Memories of a Felicitous Life

David A. Shirley, 1934-2021

BERLIN, WÖRTHSEE & BERKELEY

June 24th, 2021

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Foreword

When we learned of David Shirley's passing in late March, we immediately felt the need to write an obituary for the internet pages of our department, the *Fachbereich Physik* of the Free University of Berlin, to which Dave had a strong connection over many years – among other things, he was the recipient of its first honorary doctorate, in 1987. We soon discovered that Stephen Kevan, with Maria-Novella Piancastelli, had done the same for the LBNL-ALS website.

In Germany, it is traditional to make available a Book of Condolence, in which friends and associates can write their memories and messages to the family of a departed colleague. Due to the pandemic, that was impractical at present, but a good alternative might be to make a digital Memory Book, which could be made available to many people who wanted to keep alive their recollections of Dave Shirley. When we discovered that Stephen had edited a similar book some years ago for Neville Smith, former Scientific Director of the ALS, our plan was born. This book is the result. Helping to prepare it has brought back many memories for us, and has reminded us of how many lives and scientific careers were enriched and touched by encounters with David Shirley. We, the editors, have also been surprised at the variety of impressions and feelings expressed by Dave's former students and collaborators – noting that they represent the opinions of their authors, and not necessarily our own.

Dave indeed impacted the lives of an astonishing number of people over the years, through his ability as a mentor and teacher, his scientific intuition, and his leadership. The aphorism quoted by Marcus Tullius Cicero in his essay '*Cato Major*', written more than two millenia ago, fits his life perfectly:

"…conscientia bene actae vitae multorumque bene factorum recordatio iucundissima est"…

"The awareness of a fulfilled life, and the memory of many beautiful achievements, are the greatest happiness."

William Brewer, Günter Kaindl, Stephen Kevan
Berlin, Wörthsee and Berkeley, June 2021

David Shirley, in his 'private' office at LBL, Bldg. 70A, early 1970's.

Here, he received generations of graduate students and visitors, friends and colleagues.

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Memories of a Felicitous Life – David A. Shirley, 1934-2021

1. INTRODUCTION

All of us who are contributors to this book, and of course many others who knew David Shirley and who often profited from his leadership, mentoring, teaching qualities and friendship, were saddened to learn of his passing on March 29th, 2021, just one day before his 87th birthday. We have assembled this Memory Book in order to express our gratitude at having known Dave, and to keep his memory alive for many people who were close to him.

David Arthur Shirley was born in the small town of North Conway, NH on March 30th, 1934. His father and later his brother were foresters. He graduated from high school there and then departed from the family tradition by studying Chemistry at the University of Maine in Augusta, about 70 miles to the northeast of his hometown. After completing his Bachelor at UMA, he went in 1955 for graduate work to the University of California in Berkeley, where he joined the group of William F. Giauque, a pioneer of low-temperature physics and chemistry. Giauque had received the Nobel Prize in Chemistry in 1949 for his development of adiabatic demagnetization, for many years the only technique available for attaining temperatures in the millikelvin range.

Fig. 1.1: David Shirley, early 1980's, as Director of LBL in his office high up in Bldg. 50.

David Shirley, for his PhD work, was originally expected to carry out measurements at low temperatures and high magnetic fields, the latter to be produced by a newly-constructed copper solenoid which operated at high current and was to be cooled by circulating kerosene, pumped through the hollow windings at high pressure. The favorable thermal and hydrodynamic properties of kerosene outweighed its potential danger as a flammable liquid. The solenoid was installed in an airtight chamber which could be flooded with CO_2 to extinguish any fire that might occur. That system failed in practice, however, and the solenoid was destroyed in a fire before Dave could use it. He carried out an alternate project and finished his thesis by 1958, receiving the PhD officially the following year.

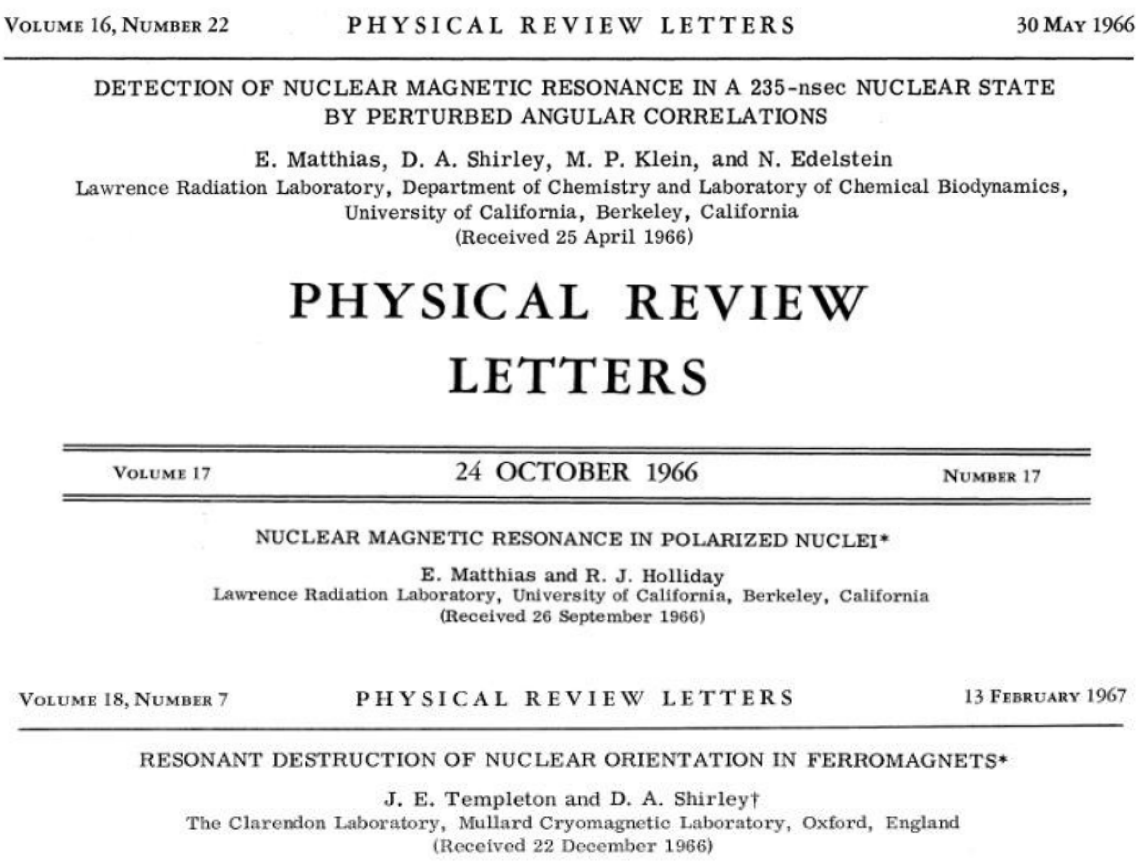
In the meantime, he had met and married a fellow graduate student, about his age: Virginia Schultz, who had obtained her Bachelor in Chemistry from Carnegie-Mellon University in her native Pittsburgh. They were married in 1956, and Virginia received her Masters degree in Nuclear Chemistry the following year.

Dave accepted a position as research assistant at the Radiation Laboratory already in 1958, with the goal of setting up a research activity in low-temperature nuclear orientation (NO), a method which was relatively new at the time, and practiced at only a few laboratories around the world.

The Clarendon Laboratory at Oxford University was one of the first. A visitor who had worked there, Charles E. Johnson, collaborated with Dave in his early years at the Rad Lab. (The Radiation Laboratory was renamed 'Lawrence Radiation Laboratory' (LRL) in honor of its founder and first Director, E.O. Lawrence, who died suddenly in 1958. It was later renamed 'Lawrence Berkeley Laboratory' and is now the Lawrence Berkeley National Laboratory – LBNL). The NO research was supported by John O. Rasmussen, a nuclear theorist at LRL who was interested in using it to obtain data on important properties of radioactive nuclides. Virginia, after finishing her Masters, also joined LRL and helped to produce the 5th Edition of the Table of Isotopes. She then taught chemistry at Mills College (Oakland) and at UC Berkeley for a while, returning to the Lab in 1961, where she continued working on the 6th and 7th Editions of the Table. She also was author of four editions of the Table of Nuclear Moments.

In 1960, Dave was hired as Assistant Professor of Chemistry by UC Berkeley and started his own research group, working in the Nuclear Chemistry division of LRL. He continued with nuclear orientation, but also began applying the (then new) Mössbauer effect, as well as Electron Paramagnetic Resonance (EPR) and Perturbed Angular Correlations (PAC), all spectroscopic methods which can give precise information on nuclear properties (and on hyperfine interactions, which can also provide data on the electronic and solid-state environment of the atoms studied). Collaborators in those experiments were J.F. Schooley (later at NBS/NIST) and Morton Kaplan (later at Yale and Carnegie-Mellon Universities), postdocs in Berkeley in the early 1960's. The PAC method was brought to Dave's group by Eckart Matthias, Miller Fellow in 1963/65 after receiving his doctorate in Uppsala, Sweden, and later Staff Scientist at LRL. Postdoc Nick J. Stone, from Oxford, contributed to the NO work in 1963/65. Stig Hagstrom, a Swedish postdoc from Uppsala University, brought the X-Ray Photoelectron Spectroscopy (XPS) method in 1964, and worked with graduate student Charles F. Fadley to establish it, initially in collaboration with Jack Hollander of the Field-Free Laboratory. It later became the principal activity of the group. Other early collaborators were Paul Barrett (from UCSB), Israel Nowik (Racah Institute of Physics), and Norman Edelstein (who later became head of the neighboring Actinide Chemistry group at LBL).

By the mid-1960's, the Shirley group was internationally known and very diverse, using many Hyperfine Interactions techniques as well as XPS. Dave and Virginia went to Oxford for his first sabbatical in 1966/67, on an NSF Fellowship. In the meantime, their family had grown, with children David Jr., Diane, Michael, and Eric. On returning to Berkeley, Dave was co-organizer (together with Eckart Matthias) of the *1st International Conference on Hyperfine Interactions*, the beginning of a conference series which still continues at three-year intervals today under a slightly different name. It was held at Asilomar (near Monterey), CA in the summer of 1967. He also became Chairman of the Department of Chemistry at UCB, and was promoted that year to Full Professor (having obtained a tenured Associate Professorship in 1964).



VOLUME 16, NUMBER 22 PHYSICAL REVIEW LETTERS 30 MAY 1966

DETECTION OF NUCLEAR MAGNETIC RESONANCE IN A 235-nsec NUCLEAR STATE BY PERTURBED ANGULAR CORRELATIONS

E. Matthias, D. A. Shirley, M. P. Klein, and N. Edelstein
Lawrence Radiation Laboratory, Department of Chemistry and Laboratory of Chemical Biodynamics, University of California, Berkeley, California
(Received 25 April 1966)

PHYSICAL REVIEW LETTERS

VOLUME 17 24 OCTOBER 1966 NUMBER 17

NUCLEAR MAGNETIC RESONANCE IN POLARIZED NUCLEI*

E. Matthias and R. J. Holliday
Lawrence Radiation Laboratory, University of California, Berkeley, California
(Received 26 September 1966)

VOLUME 18, NUMBER 7 PHYSICAL REVIEW LETTERS 13 FEBRUARY 1967

RESONANT DESTRUCTION OF NUCLEAR ORIENTATION IN FERROMAGNETS*

J. E. Templeton and D. A. Shirley†
The Clarendon Laboratory, Mullard Cryomagnetic Laboratory, Oxford, England
(Received 22 December 1966)

Fig. 1.2: Three papers published in 1966/67 by David Shirley and members of his group as well as collaborators. These articles marked the first demonstrations of the combination of nuclear resonance with nuclear spectroscopic methods applied to excited nuclear states: PAC/NMR and NO/NMR. The latter in particular became a standard method, practiced at many laboratories around the world.

"*In a few years, David Shirley had gone from being a graduate student working in classical physical chemistry with chemical-thermodynamic methods from a long tradition – to being the leader of a successful research group dealing with a broad spectrum of problems in nuclear and solid-state physics, metrology and fundamental physics; and to being a tenured professor at a major university, with increasing responsibilities in teaching and administration*".

In the later 1960's, the Shirley group was increasingly active in both its experimental fields, and it hosted many visitors – postdocs and older colleagues – as well as numerous graduate students. In 1969, Eckart Matthias left the group to take up a professorship in physics at the Free University in Berlin (FUB) as successor to its founding professor, Hans Lassen. Important experimental developments during this period were the combination of nuclear magnetic resonance with the nuclear-detection methods PAC and NO (see Fig. 1.2).

Collaborators, Postdocs and Visiting Scientists in the later 1960's included Dieter Quitmann, Joseph Jaklevic, James Templeton, G.N. Rao, Helmut Gabriel, Erwin Klein, Paul Bagus, Heinz Haas, Stevan Koicki, Darrah Thomas, and Günter Kaindl. Kaindl came with a Miller Fellowship in 1969-71, and stayed on as a Staff Scientist until 1972. He had met Eckart Matthias during a research stay of the latter at the *Technische Hochschule* Munich (TUM), and Matthias recommended him for the fellowship. After leaving LBL and after a brief stay at the TUM, Kaindl accepted a position at the Ruhr-Universität-Bochum, and in 1976 he was appointed as successor to Stefan Hüfner to a professorship at the FU Berlin.

Fig. 1.3: Christmas in Berlin, 1970. *Seated*, l to r: Mary Eagleson Brewer, David Shirley, host Helmut Gabriel. *Standing*: Dieter & Dorothea Quitmann, Virginia Shirley, Barbro & Eckart Matthias, Patty & Jim Huntzicker, William Brewer, Erwin Klein, Steve & Ellen Rosenblum.

Several of the visitors to the Shirley group, as well as some graduate students who completed their degrees in the period 1968-72 also went to Berlin and worked there for shorter or longer periods, some for the remainder of their careers. These included Dieter Quitmann, Helmut Gabriel, Erwin Klein, and William Brewer. Jim Huntzicker, Steve Rosenblum and Dan Salomon also spent shorter postdoctoral stays at the FUB. Herbert Rinneberg and Heinz Haas were *Privatdozenten* at the FUB, and Heinz-Eberhard Mahnke was *Privatdozent* and later *Honorarprofessor* there. David Shirley himself went on a sabbatical semester with an NSF Fellowship to the FUB in 1970/71, taking his family along. During their stay, their younger daughter Gail was born in Berlin. There were thus strong bonds between the Shirley Group and the *Fachbereich Physik* (Physics Department) of the FUB, which continued over many years.

On returning to Berkeley in 1971, Shirley became Dean of the College of Chemistry there. In 1972, he received the E.O. Lawrence Award. From 1975, he was Director of the Materials and Molecular Research Division of LBL. Beginning in the early 1970's, the emphasis of his research group shifted from Hyperfine Interactions to Photoelectron Spectroscopy, at first in the laboratory using gas-discharge lamps and conventional X-ray tubes as radiation sources. David Shirley's last official act concerning his earlier research field was the invited lecture that he gave at the *3rd International Conference on Hyperfine Interactions* in Uppsala, Sweden in 1974. Visitors and Collaborators from 1970-85 include Eberhard Mahnke, Herbert Rinneberg, Lothar Ley, Kenneth Krane, Joachim Stöhr, Zahid Hussain, Gary Mason, Uwe Becker, Hans-Georg Kerkhoff, Yuan T. Lee, Eberhard Umbach, and Maria-Novella Piancastelli.

By the mid-1970's, experiments using synchrotron radiation at the Stanford Synchrotron Radiation Project (SSRP) at SLAC/Stanford were begun. The Shirley group became major users of that facility, and David Shirley's support was important for upgrading its status to that of a Laboratory (SSRL). Today, it is a principal activity of SLAC. Shirley was among the first to recognize the potential of the high brilliance, selectable energy and polarization of synchrotron radiation for research in many fields, and he became a strong supporter of the conception and construction of appropriate facilities in the following 20 years. In 1980, he was chosen to be the 4th Director of LBL, and he fulfilled that position in the following 9 years.

Fig. 1.4: Dedication of the ALS in Berkeley, Oct. 22, 1993. From left: Jay Marx, Don Perlman, Martha Krebs, David Shirley, Governor's wife Gail Wilson, Brian Kincaid, Lab Director Charles Shank, and Herman Grunder.

Under his leadership, several national research centers were established at LBNL, including the Center for Advanced Materials (CAM), the Center for X-Ray Optics (CXRO), the National Center for Electron Microscopy (NCEM), and the Advanced Light Source (ALS), an electron storage ring of the third generation, optimized as a source for XUV radiation (opened in 1993).

Built on the historic site of Ernest Lawrence's 184" cyclotron, the ALS was the first synchrotron to be built at Berkeley Lab in almost 30 years. One of Shirley's primary legacies, the ALS has now been operating for over 27 years. It has had a large impact on the development and use of tools that employ light – from the infrared to the hard X-ray regime – to probe the physical and chemical properties of diverse systems. CXRO has been a strong partner and user of the ALS and has played a major role in the development of extreme ultraviolet lithography, a technology that was recently commercialized in the iPhone. Today, few would challenge Shirley's vision about a facility optimized for soft X-ray science.

