few M.A. programs "by course work". Research activities were not expected from faculty members, nor were they at all prevalent, and the notions of building a research-oriented physics department were not initially encouraged. The acquiescence of the University was eventually won and was finally transformed into active support after the arrival of J.F. Leddy who, as President, undertook to retain the Physics Faculty members appointed under the terms of the NRC "Negotiated Development Grant," against some considerable opposition from other areas of the University. Without his enlightened policies and those of the late Rev. Ruth, Dean of Arts and Sciences, it would not have been possible for the Department to embark on the research initiatives which continue to prosper today. By now the Department has produced over 60 PhD graduates many of whom have had significant subsequent achievements, and a larger number of MSc graduates. The quality of the research performed by the members of the Department has received a degree of recognition which might be regarded as out of proportion to the size of the Department and of the University. Members have received two doctorates "honoris causa" (Krause from Nicholas Copernicus University in Toruń, Poland; and Ruth from the University of Windsor), two CAP Gold Medals for Achievement in Physics (Drake, McConkey), a (CAP) Herzberg Medal (Drake), two Killam Research Fellowships

(Drake, McConkey) the Will Allis Prize from the APS (McConkey) and an Alfred P. Sloan Foundation Fellowship (Drake). They have been elected to the Fellowship of the Royal Society of Canada (Drake, McConkey), of the American Physical Society (Baylis, Drake, Krause, McConkey, Schlesinger), Electrochemical Society (Schlesinger), the British Institute of Physics (Drake, Krause, McConkey, Schlesinger), an (overseas) Fellowship of a Cambridge College (Krause), a Nuffield Foundation Fellowship (Krause), A Royal Society Commonwealth Fellowship (McConkey), a NATO Senior

Fellowship (McConkey), a NASA Senior Fellowship (McConkey), a UK(EPSRC) Fellowship (McConkey), a Research Fellowship of the Japan Society for the Promotion of Science (Krause), and an Erskine Fellowship at Canterbury University (N.Z.) (Schlesinger). They have occupied, from time to time, chairmanships of learned (physics) societies or their divisions in Canada and elsewhere, and editorships of their journals. In 1996 the "Atomic, Molecular and Optical Physics Handbook", edited by Gordon Drake was published by the American Institute of Physics. Its 1100 pages were written by 115 International Experts in the various fields, of whom four were from this Physics Department (the book has since become a standard reference in the field). The University of Windsor has also given recognition to members of the Department, by awarding one honorary doctorate (Ruth), promoting three members to the rare rank of University Professor (Baylis, Drake, McConkey), giving three awards for excellence in teaching

(Hedgecock, Drake, McConkey), and bestowing ranks of "Professor Emeritus" on several retiring members (Czajkowski, Holuj, Krause, McConkey, Schlesinger, Szamosi and van Wijngaarden).

It is inevitable that, as time passes, the Faculty Members who joined the department in the 1960s and 1970s will retire, though they may be expected to carry on with their research activities if the present practice is to continue. There will certainly be new people joining the Department and there are good reasons to look with optimism into the future.

ACKNOWLEDGEMENTS

I should like to acknowledge numerous helpful comments and suggestions from all my colleagues in the Department. All errors and omissions are entirely my own.