Shirley stepped down as director of Berkeley Lab in 1989 but remained at UC Berkeley as a professor. Soon after his retirement as Director of LBL, he and Virginia spent a second research visit at the *Fachbereich Physik*, FUB (over a period of 13 months in the year of the opening of the Berlin Wall, 1989/90), in the research groups of Günter Kaindl and Eckart Matthias with an *Alexander von Humboldt Research Award*. During that visit, Virginia was diagnosed with cancer, and they extended their stay to allow time for her first course of treatment.

Back in Berkeley, in 1992 Shirley accepted a position as Senior Vice President for Research and Dean of the Graduate College at the Pennsylvania State University. There, he increased the number of minorities in graduate school, reduced the average time to graduation, and placed the research enterprise on sound financial footing. Virginia was able to live a normal life for several years, but in 1994/95, her condition worsened, and she passed away on March 27, 1995, at their home in State College, PA.

While in Pennsylvania, Dave encountered an old friend from Berkeley, the former wife of his colleague Joseph Cerny at LBL. She was Barbara A. (Nadelka) Cerny, an expert on information science, who had lived and worked in Berkeley from 1959 through the 1980's. Barbara was working at the DOE in Washington in the 1990's. She and Dave became reacquainted after Virginia's death, and they decided to marry in 1996. She has accompanied him on the last 25 years of his life's journey.

Fig. 1.5: Group photo of the Symposium participants, March 1999, at LBL. Barbara and Dave are in front, at right of center

David Shirley retired from Penn State at the end of 1996, moving with Barbara at first back to Berkeley. In 1999, a Symposium was organized at LBL and UCB by Günter Kaindl, Louis Terminello and Zahid Hussain to celebrate Dave's 65th birthday, on the topic "*Spectroscopy and the Structure of Matter*".

15 years later, celebrating his 80th birthday, the *Fachbereich Physik* at the FUB, in cooperation with the *Magnus-Haus Berlin* and the *Heraeus-Stiftung*, organized another Symposium on July 3rd/4th, 2014, entitled "*From Classical Physical Chemistry to Accelerator-Based Light Sources*", with around 70 participants, including previous doctoral students, guest researchers and colleagues from a number of countries. David Shirley was a member of the American Academy of Arts and Sciences and of the US National Academy of Sciences. In 1987, he became the first recipient of an honorary doctorate in physics from the *Fachbereich Physik*, FUB.

Beginning in 2001, the Shirleys lived in Hawaii for about 13 years. In 2014, they moved to Palm Springs, CA, where they lived until the end of 2020, moving to Tempe, AZ in early 2021.

David Shirley leaves a remarkable and highly impactful legacy, through the many junior and senior scientists who worked with him as well as through his successful development, advocacy, and implementation of a vision for synchrotron light sources in the USA and elsewhere.

A list of 'Shirley alumni' in chronological order is attached at the end of this book as an Appendix. It contains 119 entries, of whom 16 were (often older) colleagues, 19 postdocs, and the rest – 84 in all – were graduate students. David Shirley gave his support and guidance to all of them, most especially to his students, all of whom owe him a debt of gratitude for his often decisive aid in guiding their scientific development and launching their careers, while leaving them the freedom to develop individually. The atmosphere in his research group, both in the early days of Hyperfine Interactions, when experiments were carried out by single researchers or small groups in the

laboratory, and later on with Photoelectron Spectroscopy in all its variations, as 'big science' with larger groups working cooperatively at major facilities, is well characterized by the following quote from an eminent 20th-century American physicist, himself a successful mentor of many graduate students:

"*What does a young researcher need at the beginning of a career? Perhaps, most of all, a good mentor... And freedom – freedom to experiment with ideas, freedom to try new directions, freedom to make mistakes, freedom to think without distraction.*" (John A. Wheeler, 1998)[1]

So it is fitting that we close with the words of Joachim Stöhr, from his 2014 *laudatio* of David Shirley at the Symposium dedicated to his 80th birthday:

Thank you, Dave!

You influenced the lives of many students and scientists,
and left a wonderful legacy in your research and the ALS.

William D. Brewer, Günter Kaindl, Stephen D. Kevan
Berlin, Wörthsee and Berkeley, June 2021

[1] From Wheeler's autobiography: J.A. Wheeler and K. Ford, *Geons, Black Holes and Quantum Foam*, W.W. Norton & Co., NY 1998. For a differing opinion, see Chapter 19 in this book; perhaps only a misinterpretation.

2. Gene A. Westenbarger, Associate Professor *emeritus*, Ohio University
Graduate student in the Shirley Group, 1959-63

Thank you for locating and contacting me. I had learned of Dave's death from a recent College of Chemistry newsletter, which I don't always read. So thank you for this email as getting it twice is better than never. I was and remain shocked! Dave was just 1.3 years older than me (85.7y) and I was one of his first students from '59-'63. I had been 2 years in the military before grad school. I returned to the Rad Lab in early '71 on a 9 month sabbatical and believe I just missed you. I recall Fred Bacon mentioning you and your work. I did have the privilege of meeting Günter Kaindl and Eberhard Mahnke at the lab back then. A long time ago...

The idea of preparing a booklet for the family is wonderful. I'm not sure I can contribute much to the content, however. You may edit and include any comments you choose. Dave always treated me as an equal and he was forever upbeat and helpful, but never pushed – and always with a smile. He had many demanding things going at once, and he juggled them all marvelously. I recall once I corrected him about some minor thing we were discussing when he had a brief memory lapse. His reply to my correction was simple: "Touché!" – with a big grin and a chuckle at himself as he immediately knew he had erred. Typical Dave. I'm betting such events were very rare. That was the only time I was a microsecond ahead of him! I have not seen Dave in person since '71, but recall seeing some photographs of him taken more recently at the time of the Symposium in his honor in Germany. I appreciated seeing those. Dave was a prolific scientist and compiled an exceptional record in several important fields as well as administration. Few accomplish what he did. Certainly not me.

[From the 'Notes to Dave' sent by those who were unable to attend the Symposium for his 80th birthday in Berlin, July 2014]: "I regret that I will be unable to attend the Symposium planned for David Shirley in July. I'm sure it will be an event to remember and a well-deserved honor for Dave. He's to be congratulated on reaching the big 80…".

Again, I thank you for honoring Dave in this way and for contacting his students. Best regards from Ohio, USA,

Gene A. Westenbarger, Ph.D. UCB '63 (and proud of it!)
A student of David Arthur Shirley. May he rest in Peace.

Fig 2.1: Gene Westenbarger, 2018.

3. Richard M. Levy, Varian Medical Systems (retired)
Graduate student in the Shirley group, 1960-64

I came to Berkeley with a Liberal Arts degree and was immediately intimidated by the knowledge of my fellow graduate students entering the Chemistry Department, and by the elegant and sophisticated technology at Berkeley. My interviews with potential thesis advisors gave me little insight for choosing subjects that would interest me, or where I could succeed.

I ended up choosing Dave Shirley because he was young, personable, thoughtful, and came from New England, for which I had a special love. What I learned quickly was that Dave had a passion for his work, a degree of passion that I have never encountered in anyone before or since. He would regularly work 16 hours a day, seven days a week. Sometimes he wouldn't leave the lab to eat. Virginia and his kids would join him for a picnic in the Rad Lab parking lot.

He frequently spent all night in the lab, not because he wanted to impress anyone, but because he loved his work so much. He once criticized me because I never pulled an all-nighter at the lab, which was true. I responded that I was "working my ass off," which wasn't true. His response was that he wanted me to work my brain off.

I was never inspired by adiabatic demagnetization or angular correlation (my project), and never really understood quantum mechanics or the oil drop model of the nucleus. But I was inspired to find work that I loved as much as Dave loved his work. That work for me was not in research, but was in a high technology company developing products to cure cancer with radiation.

Several years after he retired early from Cal, which surprised me, we connected at his condo in Hawaii. He was a different person. He had no interest in even talking about research or science in general. He wanted to talk about gardening (a new passion), travel, his family, my family and career, and how much he enjoyed his new life.

We had a few drinks and shared a wonderful evening together. Dave had become the very human person I perceived when I chose him as my thesis advisor on the first day. He had so much to offer his family, his friends, and the students he worked with. He was a very special and very unforgettable person who will be missed.

Fig. 3.1: Richard M. (Dick) Levy and his wife Susan, around 2020.

4. Eckart Matthias, *emeritus* professor, Freie Universität Berlin
Six years with David Shirley: a Time of Rapid Development

When I arrived at LRL Berkeley in 1963, with a fresh doctorate from Uppsala University, on a fellowship from the Miller foundation, my host David Shirley was a young assistant professor, who had worked mainly with low-temperature methods, at first on classical thermodynamics (with his thesis advisor, William Giauque at UC Berkeley). Later, he applied low-temperature nuclear orientation (NO), collaborating with several more senior faculty members (J.O. Rasmussen, D. Templeton, C.D. Jeffries) and with some postdocs (Charles Johnson, Jim Schooley, Morton Kaplan). He had already begun branching out into new hyperfine-interaction methods (the recently discovered Mössbauer effect and EPR). My own experience from my doctoral thesis work with another excited-nuclear method, differential perturbed angular correlations (PAC), led to new directions in the Shirley group, which had already gained some experience with angular correlations in the work with Richard Levy. We published a half-dozen articles on applications and theory of PAC in the years 1964 to 66.

A major and important new development was the first observation of nuclear magnetic resonance (NMR) in a short-lived excited nuclear state by a combination of PAC and NMR in 1966 (Fig. 4.1).

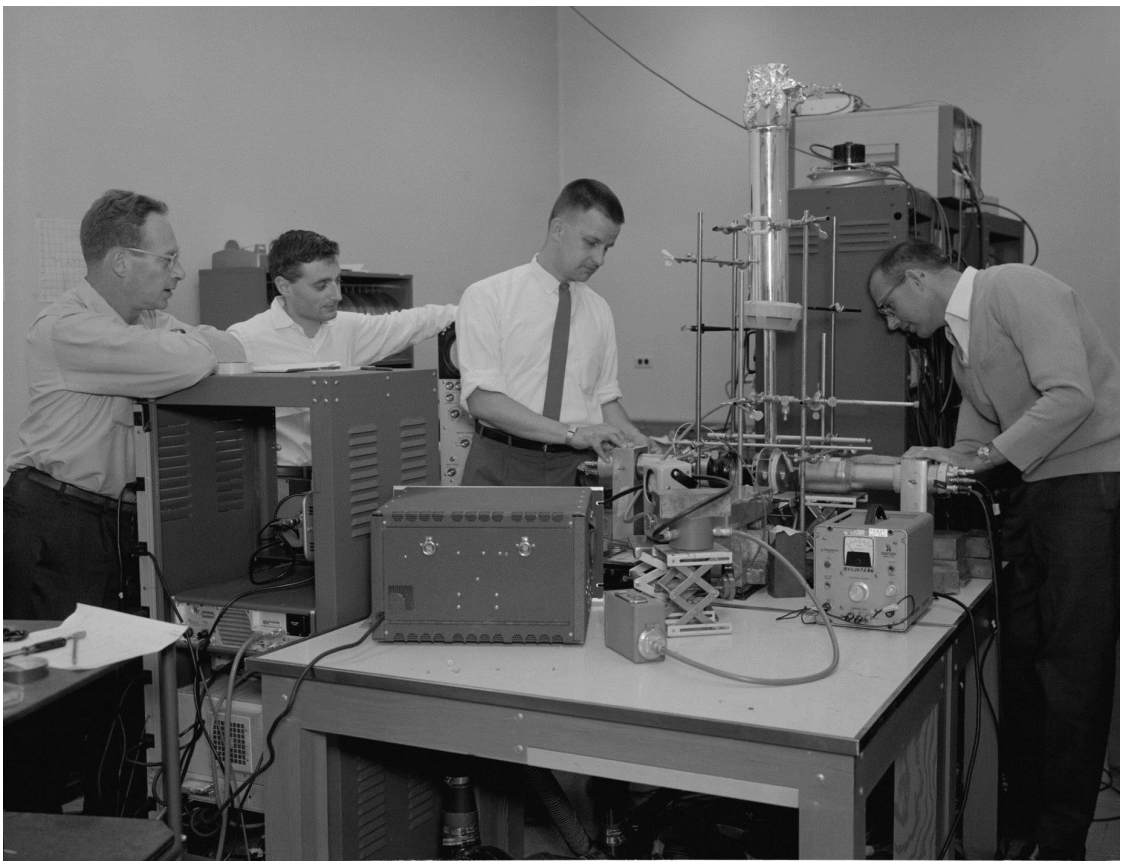


Fig. 4.1: Physicist Melvin Klein of the Chemical Biodynamics Lab, Norman Edelstein, David Shirley, and Eckart Matthias, adjusting the PAC/NMR experiment that first demonstrated the combination of nuclear resonance with nuclear spectroscopy, 1966.

At about the same time, I performed the first NMR experiment on oriented nuclei (NO/NMR), together with graduate student Jim Holliday. The method was improved upon the following year by Dave and a doctoral student in Oxford, James E. Templeton (see Fig. 1.2), becoming standard all over the world.

In the summer of 1967, after David Shirley had returned from his sabbatical year at the Clarendon Laboratory/Oxford, we organized together the *1st International Conference on Hyperfine Interactions*, held in August of that year in Asilomar, CA. This conference, and the resulting proceedings book, established the international reputation of the Shirley group. That same year, Dave Shirley was promoted to full professor at UC Berkeley. In the fall of 1967, I went as a visiting scientist to Rudolf Mössbauer's newly-established institute at the *Technische Hochschule München* (now the *Technische Universität München*) to obtain my *Habilitation*, an advanced degree that was still obligatory at that time in Germany to qualify for a faculty position in fields of basic research. This led to my appointment as professor and director of the 1st Physics Institute at the *Freie Universität Berlin* in 1969.

In just six years, we had both become full professors at major universities. Dave was now Chairman of the Department of Chemistry at UCB, and I an Institute Director in Berlin. Our mutual scientific cooperation and support had brought a great leap to both of our careers in a surprisingly short time!

Fig. 4.2: David Shirley and Eckart Matthias in Sweden, around the time of the *3rd International Conference on Hyperfine Interactions*, held in Uppsala in June of 1974.

5. Richard Frankel, Professor *emeritus*, CalPoly
Graduate student in the Shirley Group, 1961-65

This photo (see Fig. 5.1) has been sitting quietly in a box of memorabilia for about 60 years and a coast to coast round trip. I think it shows how Dave loved doing experiments as much as savoring what he learned from them. This is something I carried with me through forty-five years of doing experiments myself. I don't remember what happened in the experiment shown in the photo, except that we got a real finger-shaking dressing-down from the lab safety authorities, for not wearing safety glasses while pouring liquid nitrogen.

[From the 'Notes to Dave' sent by those who were unable to attend the Symposium for his 80th birthday in Berlin, July 2014]: "I worked with Cerium, Europium, Tellurium, Antimony, Cobalt and Einsteinium isotopes. In fact, our radioactivity nanny Gertie Boltz once thought I had swallowed some ^{253}Es and sent me down to the campus to sit under a whole-body radiation detector for half an hour… Fortunately nothing was found.

Happy birthday, Dave…Thank you for manning the wheel as I made the perilous transition from student to scientist".

Condolences and best regards to Barbara and family.

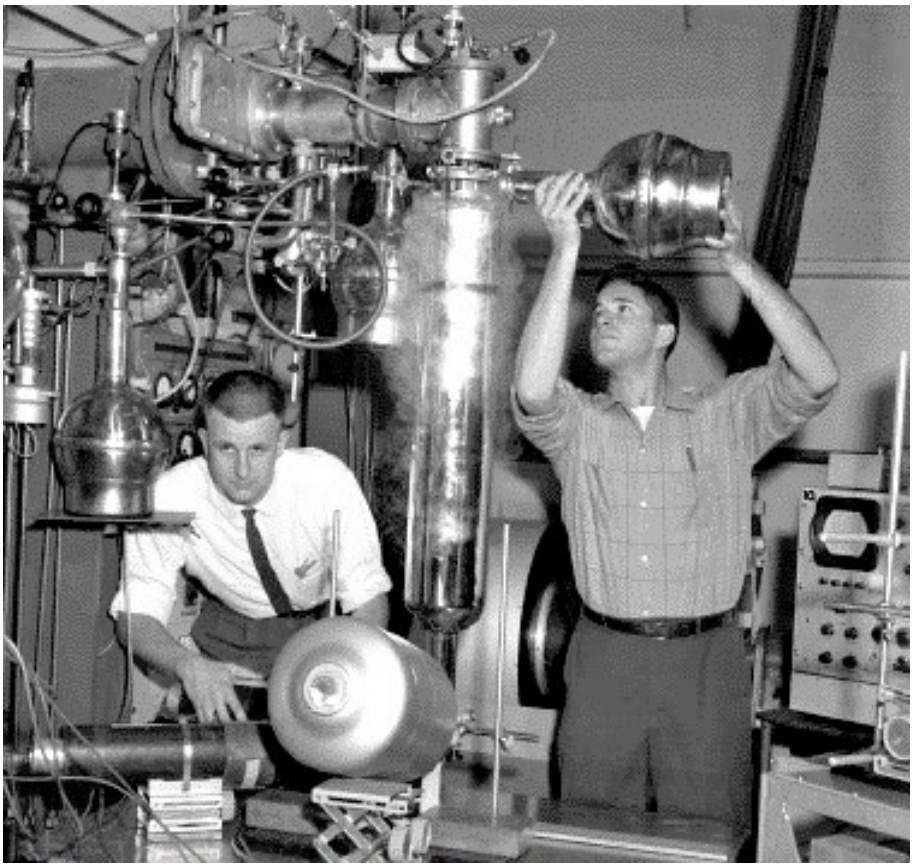


Fig. 5.1: David Shirley and Richard Frankel, tending to a nuclear orientation cryostat in 1964.

6. N.J. Stone, *emeritus* Prof., Oxford University
Postdoc 1963-65 in the DAS group

The two years I spent as a young post-doc with Dave's group at LBL were a time of great personal development for me. Working with his top-quality grad students Dick Frankel, Johan Blok, Hollis Wickman and Dick Levy on the ground floor of Bldg. 70A, I fully enjoyed the benefits of Dave's great drive and enthusiasm. As group leader, he asked for 'a meal of good raw data' and saw to it that we had earliest access to the very best of the new, high-resolution gamma detectors and the modular, stable and reliable, semiconductor electronics being developed at the laboratory. I was pretty conversant with the nuclear orientation side of things and enjoyed learning the complementary methods of the Mössbauer effect and Perturbed Angular Correlation. Eckart Matthias, my office mate and fellow post-doc, was a few years my senior and was working with Dave on the latter methods. Having them all working together in the same group was unusual, and typified Dave's broad approach to experimental investigation.

I had enjoyed great freedom as a graduate student in the Clarendon, with my supervisor largely occupied with other activities across the road in the then new Oxford Nuclear Physics laboratory. The close interaction with Dave was a valued contrast. He was intensely interested in every experiment and kept the whole group on our toes in a competition to produce exciting, clear-cut results.

When I returned to Oxford after two years, as my J1 visa required, Dave was instrumental in getting technical support for my new ventures and made fundamental contributions to the early successes of my fledgling group. His sabbatical year with us in 1966/67 saw the break out of studies of isotopes polarised in dilute ferromagnetic alloys, in combination with NMR, which formed the foundation of so many later developments.

In later years we kept in touch from time to time, meeting at conferences of the Hyperfine Interaction community. Memorable, more personal, occasions were a group reunion in Berkeley in 1999, our visit to his new Hawaii home, and especially his 80th party and symposium in Berlin.

Dave was a formative influence for me. He showed the importance of close interaction and daily involvement with his students. For me this was exemplified by the call that would sound through the hallway of his lab area on many hot summer afternoons - 'Swimming Bus'. We would pile into his Volkswagen and head down the hill to the university pool for some energetic horseplay. I can just see his non-too-elegant swallow dive. Great times!

Fig. 6.1: At the evening reception following the Symposium in Berlin for David Shirley's 80th birthday: *from left*, Jrina and Nick Stone, David and Barbara Shirley, Günter Kaindl.

7. Warren C. Easley, E I Dupont, retired, Louisiana Pacific, retired
Shirley Group Graduate Student 1963-1967

My four years in the DAS group were, as one of my colleagues put it recently, 'graduate student heaven.' Dave was a strong advisor, providing guidance and support without micro-managing, the group was filled with brilliant, enthusiastic students and postdocs, and the level of support in Building 70-A was practically unlimited. As Dave used to say, 'Working up here teaches you to think big.' However, it took me a while to realize how good I had it. A year into my tenure, I became restless because I was also interested in chemical oceanography. I was comfortable going to Dave with my doubts, which says a lot about his leadership. He encouraged me to go down to Scripps and spend a few days 'wandering around and asking questions.' I did that and came back realizing that oceanography wasn't doing chemistry on a ship in Bermuda shorts and flip-flops. In fact, the problems were fairly mundane compared to the array of studies going on in Dave's group. Shortly after that, I found my grove—how electrons and nuclei interact with each other and their solid-state environments—and never looked back.

The atmosphere in Dave's group was serious when it came to science and much was expected from his students. At the same time, he created an atmosphere where fun was allowed. I remember the swimming bus, touch football games in Strawberry Canyon, and, of course, the hijinks that went on in the wee hours of the morning when nuclei finally got aligned and counters were clicking away.

My four years in the DAS group were four of the best in my life in terms of intellectual growth and personal development. It was my honor and good luck to have been a student of Dave Shirley.

Fig. 7.1: Steve & Ellen Rosenblum, Beth & Norman Edelstein, and Warren & Marge Easley, in Oregon at the 'Dave Shirley memorial reunion' held soon after the Symposium in Berlin for Dave's 80th birthday.

8. James J. Huntzicker, Oregon Health & Science University
Graduate student in the Shirley Group, 1963-68: a Tribute to Dave Shirley

I was a PhD student with Dave Shirley from 1963-1968, arriving at the same time as Steve Rosenblum and Warren Easley. My PhD work built on earlier work by Nick Stone and Dick Frankel in Dave's group. Although nuclear chemistry tools were used in my work, it was a classical thermodynamics project and most likely the last thermodynamics PhD project that Dave sponsored. The roots of my project can be traced through Dave to his PhD advisor William Giauque, who won the 1949 Nobel Prize in Chemistry for his work on low temperature thermodynamics and the development of adiabatic demagnetization, a tool which I used extensively in my research. Interestingly, Professor Giauque was also the PhD advisor for my undergraduate research mentor, Edgar Westrum, who was a Professor of Chemistry at the University of Michigan.

Dave Shirley was an enormously creative and productive scientist. When I arrived at Berkeley in 1963, he was a young assistant professor, and by the time I finished my PhD he was full professor and chair of the Department of Chemistry. Dave's approach to science embodied an innate curiosity and a drive to understand how nuclei, atoms, and molecules worked under a variety of physical conditions. In explaining physical phenomena, he was very demonstrative, using what I and, I think, my student colleagues, called "finger physics." By this I mean that he was very adept at using a combination of fingers—up, down, right, and left—to describe the motions and orientations of nuclei and their associated electrons as well as the magnetic fields associated with them. I was never quite that agile.

Dave taught me to think broadly and not be constrained by the way I had always done things. A few years after having finished my studies with Dave, I asked for his support to make my own radical change in my scientific career, and he supported me enthusiastically. I am very grateful for all that I learned from Dave—as well as all that I learned scientifically and otherwise from the team of students, postdocs, and staff (thanks, Wini!) that he had assembled.

Fig. 8.1: Steve Rosenblum, Warren Easley and their wives, and Jim Huntzicker in Oregon, August 2014, at their 'Dave Shirley memorial reunion' held soon after the Symposium in Berlin for Dave's 80th birthday.

9. Rivka and Israel Nowik, *emeritus* Professor, Hebrew University, Jerusalem

Memories of David Shirley – The year the Wall came down

The passing of David A. Shirley has saddened me and my wife Rivka very much. Dave and I go back more than half a century; we have a joint paper as early as 1966. We shared a wonderful full year together at the *Fachbereich Physik* of the *Freie Universität Berlin* in Günter Kaindl's group in 1989/90, having the opportunity to see each other daily. The fall of the Berlin Wall was a lifetime experience, filling everybody with joy and great expectations for the future of our world. Rivka and I became close friends with Dave and Virginia, a friendship that continued ever since. We also fondly remember a wonderful evening we had with Dave and Barbara in our home in Jerusalem.

Dave was an excellent scientist. His contributions to many fields of physics were extremely impressive, and every discussion with him was enlightening. We send our condolences to Barbara, his five children, and the numerous grandchildren. We wish them all the best.

Israel and Rivka Nowik

Fig. 9.1: David Shirley and Israel Nowik as '*Mauerspechte*' ('Wall Woodpeckers'), chipping pieces out of the now obsolete Berlin Wall (Winter 1989/90).

Fig. 9.2: Israel Nowik and David Shirley in the back of Günter Kaindl's overloaded automobile, with seven adults and tools to chip out some souvenirs of those "wild and happy times" in Berlin. In the background, Rivka Nowik, Ursula Kaindl and Dieter Quitmann can be seen.

10. Norman M. Edelstein, Scientist at LBNL
Memories of a Scientific Neighbor

Dave Shirley's and Burris Cunningham's groups shared the ground floor of Building 70A at the UC Radiation Laboratory when I arrived to join the Cunningham group in October 1964. The electron paramagnetic resonance spectrometer was in Dave's large nuclear orientation laboratory, 70A-1159, where Dave's student, Warren Easley, was using it for hyperfine measurements. I started helping Warren, and once my actinide ion experiments were initiated, Warren participated in those experiments. Due to the proximity of the two groups, and along with Dr. Mel Klein, I interacted closely with Dave and his group members, for the years that he and his group were in Bldg. 70A. (See *Fig. 4.1*).

I was almost an auxiliary member of Dave's group, as I ate lunch at the picnic table behind the cafeteria with them and went to some of his group's parties. Wini Heppler, the technician in Dave's group, was the person who organized most of the Shirley group events in which I sometimes participated. I had cordial interactions with Dave as well as the Shirley group during the time that they were in Bldg. 70A. I am also grateful to Dave for sharing his physical chemistry notes with me when I taught the first course in Physical Chemistry for one summer school session.

Fig. 10.1: Group photo, 1969. *Front, from left*: Günter Kaindl, Norman Edelstein, Wini Heppler, Arthur Soinski, Dan Salomon, Rick Streeter, Gus Apai. *Behind*: Tom Koster, Roger Pollak, Fred Bacon, Dorothy Chan, William Brewer, D. Philips, Sammy Hung.

11. William D. (Bill) Brewer, Prof., FU Berlin (retired)
Thoughts on David Shirley's Group in the 1960's

When I joined Dave Shirley's research group as a beginning graduate student in November 1965, Dave was a young 31 years old and had received tenure at UC Berkeley just a year before. As was usual, he gave me a 'preliminary project' which I was to carry out in the next 15 months and use as the topic of my Prelim Exam for admission as a doctoral candidate. His suggestion was fundamental and novel – just 8 years earlier, the famous Wu-NBS experiment had been the first to demonstrate parity non-conservation in the Weak Interactions (WI), and it led to the 1957 Physics Nobel prize for the theoreticians who had predicted that unexpected effect, T.D. Lee and C.N. Yang – probably the fastest Nobel prize in history.

Wu *et al.*, in 1957, had observed the forward-backward asymmetry of the emitted beta particles (electrons) from the decay of oriented ^{60}Co nuclei at low temperatures, an experimental triumph given the technology of the day, and the most significant nuclear orientation (NO) experiment ever performed. Dave Shirley had pioneered the NO method at Berkeley in 1958, with the help of Charles Johnson and later Nick Stone, both from the Clarendon Laboratory in Oxford, where the world's first NO experiments had been carried out in the early 1950's.

What he suggested to me was to observe, for the first time, the forward-backward asymmetry of the emission of Inner Bremsstrahlung (IB) accompanying nuclear beta decays. This is a second-order process in which a beta decay, mediated by the WI, is (rarely) accompanied by a continuous spectrum in the gamma-ray region, mediated by the Electromagnetic Interaction (EI). Gamma rays normally show no asymmetry, since the EI conserves parity. But in an IB process, the EI and the WI are coupled, leading to the typical asymmetry due to parity non-conservation in the WI. This had not yet been detected experimentally in 1965. Due to the extreme weakness of the IB spectrum, the experiment was not easy, but it was certainly possible and very interesting. After some preliminary work in detecting weak gamma spectra, by June of 1966 I was ready to start the real experiment, and Dave made a brilliant suggestion.

We couldn't use an ordinary beta-decay nucleus, since the External Bremsstrahlung (EB) accompanying the scattering and absorption of the emitted beta particles would mask the IB spectrum and falsify the results. The only alternative was a nucleus which decays by Electron Capture (EC), so that the only electrons involved are inner atomic electrons, captured into the nucleus, with their accompanying IB. As it turns out, there are only about a half-dozen possible cases in the whole Table of Isotopes, and Dave had picked the apparently most promising of them all, ^{49}V, which has favorable nuclear, solid-state and chemical properties and is readily available, with a conveniently long decay half-life. (I later wondered if his wife Virginia, an editor of the Table of Isotopes, gave him a hint here).

When Dave left for his first Sabbatical year in July 1966, to the Clarendon Laboratory, Oxford, U.K., on an NSF Fellowship, I was ready to begin the experiments. Work two years earlier at Oxford with the neighboring isotope ^{48}V oriented in an iron host at low temperatures had made it seem likely that the NO would present no problems (although the Oxford work had shown an anomalously small nuclear magnetic moment). I ordered the isotope, made samples, observed the IB spectrum at room temperature, and set out to do the NO experiments.

However, they showed *no asymmetry* of the IB spectrum. I repeated the experiments numerous times, making new samples, testing the apparatus, even doing a 'blind' experiment with a fast NO thermometer to prove that low temperatures were being achieved. I was using an inherited 'Westenbarger-type' apparatus, developed by an earlier grad student, Gene Westenbarger, with a small amount of the 'cooling salt' *chrome alum*. It had a limited measuring time due to the inevitable heat leaks, causing the sample to warm to above 20 mK after at most a half-hour. Westenbarger himself had obtained longer measuring times, but some unidentified additional heat leaks had shortened them by the time I arrived. Still, the temperatures reached were below

10 mK and should have been more than adequate for my measurement. By September 1966, I was convinced that the ^{49}V experiment was not going to work, in spite of my best efforts, and looked for an alternative.

Dave was far away, communication was slow and cumbersome in those days, and no-one else in the group was doing anything remotely similar, so I was on my own. I sat down with the Table of Isotopes and distilled out the 6 or so possible candidates. The second-best, after ^{49}V, was ^{37}Ar. Its nuclear properties are perfect, but its chemistry is hopeless – Argon is a noble gas, not soluble in ferromagnetic metal hosts and not forming any magnetic compounds. The only way to prepare samples would be online implantation into a cold host foil, technically still beyond the horizon in 1966. Thus I finally arrived at ^{119}Sb, an isotope with favorable nuclear properties but a disturbingly short half-life of less than 3 days, and difficult preparation (by α-particle bombardment of a tin target, followed by two successive chemical separations). I could produce the isotope at the 88" cyclotron just down the hill, but would have to deal with the chemistry myself, the first separation in a shielded glove-box due to the high level of radiation.

After a trial run to test the preparation and observe the IB spectrum, I made several samples in Fall 1966 and carried out the experiments. The IB asymmetry was readily observable, and I could even measure its energy dependence (due to an admixture of p-electrons in the EC decay). By January 1967, I had enough data to defend my project and pass my Prelim Exam. When Dave returned from England in June 1967, I had analyzed all the data, made scattering corrections, determined the asymmetry coefficient and plotted the results. We were able to write up a Physical Review Letter and submit it the following spring. It was my first PRL, the only one ever to be accepted for publication quickly and without a hassle, and had just two authors: Dave and myself:

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PARITY NONCONSERVATION BY INNER BREMSSTRAHLUNG FROM POLARIZED ^{119}Sb

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(Received 1 March. 1968)

The spatial asymmetry of internal bremsstrahlung from ^{119}Sb polarized in Fe at low temperature has been observed. The data fit the theoretical correlation function well, although some dependence of the asymmetry coefficient A on photon energy was found. At energies near the end point, complete parity non-conservation was observed, in agreement with theoretical predictions.

That was a flying start to my doctoral thesis and a good illustration of what many people have remarked and praised in Dave Shirley as a mentor and group leader: He gave us the freedom to make our own mistakes, without undue criticism or pressure, and thus allowed us to gain valuable experience and self-reliance which was useful for a lifetime.

And why had his original, genial suggestion not worked? That I found out only a decade later, when I was established at the FU Berlin with my own group – together with Erwin Klein – with technically much more advanced low-temperature apparatus, giving temperatures down to 2 mK and measuring times of days or longer. Geoff Wilson, an Australian physicist, spent a year as a guest in our group in 1977/78. He had been a postdoc in Oxford when the original ^{48}V experiments were performed there, and he wanted to study that case in more detail. We made alloys of V in Fe, Co and Ni, studied them at low temperatures and high magnetic fields, applied Geoff's modulated-pulse NMR method to determine their hyperfine interactions precisely, and observed the time dependence of the NO. The result: the nuclear spin-lattice relaxation time of

V in Fe at low temperatures is of the order of *5 hours*. The nuclei simply never had time to come into equilibrium with the cold Fe lattice in my earlier experiments. That explained the 'anomaly' seen in the early Oxford experiments, also – they measured an average NO, not yet in equilibrium; their longer measuring times with a larger apparatus allowed them to see some effect, but a reduced one. With my low counting rates and short measuring times, I had no hope in Berkeley in 1966. We could have repeated the ^{49}V experiment in Berlin, but due to the high background radiation in our lab, with 5 cryostats in a limited space, it would have been difficult.

Another decade later, the Belgian group of Ludo Vanneste and his students at the KU Leuven performed the ^{37}Ar experiment at the online implantation NO apparatus NICOLE at CERN, Geneva, using a spallation reaction and an isotope separator online to make the ^{37}Ar and implant it continuously into a cold Fe foil.

David Shirley, with his secure instinct for an interesting problem, had picked an apparently optimal case, with no way of knowing that particular quirk of low-temperature relaxation times (the neighboring isotope ^{54}Mn in Fe host has a relaxation time more than three orders of magnitude shorter, around 10 seconds at 10 mK). We understood all this only in the 1990's. But Dave gave me the freedom to 'do it my way', and the result was a great success for both of us!

Fig. 11.1: Jrina and Nick Stone, and William Brewer, evening of the first day of the 80th birthday Symposium for David Shirley, Berlin, July 2014. Dinner with Dave, Barbara, and former group members at the restaurant *Stäv* in Berlin-Mitte.

12. Gottipaty Rao, Professor of Physics, Adelphi University, Garden City, NY
Visitor in the Shirley group, 1967/69 and summer 1974

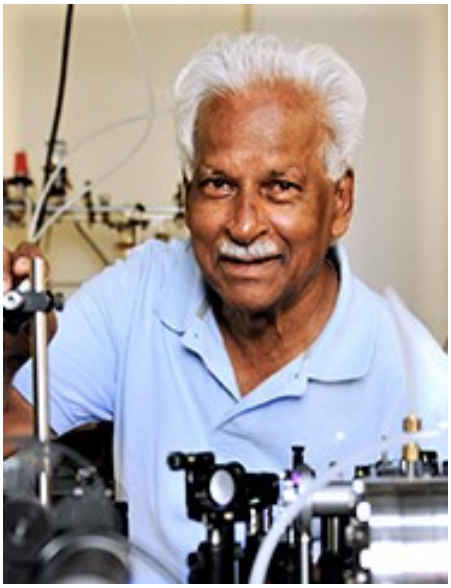
It was during the summer of 1967, I landed at San Francisco airport. It was a warm and sultry day and my flight was delayed by about two hours. Dave was waiting to pick me up in that hot weather at about 4 pm. He drove me to his home, where Virginia Shirley served a nice dinner joined by their children David Jr., Diane, and Michael. I had a wonderful time and Dave dropped me off at the International House around 9 pm. That was a truly wonderful and memorable experience.

Next day, Dave showed me the administrative offices of Nuclear Chemistry and his lab in Bldg. 70A. Dave told me that it is the lab policy to provide all the facilities you need to accomplish your research goals, and if you need any specific equipment we don't already have, the lab will try to get it for you. Do not hesitate to ask for whatever you need!

Dave always wanted the best of everyone who worked in his group. He liked everyone in his group to be productive, motivated and focused on research and academic goals. He has been a mentor and a role model for me. Dave was very personable and helpful to me. On his own he volunteered to help me to get a visa for my wife to join me. My stay at Berkeley in his group was inspiring and stimulating. The group was always buzzing with activity and new ideas and new experimental plans.

Dave has always amazed me with his sharp memory. If I told him the NMR resonance frequency up to four decimal places today, he would exactly remember the correct number including the fraction after many months!

Dave had a huge impact on my professional and research career. After a two-year stay at Berkeley, I returned to my permanent position at IIT, Kanpur and I tried to develop a research group and a research program along the same lines as Dave: a large and active group, broad-based, well-funded research programs. I think I succeeded at a modest level in implementing the things I learnt in Dave's group. Professor Jim Huntzicker, who visited IIT, Kanpur, as a visiting professor, used to call me 'Dave of IIT, Kanpur'. I felt that it was a good compliment to me and my research program. I believe that Dave was instrumental in training and guiding me and in acting as a mentor and a role model. He shaped my research and professional career and changed my life.



Dave was very personable, always ready to help, a good mentor, and he had lots of ideas about future research.

Thank you Dave, we always remember you with gratitude, respect and affection!

Fig. 12.1: Gottipaty N. Rao, at Adelphi University.

13. Helmut Gabriel, *emeritus* Prof., FU Berlin
Visitor in the Shirley group, 1968/69

I met Prof. David Shirley for the first time at the beginning of March 1968 when I joined his research group as a guest researcher sponsored by the Max-Kade Foundation. On the day of my arrival, a slightly inconvenient surprise was waiting for me.

Dieter Quitmann, at that time a visiting Postdoc in Shirley's group, had kindly offered to let me stay at his house until I had found an accommodation of my own. He was, however, away on a weekend trip to the mountains. As it turned out later, he had left the key with one of his two next-door neighbors, who however both were not at home when I arrived. Not knowing what best to do, I ventured to visit Prof. Shirley at home. Of course, I felt somewhat uneasy at disturbing him on the weekend. My concerns were unnecessary: Prof. Shirley reacted in a very friendly manner and offered his help immediately. He drove me to his laboratory (where we found Quitmann`s letter), gave me a short guided tour and explained to me how to deal with the forthcoming formalities. This reaction was a crucial experience to me. It was my first striking example of the often-quoted American hospitality. I experienced it repeatedly during my stay in Berkeley.

The next day, he introduced me to his team, whose members also welcomed me in a very friendly fashion. It didn`t take long for me to feel accepted by the members of the group; and I still appreciate their kind willingness to help. To some of them, closer contacts quickly developed, including several wonderful shared weekend trips to exciting locations in California.

Having received documents which allowed me to enter the LRL site, I attempted to make myself acquainted with the services most important to a theorist, again supported by members of the group. I started working on the topics that I had sketched in my application to Max Kade. I decided to focus on the theory of multipole relaxation, aimed at finishing a sound investigation during my stay.

I benefitted from Shirley`s support in a twofold manner: Firstly, by being invited to his laboratory, allowing me do research in an inspiring scientific environment, which moreover paved the way to establish contact with critical scientists who were to a certain extent familiar with my problems of interest.

Secondly, by becoming acquainted with Eckart Matthias – senior staff member in Shirley`s team. He and Stefan Hüfner both had received offers of full professorships for Experimental Physics at the FU Berlin. As mentioned in the obituary, both became central figures in restructuring and expanding the department. By taking up negotiations before finally moving to Berlin, Matthias ensured that his institute was endowed with two additional positions (comparable to associate professorships, and later occupied by D. Quitmann and myself).

For many scientists, Dave Shirley was a principal supporter of their careers. Moreover, he as well was an efficient advocate for establishing internationally-renowned research centers.

We all express our gratitude!

Helmut Gabriel

Fig. 13.1: Helmut Gabriel, some years after his stay in the Shirley Group in Berkeley.

14. Erwin Klein, Prof. (retired), Freie Universität Berlin
Postdoc 1968-69 in the Shirley Group

With the help of Eckart Matthias, I got a scholarship to spend one year at LBL, working in David Shirley's low temperature group. For me, everything was new. First of course the language. Fortunately, we learned English at school and I had the luck of having a very good teacher. Although my pronunciation was different – my teacher had studied in England – nobody ever made jokes about it. I was immediately accepted by the group and felt at home right from the beginning.

New for me too was to work at millikelvin temperatures and with radioactive samples. So it was helpful to do the first experiment together with William Brewer. This cooperation was later continued at Berlin.

After I came back, I started with a dilution refrigerator ordered by Eckart from Oxford Instruments. Unfortunately, it did not work well and I had to rebuild part of the external apparatus and finally the whole dilution unit. So for quite some time no functioning low temperature experiments could be done and again it was helpful that after finishing his doctorate, William Brewer came to Berlin. We formed a joint low temperature group and he started by quickly building a functioning demagnetization cryostat.

Back to LBL: If I had a problem or a question, Dave was always available to offer help. And we had private get-togethers too, dining at his home and playing table tennis. Or spending some days together hiking in Lassen Volcanic National Park.

Altogether I can say that the time I spent in Dave's group influenced the rest of my academic life.

Erwin Klein

Fig. 14.1: Erwin Klein, at the evening reception for the Shirley Symposium, *Magnus-Haus* Berlin, July 2014.

15. Heinz Haas, *Hahn-Meitner-Institut* and CERN
Two California Dream Years

The two years that I spent in David Shirley's research group at Lawrence Berkeley Laboratory, 1969 to 1971, were definitely among the most important in my scientific life.

Dave gave me the possibility and assistance to become familiar with the area of nuclear solid-state physics, new to me at the time. He had a very clear way of explaining scientific and technical matters that helped me, as well as all the other junior collaborators, to progress productively with our projects. Much more than that, Dave's enthusiasm about novel ideas has given rise to research topics also in this field that are still bearing fruit now, half a century later.

Dave's personality was essential for the efficient working environment we all enjoyed at LBL. Beyond that, the joint events and group meetings created an unusually pleasant social environment, and the group outings also allowed us to get to know the exceptional Shirley family (see Fig. 15.1).

Clearly, whoever had the chance to work with David Shirley will keep fond memories of this great personality, and share the sorrow of his no longer being among us.

Heinz Haas

Fig. 15.1: Dave Shirley with his children David, Diane and Michael, on a 1971 group excursion to Yosemite, recovering from a cold and very wet night in makeshift tents.

16. Günter Kaindl, Professor *emeritus*, *Freie Universität Berlin*

From Miller Fellow to lifelong friendship

The factor *chance* often plays a decisive role in the life of a person, for example in my own early development, which was very positively influenced by chance more than once. First of all, when I learned just 2 weeks before my final oral exam in experimental physics for the *Diplom* (Masters) degree in 1965 at the *Technische Hochschule München* (THM), that my examiner would be Rudolf L. Mössbauer. He had just returned from Caltech to his *alma mater*, the THM, where in 1958, during the research for his doctoral thesis, he had discovered the quantum phenomenon of *recoilless resonance gamma-ray absorption*, now known as the *Mössbauer Effect*, for which he received the Nobel Prize in physics in 1961, at age 32. In those days, such oral exams at the THM were just a private oral question session, and after about an hour, Mössbauer asked me what my plans were. I told him that I had an offer to be scientific assistant at a German medical faculty, with the option to study medicine on the side. Mössbauer's spontaneous reaction was, "No, don't do that; I can offer you the same." – and I accepted his offer. That is how I became a scientific assistant in Mössbauer's young institute, although I had not yet completed my doctoral degree. And I never regretted my decision, since soon I could enjoy and contribute to a most creative atmosphere and academic culture, with great freedom, once trust had been established, and where everyone could attain his or her individual best form.

A year later, Eckart Matthias came to our institute as a guest researcher from Dave Shirley's group at the Lawrence Radiation Lab/UC Berkeley, to obtain his *Habilitation* degree. This turned out to be my second chance, with decisive consequences for my career. Eckart collaborated with one of our doctoral students, who had just started work on the high-resolution 6.2-keV gamma resonance of ^{181}Ta. When Eckart returned to Berkeley a year later, I soon received a letter from him asking if he might recommend me to the Miller Institute for Basic Research in Science at Berkeley. From this letter, I first learned about the Miller Institute, and also that Eckart himself had received that fellowship after his PhD at Uppsala University. Somewhat later, in Nov. 1968, a letter from the Miller Institute informed me that I would be one of 6 Miller Fellows who were to begin their 2-year assignments at UC Berkeley on Sept. 3, 1969.

At this point in 1968, I had already planned to finish my research for the doctoral degree in a year's time, and most likely to follow Mössbauer's advice of applying for a postdoctoral stay at Caltech. But the award of the Miller Fellowship forced me to speed up even more. I submitted my doctoral thesis on June 27, 1969; it was accepted 5 days later, and the oral defense before three prestigious professors, R.L. Mössbauer, P. Kienle (my *Diplom* thesis adviser), and W. Wild, was scheduled just 7 days later, on July 9. This totally unbureaucratic procedure even left me enough time to travel by car with my fiancée Ursula for a 3-week vacation to Greece. After that, Ursula stayed in Munich to finish her education, and we married a year later in Bavaria.

On the evening of Sept. 2, 1969, I arrived in Berkeley, via a helicopter ride from S.F. airport above a dense layer of fog across the Bay. After checking in at the International House, I walked down to Telegraph Avenue for a drink at one of the eateries, ordering 'a beer'. The waitress responded, "We only have root beer", which I interpreted as a special brand. My ignorance failed to lead me to the desired purpose after the long flight, but it cured me of ever ordering that 'brand' again.

On the following day, my first meeting with David Shirley in Bldg. 70A of the 'Rad Lab' was very pleasant. Dave showed me around and introduced me to Winnie Heppler, the chemistry technician and soul of the group, as I would soon learn. I was also introduced to the current graduate students, postdocs, and other researchers on the ground floor of Bldg. 70A, and to

Norman Edelstein and Burris Cunningham, the famous actinide microchemist, whose name I knew from the radiochemical part of my doctoral research; later, I would learn a lot from Burris about rare-earth and actinide chemistry and metallurgy, usually during the late-night hours.

Fig. 16.1: A photo of some members of the Shirley Group in October, 1969. *Below, from left*: Günter Kaindl, Norman Edelstein, Dan Salomon (the originator of the photoshooting, in the box), Roger Pollak. *Behind*: Tom Koster, Rick Streeter, Wini Heppler, Arthur Soinski, Gus Apai, D. Phillips, William Brewer, Fred Bacon, Sammy Hung, and Dorothy Chan.

The above photo (*Fig. 16.1*) reflects the companionship and positive climate in Dave's group, similar to what I had enjoyed at my *alma mater* in Munich. Dave granted us great academic freedom combined with a constant willingness to discuss ongoing or future projects whenever possible. In this way, he generated a most creative atmosphere that can be characterized by competitiveness, cooperation, and solidarity, an ideal mixture for fruitful collaborative research.

The *International House*, close to the Rad Lab on the hill above it, turned out to be ideal for acclimation, providing full board service and other amenities in a truly international atmosphere. I lived there during my first 6 months in Berkeley, until I moved to an even closer apartment on Highland Place, just below the 88" Cyclotron. There, most of the short-lived isotopes for my work on nuclear orientation (NO) and NO/NMR were produced. Even though the NO techniques were new to me, I was well trained in low-temperature methods and radioactivity due to my research at the THM *Garching* Campus, with its research reactor and the *Walther-Meissner Institut* for low-temperature research. In those days, Walther Meissner (of *Meissner Effect* fame) and Robert Doll (flux quantization) were still working there.

My start in Dave's group was smooth and fast, because I could immediately collaborate with Dan Salomon, a graduate student whose work on high-resolution Mössbauer spectroscopy using the 6.2-keV gamma-resonance of ^{181}Ta began when Eckart Matthias was still in Dave's group (until mid-1969). We first evaluated older data, but then we improved the Mössbauer setup (by using a sinusoidal drive for higher velocities and an optimized proportional counter), leading to immediate success in observing huge isomer shifts of the 6.2-keV Mössbauer resonance. Dan was particularly adept at preparing the ^{181}W sources by diffusing the highly radioactive ^{181}W source material under UHV into various metal single crystals. Soon, we were dominating the ^{181}Ta Mössbauer field.

My second project was in the area of nuclear orientation at mK-temperatures, attainable at that time by adiabatic demagnetization of paramagnetic rare-earth salts, a specialty of Dave's, but new to me. Since Dave and Eckart Matthias had published their pioneering nuclear-magnetic resonance (NMR) experiments on an ensemble of radioactive nuclei that were polarized at mK temperatures in a magnetic field just 3 years earlier, it was challenging for me to proceed with this new technique for studying nuclear properties and spin-lattice relaxation times. I improved the demagnetization cell containing $CeMg(NO_3)_5$, and simplified its mounting procedure by introducing indium seals, and we soon reached extremely low temperatures, below 3 mK.

My third interest was in photoelectron spectroscopy, another new method developed initially by Kai Siegbahn at Uppsala University, which he called ESCA (Electron Spectroscopy for Chemical Analysis). At the Rad Lab, it was carried out at the Field-Free Laboratory using a spectrometer which had been modified by Chuck Fadley and Stig Hagstrom working with Jack Hollander; they converted a large magnetic spectrometer originally built for conversion-electron spectroscopy to an ESCA spectrometer by replacing the conversion-electron emitting radioactive source by a small X-ray source and a sample which emitted photoelectrons. Chuck had used this spectrometer for his PhD work on the exchange splitting of core levels in 3d-transition elements, just a year before I arrived. I started my photoemission research by studying the binding energies of Os 4f-levels in a series of osmium compounds with formal valences from II to VIII. Their ladder-like behavior correlated well with the Mössbauer isomer shifts of the 36.2-keV gamma-rays of ^{189}Os (see LBL Annual Report, 1971, p. 230-233).

I also collaborated with Neil Bartlett, the first chemist to synthesize rare-gas compounds, on a Mössbauer study of quinque-valent gold compounds. And in addition, I was involved in an extensive collaboration with Philipp B. Russel, a graduate student of Stanley S. Hanna from Stanford University, on Mössbauer studies of changes of nuclear-charge radii by resonant gamma excitation of the 2+ levels in the ^{170,172,174,176}Yb isotopes. The experiments were carried out at the Stanford FN tandem Van de Graaff accelerator, where the short-lived single-line sources for these experiments were produced by Coulomb excitation with 64 MeV $^{35}Cl^{7+}$ ions followed by recoil implantation through vacuum into aluminum.

A year after my arrival at Berkeley, I married my fiancée Ursula in Munich, and we started to investigate the beautiful and culturally rich environment in the western USA in our free time. Our son was born a year later. We enjoyed life in Berkeley very much, but nevertheless, we decided for family reasons to return to Munich after 3 years, where I wanted to get a *Habilitation* degree at the THM (by now the *Technische Universität München*, TUM).

I consider these first 3 years with Dave to have been successful and extremely important for my career, with about 25 publications, most of them in high-impact science journals. Those years also laid the foundation for our lifelong friendship. In the following years, when I initially accepted an associate professorship at the *Ruhr-Universität Bochum* in 1974, followed 2 years later by a full professorship at the *Freie Universität Berlin*, I spent several half-year sabbaticals in Dave's group in Berkeley. In this way, I could closely follow his role in establishing

Stanford's SSRP and later SSRL (synchrotron-radiation source laboratories), and his early plans of building the first 3rd-generation electron storage ring, the Advanced Light Source (ALS), on the site of LBL's historic 184" cyclotron. The ALS was finally dedicated on Oct. 22, 1993, when I was invited to present one of the main talks at the inauguration session (see Chap. 1, Fig. 1.4, and Chap. 25).

From 1995 to 1997, each Spring I had several weeks of beamtime at Beamline 9.0.1 of the ALS, one of three undulator beamlines in operation at that time, to pursue our work on the double-excitation resonances of He above 65 eV. This work had started in 1989/90, when Dave spent a full year in my group as an *Alexander-von-Humboldt* Awardee (see Chaps. 1 and 29–33). At that time, my group had built and operated the SX700-II beamline at BESSY-I Berlin, financed by the FU Berlin, with the best energy resolution in the 65-eV region worldwide. Dave had directed our interest to these double-excitation resonances. During Dave's 13-month stay, Oleg Artamonov from Leningrad University and I were organizing a joint '*Seminar on Inverse Photoemission*' in Leningrad (see Chap. 31), where Dave and Virginia, together with their daughter Gail, also joined us. After that, we travelled together to Moscow for a Soviet Conference on Synchrotron-Radiation Research (see Chap. 29, Clemens Laubschat, Fig. 29.1).

In 1987, I proposed to award an honorary doctorate to Dave for his many services towards a positive scientific development of the Physics Department at the FU Berlin. Dave received this honor on June 6, 1987, the very first honorary degree bestowed by our Department.

And when, 10 years later, on July 2, 1997, I received an honorary doctorate from Saint Petersburg University, just after the '*International Workshop on Fullerenes and Atomic Clusters*' (IWFAC), with many guests from Russia, Germany, and other countries, Dave and Barbara came from the US to join us there.

Fig. 16.2: *From right*: Dave & Barbara Shirley, Stefan Hüfner, and Ursula & Günter Kaindl, in a boat on the *Neva* river, with the *Hermitage* palace/museum in the background (July 3, 1997).

In 1998, we first spent a week of great skiing with Dave and Barbara in *Colfosco* (Kolfuschg), in the Province of *Alta Badia*, Italy, my favorite skiing region since 1961, when – as a student – I first stayed there with a few colleagues in the house of the local priest.

Fig. 16.3: Dave and Barbara at the upper station of the *Lagazuoi* cable car, at 2740 m above sea level. From here, a fabulous and varied ski descent with an altitude difference of 1070 m leads through three beautiful natural parks down to *Armentarola*.

We repeated those spring skiing holidays at *Alta Badia* in 1999 and again in 2001, then skiing also on the nearby ski slopes of the 'Queen of the Dolomites', the 3343 m high *Marmolada* (in the neighboring Province of *Trentino*) and in *Cortina d'Ampezzo* (in the neighboring Province of *Belluno*). The photo below (*Fig. 16.4*) shows Dave, Günter, our friend Dr. Hermann Wurster, Barbara and Ursula near the upper station of *Punta Rocca* on *Marmolada*, at about 3270 m, from where ski slopes with a minimum of 12 km length lead down to *Malga Ciapella* at 1457 m, covering an altitude difference of 1810 m. Dave mastered these challenging ski runs very well.

Fig. 16.4: View from the *Marmolada* down to the Dolomites in the background (on March 13th, 1999).

Less than 2 weeks after this skiing adventure in March 1999, I travelled to San Francisco to participate in the Symposium that I had proposed and organized with Zahid Hussain and Louis Terminello, supported by LBL and UC Berkeley, to celebrate Dave's 65th birthday on March 29th (see Chap. 1, *Fig. 1.5*).

When Dave turned 80 in 2014, 15 years later, I organized another Symposium in Berlin, together with William Brewer and my previous secretary Birgit Dabisch, and supported by the Department of Physics at the FU Berlin, the German Physical Society (DPG), and the Heraeus Foundation. It was entitled '*From Classical Physical Chemistry to Accelerator-Based Light*

Sources', with many of Dave's previous graduate students, postdocs, guest researchers, and friends attending from all over the world. Many of the photos in this book are from that Symposium and the following evening reception at the *Magnus Haus Berlin* (see Chapters 1, 6, 11, 14, 18, 20–22, 27, 32 and 34).

Dave and Barbara visited us on several other occasions in Bavaria, and we showed them several of the natural and cultural highlights of the country. We went to the *Oktoberfest*, the *Andechs* monastery with its famous beer brewery, *Neuschwanstein*, the mountains in the *Allgäu* region, with their traditional Alpine dairies, where the real Alp cheese is made every day from the fresh milk of the contented and healthy dairy cows directly at the high-altitude pastures (so-called *Sennerei*). In autumn the cattle are guided down by the *Senner* or *Sennerin* to the valley to spend the winter there; understandably, the cows are not amused by this loss of freedom they had enjoyed all summer on the high pastures. We also visited the old Roman city of Augsburg, with its *Fuggerei* (the oldest social settlement in the world, celebrating its 500th anniversary this year (2021), where Mozart's grandfather lived in his later years), the Munich State Opera, several art museums in the region and in Munich, etc.

Dave and Barbara were here in *Wörthsee* together for the last time in May 2016, when we visited *Wessobrunn* (famous all over Europe for its stucco artists). I then travelled with them by car to Appenzell and St. Gallen in Switzerland, from whence they proceeded by train for a week of vacation.

Fig. 16.5: Dave and Barbara in St. Gallen, on May 28th, 2016.

My last personal encounter with Dave was in July 2017, when I was invited for the 7th time as a guest to the *Bohemian Grove Midsummer Encampment* in the redwoods of California, a unique cultural festival of highest quality in a beautiful environment combining tradition, firm principles, friendship, and companionship. Dave had introduced me to the Club in 2002, which opened for me a full new world of 'American culture at its best'.

After 52 years of friendship, I miss you very much,
my dear friend and colleague Dave.

17. Heinz-Eberhard Mahnke, *Honorarprofessor, Freie Universität Berlin*

Memories of David A. Shirley – The cosmopolitan spirit in his group

Although I experienced only one and a half years (1970-72) of close cooperation in the highly respected and widely recognized research group led by David Shirley, my future career was strongly influenced by my postdoc time spent in the group. Besides the high quality research I could contribute to and take part in, two experiences I had from my close relationship to Dave had a strong influence and impact on my own career as a scientist:

The first one resulted from the cosmopolitan spirit of the LRL in general and within Dave's group in particular. I experienced the open-mindedness right from my first day, already in the international office of LRL (I remember Pearl B. Cone, who helped me a lot), and then within Dave's group: senior researchers, postdocs and students, "people of color" and whites. When I joined the group in the late summer of 1970, I had an overlap of only three months with Stevan and Anka Koički. They were from Belgrade, Yugoslavia, the founding and leading nation of the non-aligned countries, while my wife Heidi and myself came from the western "outpost" West Berlin, within East Germany and the Eastern bloc countries.

When the iron curtain opened 20 years later, Stevan, then president of the Serbian Academy of Science, remembered me and initiated a cooperation between our nuclear solid-state physics group at the *Hahn-Meitner-Institut* (HMI) in Berlin and the VINČA institute near Belgrade. Due to the disintegration of former Yugoslavia and the resulting difficulties, it took a while; but finally, Vasil Koteski was able to come and join my research activities as a graduate student, and we started complementing local structure studies using hyperfine interaction techniques with X-ray absorption experiments on dopants in semiconducting compounds at synchrotron facilities. Besides Vasil's successful dissertation, the cooperation between the HMI (now *Helmholtz Zentrum Berlin*, HZB) and VINČA resulted in a number of highly-acknowledged publications of our XAS research experiments. We, especially Vasil, supplemented our XAS results with model calculations based on density-functional theory (WIEN 97 program), which brought us somewhere in the neighborhood of the theoretical research performed by Dave's son Eric Shirley.

The second experience was from the summer of 1971, during the group hike with Dave in Yosemite. Heinz Haas, also a member of Dave's hyperfine interaction group, participated in the group hike, having just returned from a Gordon Research Conference. From him, as well as from Dave, I got the first accounts of this special format of highly-prestigious international conferences on various topics within the classical domains of physics, chemistry and biology.

Heinz' and Dave's reports left a strong mark on me. When I had turned my research interest towards cultural-heritage science, with a sabbatical stay at the C2RMF, Palais du Louvre in Paris, I remembered this special conference format and introduced my new research field into the Gordon Research Conferences. I chaired the first GRC on cultural-heritage science, jointly with Marco Leona from the Metropolitan Museum in New York, in 2012.

I am very grateful to David A. Shirley, who impressed me with his perfect time management, getting everything done punctually in his many duties. We send our sincere condolences to Barbara and his five children, especially Gail, our fellow "Berliner", born in Berlin at a time when we, Heidi and I, were already in Berkeley in the late summer of 1970.

Heinz-Eberhard Mahnke
Berlin, June, 2021

Fig. 17.1: Roger Pollak (Shirley group grad. student, 1967-72) and Heinz-Eberhard Mahnke, during the Symposium in Berlin in honor of David Shirley's 80th birthday, July 2014.

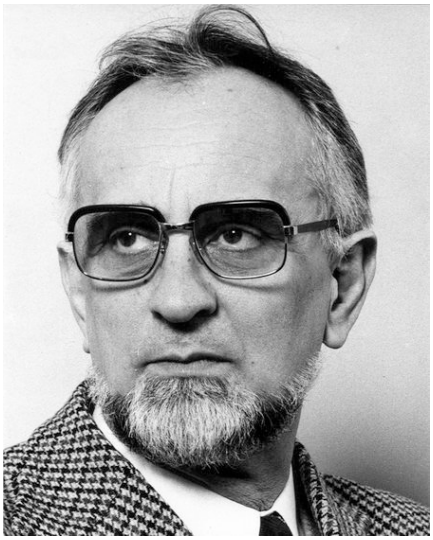


Fig. 17.2: Stevan Koički (1929-2007), taken during his years as president of the Serbian Academy of Science.

18. Herbert Rinneberg, PTB Berlin (retired)
Visitor to the Shirley Group, 1972-74

From 1972 through 1974, I was a postdoc in the group of David Shirley at Lawrence Berkeley Laboratory. Most days around noon, after having completed his official duties at Lawrence Berkeley Laboratory and University of California, Dave used to come to building 70A to join his group, sometimes even for lunch, which he carried with him in a brown bag. Dave entered his office, always leaving the front door open to invite contacts. The front door carried a large sheet of brown paper with the scrawly handwriting of one of his kids, saying, ”I did my work today, man what a good feeling!“. And Dave had many occasions to follow this motto.

I am grateful to Dave Shirley for having been able to work in his group. My wife Monika and I remember Dave as a very friendly and considerate person.

Herbert Rinneberg

Fig. 18.1: Herbert Rinneberg at the evening reception of the Shirley Symposium, *Magnus-Haus* Berlin, July 2014.

19. Lothar Ley, Prof. (retired), University of Erlangen-Nürnberg, DE
Distinguished Visiting Professor, La Trobe University, Melbourne, AUS
Postdoc in Dave Shirley's group from March 1972 to Feb. 1975

In the spring of 1972, five people gathered around a shining new piece of scientific equipment: They were Dave Shirley; three of his graduate students, Roger Pollak, Steve Kowalczyk and Read McFeely; and a newly-arrived postdoc from Germany, Lothar Ley. The place was a small wooden building nestled among eucalyptus trees on the steep slope of Strawberry Canyon, resembling more a hut in the woods than what its official name suggested: the *Field-Free Laboratory* of the Lawrence Berkeley Laboratory. As the name indicated, it was built without any iron so as not to disturb the field of the magnetic spectrometer that Dave Shirley and his student Charles (Chuck) Fadley (along with Stig Hagstrom and Jack Hollander) had adapted some years before to establish ESCA in the US with considerable success. In their hands, ESCA (Electron Spectroscopy for Chemical Analysis), introduced by the Swedish scientist and later Nobel prizewinner Kai Siegbahn, had turned into a powerful method to study the electronic structure of gases and a few simple ionic solids. The new spectrometer, with its revolutionary features (monochromatized X-rays, multichannel electron detection and a double-focusing electrostatic analyzer) was intended to replace the older one. It had been developed by Mike Kelly at the Hewlett Packard plant in Palo Alto, just an hour's drive across the bay from Berkeley, and it was destined to transform photoelectron spectroscopy into the predominant tool for the study of the electronic structure of solids, a position it still holds today. The new role of photoelectron spectroscopy may have been foreseen by Dave, but hardly by his students, who were all chemists by training, and least of all by me, an "ex nuke" as Read liked to call me, one who had done his PhD in nuclear physics.

That apparatus was to be the focus of our scientific work for the next three years – and it became much more than that. It was to become the focus of our lives, the greatest scientific adventure we had ever embarked upon, an incredible success story and the growth of a life-long friendship between the four of us. With this instrument, we transformed ESCA from a primarily chemically-oriented method to one of the key experimental methods of solid-state physics. We virtually 'invented' the field of density-of-electronic-states spectroscopy and published 35 papers in three years on this and related topics. Were they good papers? Of course, we thought so. But what does the record say? I looked up Dave's publication record and it turns out that eight of his ten most cited papers are from our common effort in those years. Half a century after publication they are still cited today, one of them still 10 to 15 times a year.

How did we do it? To be honest, I don't really know. We were young, fearless and eager to get going; so we just jumped in. But we also had tremendous help. On the technical side, there was the infrastructure of the "Lab", with Gene Minor, our genial if sometimes a bit temperamental mechanical designer; the workshop that turned his sophisticated designs into functioning gadgets; and Joe Katz, who made everything electronic for us. Then there were the ladies of the typing pool, who cheerfully turned each new draft of our many manuscripts from a mess with slips of paper sticking out left and right, at a time when cut-and-paste still had its original meaning, into a beautiful new typescript. Above all there was Winifred Heppler, heart and soul of Dave's group, who not only helped us with the often tricky sample preparation, but also intoxicated

us with her homebrewed wine, pampered us with smoked turkey and inundated us with a never-ending supply of zucchini. And all of our requests were promptly met by whomever we asked, because of the respect Dave commanded at LBL.

However, crucial support and scientific guidance also came from Marvin Cohen and his students John Joannopoulos and Jim Chelikowsky, who worked at the Physics Department just down the hill from us. Marvin was at that time one of the leading theoreticians doing electronic structure calculations in solids, i.e. just the stuff we were measuring. From them, we quickly learned the ropes of solid-state physics and in no time we felt at home in reciprocal space, discussing band structures, critical points and singularities like old hands. The wonder of seeing their calculations spring to life in our spectra was as miraculous for them as it was for us.

What was Dave's role in all of this? It is often said that the best mentor is the one that gives his students the freedom to pursue their own ideas. In my experience that is rubbish. Often enough it means that the mentor is not really interested in what his students or postdocs are doing. That was definitely not the case with Dave. It is true that he never told us explicitly what to measure and what questions to tackle. In this sense, he would count as a good mentor according to conventional wisdom; but he was far more. In hindsight, I see him as a true leader who led by impressing us, challenging us and kindling in us a spirit of sportsmanship and competition. Not only did he supply us directly or indirectly with all the help and support I mentioned earlier – but furthermore, we would see him regularly at least once a week, often on Sundays, when he would drive up in his beloved Mercedes and we would have lunch together, sitting at the picnic table in front of our little hut and enjoying the incomparable fragrance of eucalyptus and bougainvillea, wafting across the road from the Botanical Gardens. These were times of light banter, with witty and clever exchanges between Read and Dave that he enjoyed most of all; but it was also an opportunity to show our latest results and for Dave to show us his most recent calculations of binding-, relaxation-, and Auger-energies that more often than not were right on the money. He did these calculations based on an uncanny physical intuition, making clever use of Slater's tables of one- and two-electron integrals and with the help of the latest programmable HP pocket calculator as his private PC, long before the advent of the latter. This was not only very clever, it also impressed us because it showed us that Dave was scientifically on top of the game, despite his triple role as Dean of the College of Chemistry, full professor at the University, and leader of his own substantial group of students and researchers at LBL.

Did he commend us for what we knew to be excellent work? No, because there was the danger that we might become complacent. Instead, he challenged us to forge ahead, and he instilled in us a sense of competition not unlike a kind of sports, where our opponents had names and faces, working on the other side of the continent. And if you look at the picture below, it might be seen that this old spirit of competition is still alive after forty years, expressed in the gestures of four old fogeys swinging menacingly their pizza implements.

All that motivated and inspired us, and the sweet taste of success was like a drug on top of it all. Dave's own competitiveness is reflected in an unforgettable exchange at a Gordon conference. After his presentation someone stood up and made a somewhat

involved comment. Dave's answer: "I don't know what you mean, but I am sure that you are wrong".

What remains after half a century? It is the sweet memory of those wondrous three years that brought professional success on a scale never to be repeated again, tremendous personal growth, and above all the experience of the camaraderie and friendship of four unique human beings that grew out of a common mission and that will stay with us for the rest of our lives.

Thank you, Dave, you made all this possible.

Fig. 19.1: Roger Pollak, Steve Kowalczyk, Read McFeely and Lothar Ley (*from left*) in 2013, celebrating our 40-year reunion at Steve's pizza oven.

20. Roger Pollak, retired from IBM Research
MS and PhD with David Shirley: the Berkeley experience

I started in Dave's group in 1967 with experiments on nuclear magnetic resonance detected by perturbed angular correlations, which had been a topic of focus in the group prior to my arrival. Hans-Dieter Quitmann was my advisor while Dave was away (in Oxford, on sabbatical).

During this period, I received my draft notice and applied for and obtained a Masters degree for the work that I had done, so that I didn't leave Berkeley empty-handed.

When I reported for my military physical, I was deemed unacceptable for service because of a childhood injury and was fortunate to be able to continue my studies. Dave wanted to increase his focus on photoemission and asked me to participate.

At that time, the spectrometer in the Field Free Laboratory across from the UC Berkeley's Botanical Garden was used by Chuck Fadley for photoemission spectroscopy. It had been converted from measuring beta rays and conversion electrons from radioactive sources by adding an X-ray tube for photoemission and a sample in place of the radioactive source. I still remember Chuck arriving on his motorcycle in his flowered shirt and cowboy boots and then climbing the tree outside the gate and hopping over the fence when the gates were locked. It was a wonderful work environment – the chalet in the hills among the eucalyptus trees.

Dave ordered Hewlett-Packard Instruments' first commercial ultra-high vacuum, high resolution X-ray Photoemission Spectrometer, which we used starting in the early 1970's to study the electronic structure of clean and chemically-reacted solid surfaces. Subsequently, Dave's group began doing experiments at the Stanford Synchrotron Radiation facility. In the early 1980's, Dave proposed and won the uphill battle to make LBL's Advanced Light Source (ALS) a reality.

When I finished my PhD in 1972, I started working at the Thomas J. Watson IBM Research Center in Yorktown Heights, NY, and worked there for almost 40 years before retiring in 2010.

I am very grateful for having had the honor of working in Dave's extensive organization on the hill overlooking Berkeley and the Bay. Dave had a great influence on my career.

I extend my sincere condolences to his family. I will miss Dave.

Fig. 20.1: Roger Pollak and David Shirley at the evening meeting at the *Magnus-Haus* Berlin following the symposium for Dave's 80th birthday, July 4th, 2014.

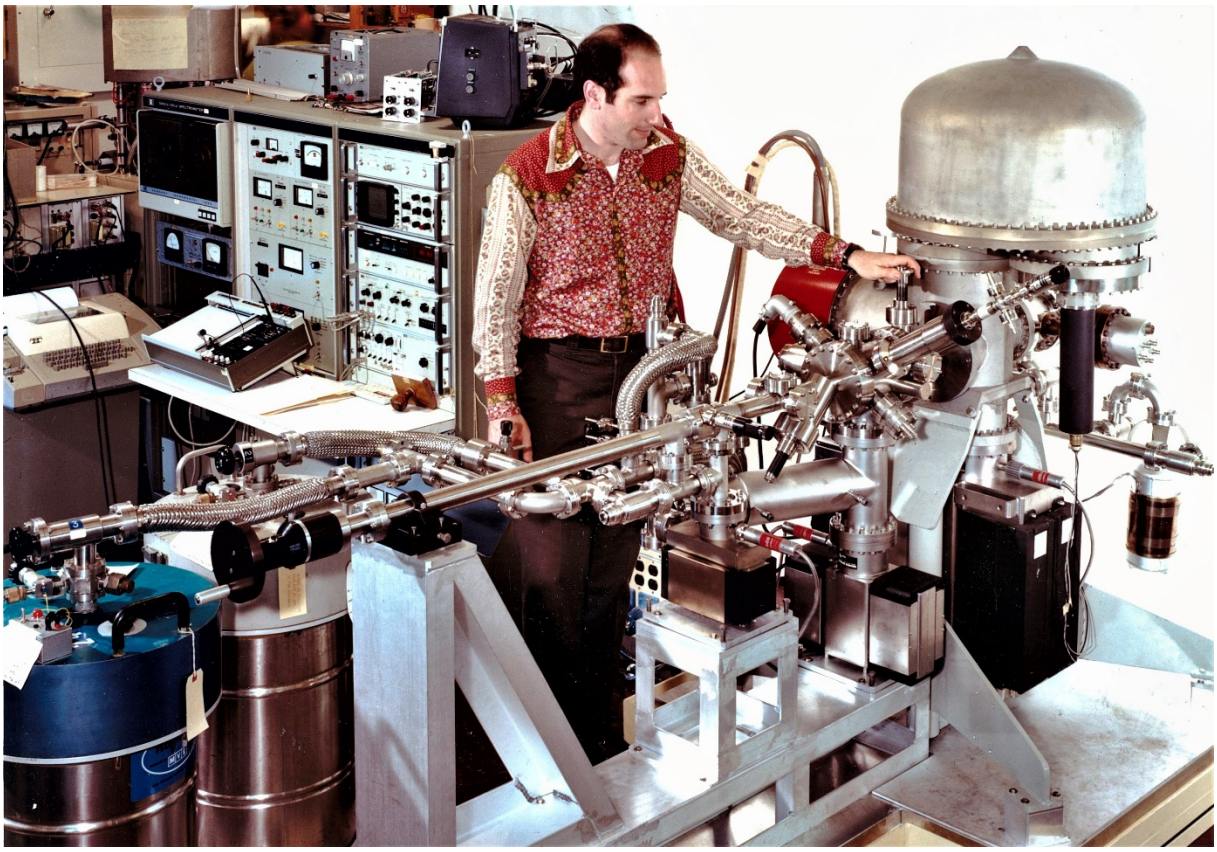


Fig. 20.2: Roger Pollak working with the HP Photoemission Spectrometer in Berkeley, around 1972.

21. Melike and Sefik Suzer, Bilkent University, Ankara
Shirley Group graduate student, 1970–76

I am deeply saddened to have learned that my extraordinary supervisor and friend passed away.

I met Dave at the end of 1970 and spent 5 splendid PhD years in his vigorous scientific circles at UC Berkeley. He was a very tolerant supervisor, so that I had done almost nothing in my first 2 years. However, I made it up quickly by plunging deeply into probing the electronic fine structure of open- and closed-shell atoms and molecules under his wisdom and guidance.

Dave was my academic role model, and I have always felt the presence of his support and mentorship when trying to establish my own research agenda in Turkey. Moreover, Dave and Barbara visited us in Ankara, Turkey in September 2001, as another kind demonstration of his unending support. I consider myself very lucky to have been his student, and also to have been able to attend the symposia for his 65th birthday in Berkeley (1999), and his 80th in Berlin (2014). I will always remember Dave as a great, warm and witty scientist. We extend our deepest condolences to Barbara and the Shirley family.

Ankara, April 28, 2021

Fig. 21.1: Melike and Sefik Suzer, at the *Stäv* restaurant in Berlin, during the 80th birthday Symposium event for David Shirley, July 2014.

Fig. 21.2.: The Suzers visiting the Shirleys at their home in Berkeley (above Wildcat Canyon), June 2001.

Fig. 21.3: The Shirleys at Bilkent, evening reception following a lecture by David Shirley, Sept. 2001.

22. Joachim Stöhr, Prof. *emeritus*, Stanford University
How Dave changed the Direction of my Life and Science

I first met Dave Shirley in June 1974 in Uppsala, Sweden, at the *3rd International Conference on Hyperfine Interactions Studied in Nuclear Reactions and Decay*. At the time, I was a graduate student at the Technical University of Munich, working on my PhD in Mössbauer spectroscopy. Dave gave the plenary talk at the conference about links between various hyperfine spectroscopy techniques and photoemission spectroscopy, at that time called "ESCA". During his talk I realized that I was wasting my time doing Mössbauer spectroscopy, and in order to learn about the electronic structure of matter I needed to directly study the most important thing – the electrons themselves. Upon my return to Munich I finished my thesis and wrote Dave a letter asking to join his group as a postdoc. Fortunately, Günter Kaindl (who had been a student in Mössbauer's group before me) put in a good word for me, and so I went to Berkeley in early 1975.

Upon my arrival, I was struck by the quality of the Berkeley graduate students in Dave's group who kept me on my toes, especially since I was a novice in photoemission. Another surprise was Dave's venture into the use of synchrotron radiation for photoemission at the Stanford Synchrotron Radiation Project (SSRP) at SLAC/Stanford. It did not take me long to realize the remarkable potential of synchrotron radiation for science. During my Berkeley years, I therefore became a real synchrotron jock and this defined the future direction of my life and science. I have Dave to thank for it.

Of course, Dave himself realized the importance of synchrotron radiation research and began planning for a facility at Berkeley Lab around 1980. The ALS was an ambitious project championed by Dave as LBNL director. I remember it being jokingly referred to as "BALS" by some (hard X-ray) critics, but to me and most of the X-ray community it demonstrated real scientific leadership. I participated in the uphill battle to get the ALS built by emphasizing the importance of soft X-rays in a talk I gave to the Seitz-Eastman committee in 1984. The committee was asked by the US Department of Energy (DOE) to evaluate the relative merits of soft (ALS) versus hard (APS) X-ray facilities and a neutron facility (SNS). In the end, it was Dave's emphasis on "brightness" (introduced by Kwang-Je Kim at LBNL) rather than "flux" that secured funding for the ALS and APS over the SNS. The concept of brightness was by no means generally appreciated initially and when a skeptic asked, "Who needs brightness?", Dave grinned and answered, "Well, it's a good thing to have – some of us have it and others don't". It was vintage Dave!

I last saw Dave in July 2014 in Berlin, a city both of us loved, where his many friends had organized a symposium in honor of his 80th birthday. In retrospect, it closed a forty-year circle from the time I first met him. The symposium was a fitting event that emphasized his influence on the scientific careers of many ex-students, postdocs and collaborators and of his extraordinary accomplishments as a scientific leader.

Joachim Stöhr,
Prof. Emeritus, Stanford University

Fig. 22.1: My last meeting with Dave and his wife Barbara, at the Symposium in Berlin honoring his 80th birthday.

23. Geoff Thornton, Professor of Physical Chemistry, UCL London
Postdoc in the Shirley Group, 1977-1979

I was fortunate enough to spend two great post-doc years in the Shirley Group between 1977 and 1979. What an adventure it was! I had just finished my PhD at Oxford University, got married in June 1977 and arrived September of that year in Berkeley.

The Shirley Group in Building 70A at that time was some 20 strong. I started working on gas phase experiments with Mike White, Erwin Poliakoff, Richard Rosenberg and Steve Southworth. These were mainly conducted at the Stanford Synchrotron Radiation Facility as it was then called, with comfy accommodation in an on-site trailer. I see Mike and Richard occasionally at conferences. Dave was head of MMRD at that time, so he was very busy. Nevertheless, he was always fully engaged with the science and a constant source of inspiration. He also made a point of coming down to SLAC on a Sunday with one of the family to see how we were getting on. I always felt that that Dave provided us with great opportunities to do excellent science. It was a very productive time, with a lot of super publications—enough to subsequently get me a job at Manchester University.

On the social side, I well remember Dave's big group parties at his house in the Berkeley Hills where we would look at the stars through his telescopes. His youngest son Eric (who was very small at the time) would circulate with bowls of peanuts.

Dave's enthusiastic and engaged group management style was a strong influence for me as a young post-doc in the 1970's and one which I try to continue with my own group now at University College London.

Fig. 23.1: Group photo, 1978. *Front row*: D.A. Shirley, Rich Davis, Danny Rosenblatt. *Behind, standing*: Geoff Thornton, n.n. (in door), Steve Kevan. *Seated*: Richard Rosenberg, Mike White, Dave Denley, Steve Southworth, n.n., Dennis Trevor, Jim Pollard, Erwin Poliakoff.

24. Zahid Hussain, retired from LBNL/ALS
Former Division Deputy for Scientific Support
David A. Shirley: Visualizing the Dawn of Soft X-ray Science

I have been greatly fortunate to be able to work as a postdoc with David Shirley (1979-81), and to carry out my PhD work (1974-79) under the supervision of one of Dave's earlier students, Charles A Fadley. When I joined Dave's group, it was flourishing with innovative instrumentation that was driving science both at LBNL and also at SLAC/SSRL, making use of synchrotron radiation (SR). This was of great interest to me, as I carried out a major part of my PhD thesis research with SR. I thought of doing something different, and asked Dave if he would allow me to work on a beamline (later named '*Jumbo*') at SSRL which was intended to provide soft X-rays (100–1000 eV) and tender X-rays (1 keV–5 keV). The Jumbo beamline project was put on hold because it initially produced no X-rays, for unknown technical reasons. Despite those issues, Dave was highly generous and not only encouraged me to continue working on the Jumbo beamline, but also requested the SSRL administration to support my work on this project, as he had the vision and appreciation of the value of such developments.

After fixing mechanical and alignment issues of the beamline, I succeeded in seeing the first monochromatized radiation from a pair of Beryl Bragg crystals with large d-lattice spacing, as well as from InSb and Ge monochromatizing crystals. With the help of many scientists, we completed the commissioning of the Jumbo beamline, which delivered a broad range of X-ray energies from 800 eV–4,300 eV. This development led to some novel experiments, including the first X-ray absorption spectrum from the important S K-edge (DOE had a great interest in understanding the nature of sulfur in coal, one of the serious contaminants jeopardizing its usage at that time), and the first ARPES experiments using tunable soft X-rays; and it allowed us to acquire scanned-energy photoelectron diffraction data from the core levels of many adsorbates for surface structure determinations. Taking the photoelectron diffraction data over a broad scanned energy range, which became possible with Jumbo, enabled us to use the technique of Fourier transformation for data analysis, which was envisioned by Dave for extracting structural information by analyzing photoelectron diffraction data analogously to EXAFS analyses.

I recall an interesting conversation with Dave in 1980, after visiting the NSLS, then under construction on Long Island. Dave told me, "*The day when NSLS is completed, it will be an outdated facility*". I was surprised by his statement, and Dave explained to me that the new synchrotron radiation facilities needed to be built primarily for using insertion devices such as undulators to achieve the highest brilliance (currently known as brightness); that was the birth of the third generation of synchrotron radiation facilities. Dave spearheaded the effort along those lines, leading to DOE's funding the construction of the Advanced Light Source at LBNL, optimized for soft X-rays, and the Advanced Photon Source at Argonne for hard X-rays.

While the construction of ALS was completed on time and on budget, it went through some difficult times in starting up soft X-ray science as proposed. A BES/DOE advisory committee panel chaired by Bob Birgeneau stated in their 1997 report, "*To date, the ALS user community is relatively small…Since the time of the Seitz-Eastman report (1993), important science issues which require UV (VUV/Soft X-rays) have decreased in number compared to those which require hard X-rays…".* Dave's vision and the fundamental basis for the creation of the ALS for soft X-ray science were being called into question. The Director of LBNL, Charles Shank, who took over after Dave stepped down as its Director, saw the danger of BES shutting down the ALS, and decided to take serious corrective actions.

These included making the ALS into an independent Division at LBNL, and appointing Daniel Chemla as its new Division Director, just to mention two. Additional steps for improving the

scientific culture at the ALS included the creation of the Scientific Support Group. I was assigned to lead that effort. The following years saw continuous growth of science-driven novel instrumentation, postdoctoral and student fellowship programs, and close cooperation between the ALS staff and users; all of these contributed to shaping the facility and making the ALS into the leading SR source for soft X-ray science. A testimony to this fact is that in an extensive Web of Science citation analysis for the period 2007—2016, we found that the ALS produced more high-impact publications using soft X-rays and IR than five leading synchrotron radiation facilities in Europe combined. Through the visionary leadership spearheaded by David A. Shirley, the dawn of soft X-ray science at the ALS was initiated, reaching a level of unprecedented maturity that continues to be fully recognized to this day.

Zahid Hussain

Fig. 24.1: David Shirley and Zahid Hussain at the *Jumbo* beamline, SSRL, in 1980.

Fig. 24.2: Zahid Hussain presenting his talk at the Symposium for David Shirley's 80th birthday, Berlin, July 2014.

25. Steven D. Kevan, Prof., Univ. of Oregon; Director, ALS/Berkeley
David Shirley: A Tale of Vision and Persistence

I had the opportunity to do my PhD in Dave's lab in the early days of ARPES (1976-80). It was a fun and challenging time, trying to figure out what the technique was telling us about the electronic and geometrical structure of surfaces and solids. The group was quite large, with a healthy flux of students, postdocs, and visitors. I was a little awed at how Dave kept track of everything, particularly at a time when his management activities were in full stride. I'm even more awed now, having been ALS Director for several years while trying to keep track of just one modest collaborative research project.

I want to salute Dave's leadership of the Berkeley Lab and the soft X-ray community, which was fearless and more than a little prescient. I understood this superficially in real time long ago, but when I became the ALS Science Deputy in 2012 – and occupied Neville Smith's old office – I found a paper document on a bookshelf called "How the ALS was Built". This provides a history of the heroic effort Dave led to get the ALS funded in the late 1970s and 1980s. Dave fought, and eventually won, battles on many fronts to make this happen.

One of the more interesting things I have discovered while serving on the ALS management team is how much of a centerpiece the ALS has become at LBNL - not just the physical structure, but more importantly, the intellectual fabric in Berkeley and by extension to a large user community around the world. Dave's initial estimate of approximately 300 users has now been exceeded 7-fold, and users who visit regularly communicate that it's simply a very fun place to do science. All of this was germinated in Dave's mind nearly 40 years ago. For that we should all be very thankful.

Throughout his career, Dave taught us to be fearless in pursuing interesting problems and provided the resources and environment to make progress certain – if not easy! I have tried to keep that mind set for the past 45 years, and my modest successes can be traced directly to his tutelage. Nearly 20 years ago this fearlessness helped me decide to ramp down my activities in ARPES and ramp up work on applications of coherent soft X-rays. And now I'm leading the facility that Dave built, that is being upgraded to provide a large increase in coherent X-ray power!

Another piece of Dave's sage advice (spoken in jest) was "Be nice to us on your way up, and we'll be nice to you on our way down". Dave continued to be supportive of me long after I graduated from his research group. I am glad I had the foresight to send him a few messages since joining the ALS, thanking him for that support and for his efforts to get the ALS started – and promising to do my best to keep it going.

Steve Kevan, Director
Advanced Light Source

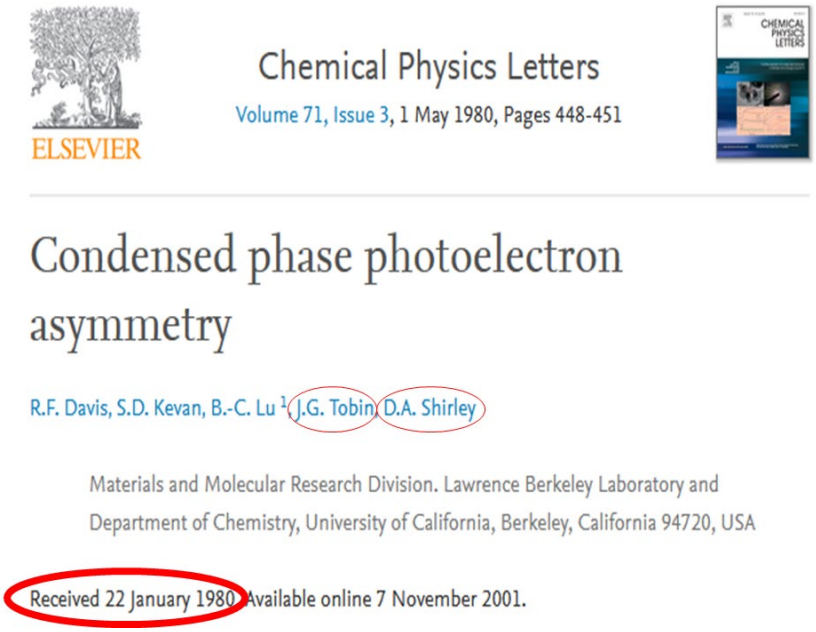
Fig. 25.1: The groundbreaking ceremony for the ALS in 1988. *From left*: David A. Shirley, Martha Krebs (DoE Planning and Development, LBL), another DoE representative, and Steven D. Kevan. In the background, the old 184" cyclotron building, which became ALS, can be seen.

Fig. 25.2: The presentation of the first David A. Shirley Award at the ALS Users' Meeting in 1998. *From left*: Steve Kevan (recipient), David Shirley, Werner Meyer-Ilse (presenter), and Eli Rotenberg (recipient).

26. Jim Tobin, Lawrence Livermore Natl Lab (retired), U. Wis.-Oshkosh
Shirley Group Graduate Student 1978 - 1983

I am deeply saddened to hear of Dave's passing. I would like to extend my most sincere condolences to his family.

The Shirley Group was a scientifically vibrant community. Almost as soon as I joined the group, I was pulled into research and publishing. I was thrilled when "my" first paper was published! As a naive second year student, my name was right there, next to Dave's! (Whoops: it looks like I am showing my age. Weren't the 1980s in the previous millennium?)



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Condensed phase photoelectron asymmetry

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However, what I also remember was how kind Dave always was to me. He oftentimes had dinners at his house in the Berkeley Hills, to which he would invite his whole group, all 30-some of us. He was patient with our personal foibles. One time, when I came back from a less than completely successful run at SSRL, he calmly put up with my grouchiness as we were unloading the equipment from the truck. When he was promoted to LBL Director, he never lost track of his students. I remember, on a regular basis, being ushered past a phalanx of admins and scientists into the Director's Office, to talk with him about my thesis. (This was very important: Dave was uniformly technically excellent – his input always raised the quality of the work). Dave may have been involved in bruising battles in the halls of academia and power corridors of Washington DC, but he always handled his students carefully and gently.

May he rest in peace. Jim Tobin

Fig. 26.1: Jim Tobin, 2014.

27. Maria Novella Piancastelli, Professor at Sorbonne University, Paris
David Shirley: Scientific clarity and honesty

I had the great opportunity and privilege of being a visiting scientist in Dave Shirley's group in the 80's, when Dave was LBL Director. It was the beginning of experiments on angle-resolved photoemission (ARPES) and relaxation dynamics of isolated species with synchrotron radiation. We were running experiments at SSRL, since it was long before the ALS was built, and basically everything we were doing was pioneering work. Dave was very busy as LBL Director, but he made a point of closely supervising our scientific activity.

He was very attentive not only as scientific mentor, but also from a more personal point of view: I remember a beautiful Christmas party at his house for the poor collaborators who, like me, were far away from their families during the festivities.

I wish to share one particular memory of my stay in Berkeley: there was a scientific controversy between us and some other groups concerning a specific kind of continuum resonances, the so-called shape resonances. At some point, I decided that the time had come to straighten out the subject, so I went to discuss with Dave with a preliminary idea about a research paper to show that we were of course the good guys. Dave listened carefully, and then smiled and said: "Sharpen your pencil!". It was the go-ahead for the paper writing (see figures). Of course those were the good old times, and we were still thinking in terms of paper and pencils… After almost forty years, this is still one of my main claims to fame, and I am truly indebted to Dave for it.

May he rest in peace.

The relationship between shape resonances and bond lengths

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The neverending story of shape resonances

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Fig. 27.1: Maria Novella Piancastelli chairing a session of the Symposium for David Shirley's 80th birthday, July 4th, 2014 in Berlin.

Fig. 27.2: Maria Novella Piancastelli, lecturing.

28. Louis Terminello, Pacific Northwest National Lab
Shirley Group Graduate Student 1984 - 1988

After finishing his PhD in Berkeley, Louis Terminello went as a postdoc to the IBM Th. J. Watson Research Center, and from there he accepted a position at the Lawrence Livermore National Laboratory (LLNL), where he remained for nearly 20 years. Since 2009, he has been at the Pacific Northwest National Laboratory (PNNL). He sent us the following message:

I was saddened to hear of Dave Shirley's passing and want to offer my condolences to Barbara and his family at this time of loss. Fondly I remember Dave's guidance and encouragement in graduate school. His high standards for how science should be done have stayed with me throughout my career and are central to what I try to instill in others. Dave Shirley's legacy of scientific excellence will live on in others.

Sincerely and with sympathy,

Louis Terminello
Associate Laboratory Director,
Physical and Computational Sciences
Pacific Northwest National Laboratory

He also sent the following photos, as reminiscences of his time in the Shirley Group:

Fig. 28.1: Members of the Shirley group and some guests in front of a restaurant in Berkeley, where they went for a group outing, 1984. *Front, from left*: Margaret Schulz, Barbara Moriguchi, Maria Novella Piancastelli, Trish Ferrett, and Wini Heppler. Wini was the group's chemical technician for many years and is mentioned gratefully in several other contributions. *Back row, standing*: Alan Johnson, Phil Heimann, Steve Robey, Louis Terminello, Alexis Schach von Wittenau, Dennis Lindle, Lai-Sheng Wang, Charlie Bahr, and Ernesto Paparazzo.

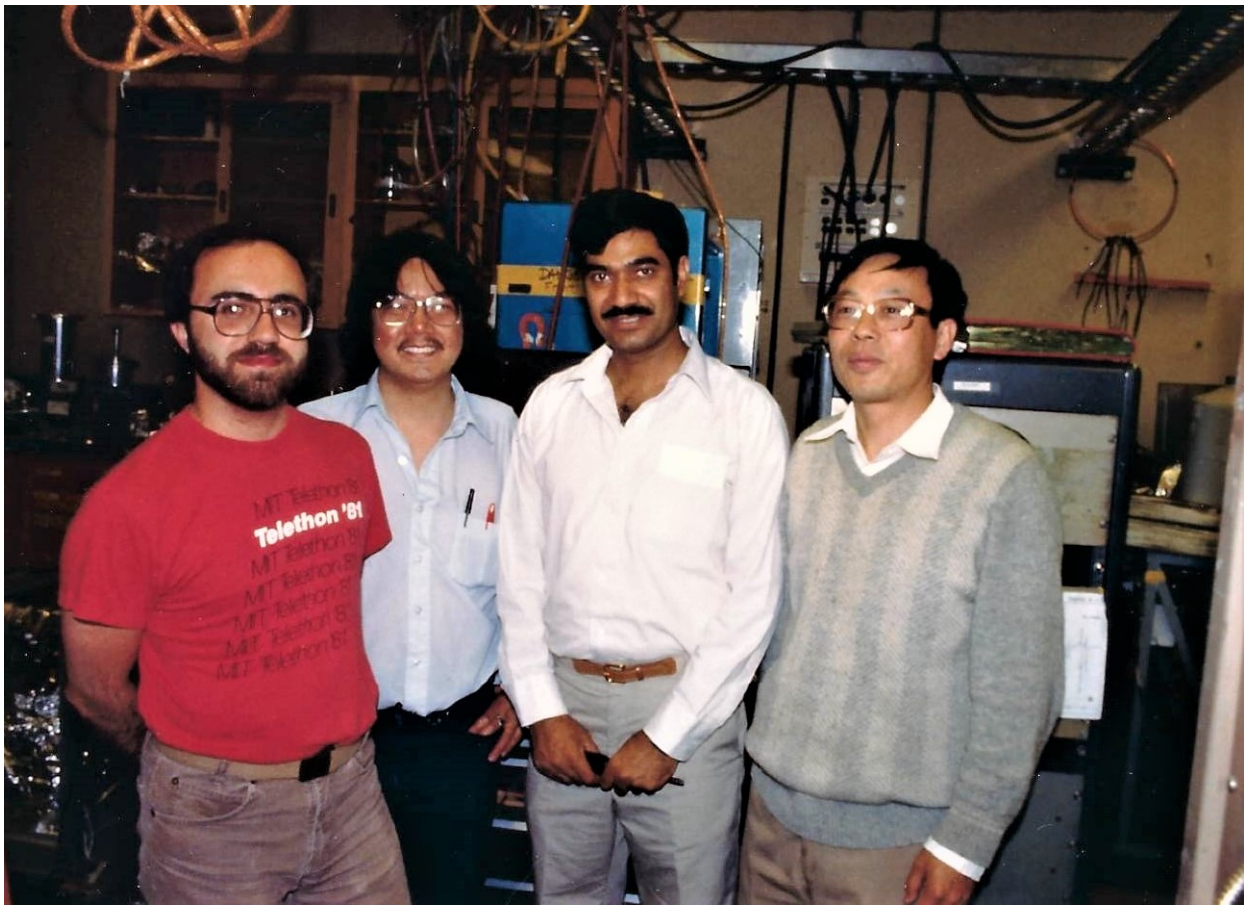


Fig. 28.2: Four members of the group at SSRL, 1985: Louis Terminello, K. Tong Leung, Zahid Hussain, and X.S. Xhang.

29. Clemens Laubschat, Prof. *emeritus*, Technical University Dresden

Memories of Dave Shirley

The scientist David A. Shirley was familiar to me from the very beginning, when in the early 1980's I joined the Kaindl group at the *Fachbereich Physik*, Freie Universität Berlin (FUB) as a Masters student, and then throughout my research for a doctoral degree in physics. How often had Günter presented Dave and his research group at the Lawrence Berkeley Lab (now LBNL) to me as a shining example! The voluminous PhD thesis of Dave´s graduate student Stephen P. Kowalczyk always lay in our lab as an inexhaustible source of photoemission data from the entire periodic table.

I first met Dave Shirley personally as a postdoc in July 1989 at the ICES-4 and the subsequent VUV-9 Conference at Manoa, Hawaii, and then had closer contacts to him during his one-year sabbatical in 1989/90, which he spent in our research group with an *Alexander-von-Humboldt* Research Award. During his sabbatical, Dave temporarily shared an office with me. At first, I was slightly embarrassed by this, since at that time I spoke only relatively poor English, having struggled mostly with Latin and ancient Greek in high school and speaking Spanish at home with my wife. As a result, I often switched from English to Spanish, and a graduate student from the UC Berkeley, Eric Hudson, who did his experimental work in our group, jokingly asked me if I had learned my English on the U.S.-Mexican border. Dave, however, brushed away my initial embarrassment with a generous gesture. "Clemens," he said, "We're trying to communicate, not to have a language exercise, and communication works out fine. In the U.S., many people never even learn a single foreign language, and if people didn't make efforts to speak English all over the world, we wouldn't be able to communicate at all!" This collegial attitude immediately relaxed the situation and we got along extremely well thereafter.

Due to the unexpected opening of the Berlin wall on the evening of Nov. 9, 1989, Dave's 13-month sabbatical in Berlin was embedded in that most exciting year that led to the collapse of the GDR and finally to the unification of Germany. I at first hadn't even noticed the historic moment on November 9, since I was working on experiments at BESSY Berlin all night, until the early-morning hours. So I was quite astonished when Dave told me the next day with beaming eyes that he had already been at the Berlin Wall with Günter, chopping off shards of the wall with hammer and chisel, as souvenirs!

On June 22, 1990, David and Virginia Shirley, with daughter Gail, along with Günter, his wife Ursula, and several active and previous group members, travelled together to Leningrad to participate in a workshop on Inverse Photoemission that had been organized jointly by Prof. Oleg Artamonov and Günter. Several other scientists active in this field had come for this workshop from abroad. We received a great welcome from our Leningrad colleagues. For us foreign guests, they had made reservations in a hotel early on, but when we arrived there with our host, we could not occupy the reserved rooms. The receptionist claimed that we had to wait because Italian tourists had not yet vacated their rooms. This went on for more than an hour, with all of us waiting in front of the hotel in the hot June sun, until Günter took two packs of coffee out of his suitcase and put them on the desk of the receptionist, an act that completely solved the problem!

The workshop was scientifically timely and interesting, and our hosts made our stay in this beautiful city, founded in 1703 by Peter the Great, most enjoyable. We participated in several sightseeing tours throughout the city and its environment, to palaces, museums, and beautiful sites. These were also most interesting times for the Soviet Union, when big changes were in the air. Food was rather scarce at that time, many of the streets were in poor condition, and only a few restaurants were open – but often without food!

From Leningrad (now – once again – called St. Petersburg) we took a convenient night train to Moscow to participate in a conference on synchrotron-radiation research, where we had submitted abstracts for oral presentations. We took part in the opening reception, with a sumptuous welcome dinner and many participants; but when we arrived the next morning at *Lomonossov* University, where the conference took place, we found that the door to the lecture hall where our session was scheduled was closed and locked! We organized a key, but then waited for some time for the chairman of the session, who did not show up. With one of us acting as chairman, we presented our lectures to ourselves – without the presence of any other scientists!

On the next day, we visited the *Kurchatov* Institute, with its then quite new synchrotron-radiation source. After passport controls at the gate, we were allowed to enter the storage ring area. In the security area, Dave initially bounced back and told Günter and me to leave the room immediately, because we were standing in front of flashing control lights from some injection device. Our Russian colleagues, however, calmed us down by telling us that the flashing lights had only been turned on for demonstration purposes.

Fig. 29.1: An excursion to *Pavlovsk* with its Tsar's Palace, June 1990: (*from left*) Wolfgang Grentz, Clemens Laubschat, Gail, David, and Virginia Shirley, 2 postdocs from the Leningrad State University, and Ursula and Günter Kaindl. The statue in the background is a monument to Tsar Peter I.

After Dave's sabbatical in Berlin, 1989/90, and Günter Kaindl's honorary doctorate in St. Petersburg in 1997, I – regrettably – did not meet up with Dave again. Much later, there was a festive Symposium celebrating his 80th birthday, which was organized in Berlin in July 2014 by Günter Kaindl, Bill Brewer and Birgit Dabisch, with support from the Department of Physics at the FUB, the *Magnus-Haus* of the German Physical Society, and the Heraeus Foundation – which I unfortunately could not attend.

But Dave has always remained a role model for me, from my early days as a graduate student onward.

30. Serguei Molodtsov, Scientific Director at the European XFEL, Hamburg
Recollections of an Inquisitive Scientist

David Shirley was a truly outstanding scientist. But here, I will not write about that. He had a great personality and was an excellent tutor and a model to be followed for many junior scientists worldwide. In the years 1989/90, I was a young postdoc in the research group of Günter Kaindl at the *Freie Universität Berlin*, financed in the beginning by the *Alexander-von-Humboldt* Foundation. It was quite exciting for me to learn one day that David Shirley would soon join our group for a full sabbatical year as an *Alexander-von-Humboldt* Awardee from the University of California at Berkeley, where he had been Director of the famous Lawrence Berkeley Lab from 1980–89. I knew his name well from his many excellent publications, already when I was a student at Leningrad State University, and I could almost not believe that soon I would get the chance to have discussions with him and even to do research together. But it happened, and the two of us participated in joint experiments at the SX700-II beamline of the FU Berlin, operated by the Kaindl group!

During those experiments, it was always a great pleasure for me to discuss with Dave not only science, but many other topics, including jokes and showing tricks. “Let’s bet that I’ll show you now that I can drink liquid nitrogen” – said Dave. I could not believe it and was almost shocked when I first saw how he put some liquid nitrogen from a Dewar vessel into his palm and from there quickly into his mouth, instantly breathing out clouds of gas.

Another episode happened after experiments when I came to his office to discuss our data. I was surprised when I saw him with a pair of binoculars, looking outside through the window. He said to me, “Please be quiet; the data can wait, but if we don’t observe this bird on the tree behind the window now, it will fly away and we will never see it again”. I do not remember the data we were discussing, but the picture of Dave with the binoculars observing the small bird will stay with me forever.

Outstanding people are unique and irreplaceable. We miss you very much, Dave!

Fig. 30.1: Photo taken in St. Petersburg of participants at the ‘International Workshop on Fullerenes and Atomic Clusters’ in June, 1997. *From left*: Serguei Molodtsov, Kai Starke, Clemens Laubschat, Eugen Weschke, Gerhard Wortmann, Michael Domke, Günter Kaindl, Ursula Kaindl, David and Barbara Shirley.

31. Oleg Artamonov, *emeritus* Professor, St. Petersburg University
Memories from Berlin and St. Petersburg

I remember David A. Shirley very well, and my wife Kira and myself are very sorry that he left us. His benevolence and deep knowledge of the issues discussed aroused my sincere respect.

The Joint Seminar on Inverse Photoemission, which I organized together with Günter Kaindl from the *Freie Universität Berlin* in June 1990, in (then still) *Leningrad*, had many participants who were prominent scientists from Germany, the USA and the Soviet Union. Dave and Virginia Shirley were among them. The meeting was scientifically successful, and – from an international point of view – would also fit well into the current situation. A few years earlier, it would have been rather difficult to get permission for organizing such an event; and a few years later, in the nineties, to get the necessary funding.

Kira still gratefully recalls how Mrs. Shirley visited their department of Nuclear Spectroscopy in *Peterhof*, and later sent them the huge book '*Nuclear Data Sheets*' that had previously been available only in the Library of the Academy of Science – about 40 km away. And what was even more gracious, she continued to send new sheets as soon as they appeared. We both remember happy times in Berlin, an excursion with Ursula to Potsdam, the hospitality of our host, and an unforgettable New Year's party at the *Freie Universität Berlin*.

Both Kira and I send our best wishes from our country home, where we live now, and express our deep condolences to the whole Shirley family.

Oleg Artamonov

Fig. 31.1: A visit to the country home of the Artamonov family on the shore of the Baltic Sea in June 1990. *Front, from left*: Sergey Samarin, Ursula Kaindl, Gail, Dave and Virginia Shirley, Oleg Artamonov, his wife Kira, and Kaindl graduate student Wolfgang Grentz. *Behind*: The Artamonov family: son Peter and daughters Ekaterina and Tatiana.

32. Armin Meisel, Prof. *emeritus* and Honorary Senator, Leipzig University
David's timely visit to Saxony – a Land of Culture

Soon after Nov. 9, 1989, the historic opening of the Berlin Wall, I was contacted by Günter Kaindl from the Physics Department of the *Freie Universität Berlin*, who informed me that David A. Shirley from UC Berkeley, former Director of LBL, was staying in his research group for a full year as *Alexander-von-Humboldt* Awardee, and would like to visit me in Leipzig. Günter invited me for a visit to Berlin on February 13, 1990, where I gave a short presentation at his weekly group seminar, and I met David, whom I knew from his many trendsetting publications in the field of hyperfine interactions and also from a few encounters at international conferences. We agreed that Dave, his wife Virginia, and Günter should come to Leipzig, and we arranged this visit for the week of February 26 to March 3.

Fig. 32.1: David and Virginia Shirley, with Armin Meisel; in the background, the *Altes Rathaus Leipzig* (dating from 1556 AD, Renaissance style).

Fig. 32.2: In front of the Bach monument.

For everyone involved, the visit was a great experience in many respects, only 3 months after the dramatic global political change that originated in Poland and was strongly accelerated by citizens of the GDR, with the Thomas Church in Leipzig being the decisive center of the movement. With the few existing hotels completely booked out during this time, I could only solve the problem of accommodating our 3 guests by accepting the offer of two secretaries from our chemistry department to host them in their apartments, in GDR-typical 11-story prefabricated buildings, called *Plattenbauten*.

Since Virginia Shirley turned out to be a great fan of Johann Sebastian Bach, playing a *Cembalo* (harpsichord) at her home in Berkeley, we first visited the famous Thomas Church and the Bach Museum in Leipzig. Johann Sebastian Bach (1685–1750) was the most important musician in Leipzig, serving as *Thomas-Kantor* for 27 years and composing more than 200 cantatas while there. Later, several other famous composers were also connected with Leipzig: Felix Mendelssohn-Bartholdy (1809–1847), who acted as permanent director of the *Gewandhaus Leipzig* and founded there in 1843 the *Conservatorium*, the first music academy in Germany, which today bears his name; then Richard Wagner (born 1813 in Leipzig, deceased 1883 in Venice); and Robert Schumann (1810–1856), who first studied law at the University of Leipzig, married in 1840 and lived there until his move to Dresden in 1844. I managed to organize tickets for a concert evening with the Gewandhaus Orchestra in the new *Gewandhaus* Leipzig concert hall, which opened in 1981.

We then visited Dresden, popularly called *Elb-Florenz* ('Florence on the Elbe'), with its University, where I studied my first 3 semesters. The Vice-Dean of the Institute of Physics there, still in office, gave us a tour, clearly showing us that he had not yet realized the irreversibility of the recent political changes. The bombed-out Residence palace in Dresden was still not rebuilt, nor was the *Frauenkirche* (Church of Our Lady), where one could see only a huge pile of stones from the collapsed church, a view that was intentionally conserved to foster complete reconstruction, which was accomplished only in October 2005, almost 61 years after the bombing night.

Fig. 32.3: Virginia, Dave, and Armin Meisel in front of the ruins of the *Frauenkirche* in Dresden.

Fig. 32.4: With Virginia and David on Brühl's Terrace, Dresden.

The view from Brühl's Terrace along the city silhouette with the river Elbe was beautiful. We also visited the famous Baroque ensemble of the *Dresden Zwinger*, with its gallery of Old Masters, the mathematical-physical salon, and the porcelain collection.

Fig. 32.5: With Günter and Virginia, on our visit to the *Dresden Zwinger*.

While in Dresden, we were again successful in obtaining tickets for a great musical event, an opera performance in the *Semper Oper*, one of the leading opera houses in Germany. It had also been destroyed during the war, but its reconstruction, true to the original, had already been completed in 1985.

On another day, we visited the city of Meissen, the oldest city in Saxony and my hometown, with its castle, the *Albrechtsburg* (late Gothic, dating from 1470 AD), where in 1708 the very first European porcelain was made by the alchemist Johann Friedrich Böttcher. We also paid a visit to the modern *State Porcelain Manufactory Meissen*, where the well-known Meissen porcelain is fabricated.

David also delivered a lecture at my Institute at Leipzig University (founded in 1409, the second oldest university in Germany). In his well-received lecture, David covered the state-of-the-art in electronic-structure studies with photons as well as future perspectives, when third-generation electron-storage rings for synchrotron radiation, like the ALS at LBL/UC Berkeley, would start operation. With great foresight, Dave was the first to propose such a 3rd-generation X-ray source (the ALS), and he carried it through all the institutions in the US. The ALS was finally opened for users in 1994, and even today, 27 years later, it is still one of the leading synchrotron radiation sources in the world.

Fig. 32.6: Armin Meisel with Barbara Shirley, Dave's 2nd wife after Virginia had passed away in 1995; Joachim Stöhr, and Dave, taken on July 4th, 2014, at the Symposium for his 80th birthday.

It was 24 years later when I had the pleasure of participating in the International Symposium in honor of David's 80th birthday, initiated by Günter Kaindl. It was organized together with William Brewer and Birgit Dabisch as a 1-day Symposium at the *Fachbereich Physik*, FU Berlin, with an evening talk by David at the *Magnus-Haus* Berlin of the German Physical Society, followed by a reception and banquet in the *Remise* and the garden, with beautiful summer weather.

David A. Shirley was a fine man, a great scientist, an understanding thesis adviser, a highly successful administrator of large innovative projects, and a very honest colleague. Even though my interactions with David were few, due to the cold war, they were very impressive, having a strong influence on my own approach to science and higher education.

I express my deep condolences to his wife Barbara and his whole family, knowing that he will be greatly missed.

33. Tobias Reich, Prof. and Dean, Johannes Gutenberg University Mainz
Visiting Scientist in the Shirley Group, 1991-94

I was sad to learn a few days ago that David Shirley had passed away on March 29, 2021. I would like to express my deep condolence to Barbara Shirley and the entire Shirley family. On this sad occasion, many memories come to mind from the time I spent with Dave, his wife Virginia, and his research group. I would like to share a few of these memories.

As described in the contribution by Armin Meisel (Chap. 32), David and Virginia visited Leipzig University at the end of February 1990. As a young assistant in Meisel's group, I was excited about the possibility of hearing a lecture by the famous scientist David Shirley. Furthermore, everyone working in the field of X-ray photoelectron spectroscopy knows of the 'Shirley background'. After an exciting lecture by Dave Shirley about the future of synchrotron radiation applications, Armin Meisel invited me to join the group which afterwards went for dinner with David and Virginia in the *Ratskeller*. It was a very pleasant evening, and it was nice to exchange a few words. I remember that Dave mentioned impressive numbers on how much time he had spent on airplanes and how many miles he had travelled back and forth to Washington D.C. during his time as LBL Director. Since the opening of the Berlin Wall and the end of the Cold War had established unexpected possibilities for scientists from the former Eastern European countries, I asked Dave whether it would be possible to visit his research group in Berkeley for some period of time. Dave – without hesitation – replied that I would be welcome, but I would need to provide my own financial support. At this point I had no idea how to come up with the money, but I was excited about the possibility to work in Dave's group.

A year later, in February 1991, the dream came true when I arrived at SFO with a Feodor-Lynen Fellowship from the *Alexander-von-Humboldt* Foundation, with Dave as host. Since he was a Humboldt Awardee, he could invite Lynen Fellows. For my application to the Humboldt Foundation, I had visited Dave in Günter Kaindl's group in Berlin to discuss my research proposal, which was centered on gas-phase studies using ZEKE (zero electron kinetic energy) spectroscopy. Also, Virginia was working in Günter's group. She promised me that she would put in a good word for me when Dave wrote his evaluation letter to the Humboldt Foundation. Leaving Europe in the Winter, my first transatlantic flight was full of deep impressions: during the 1st Gulf War, the Paris airport was deserted; the skyline of San Francisco at night made me feel as if I were in a Hollywood movie; the graduate student who picked me up at SFO took me straight to Triple Rock for a beer, where I had to show my East German passport at the entrance. When I saw the blue sky and green lawns in front of the Faculty Club, where I had spent the night, and students in shorts going to lectures, I was still not sure if this were real. Later that day I met Dave and he told me that one of his graduate students was working on a new ZEKE spectrometer to be used soon at BESSY-I, and that I could join this effort.

In Spring 1991, Dave's group consisted of several graduate students who had worked with him already for some time and were finishing their thesis work. Some of them had done experiments together with Dave at BESSY while he was on sabbatical leave in the group of Günter Kaindl. But there was also a new generation of about eight graduate students who had joined Dave's group after his return from Berlin. At the same time, Zahid Hussain and one other visiting scientist were in Dave's group. At the weekly group seminars, with a beautiful view of the Bay from the 3rd floor of Bldg. 2, I got to know the graduate students and their research projects. There were many new things to learn and to understand. I was impressed by the lively discussion after each talk.

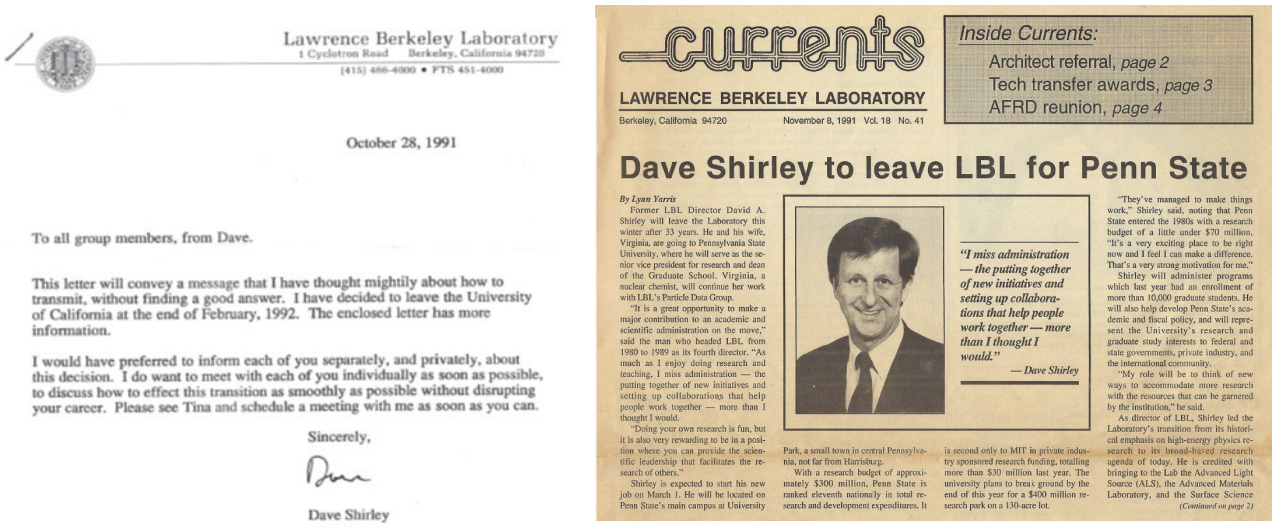
Dave and Virginia gave me and two other foreign newcomers a warm welcome and invited us for a visit to Muir Woods and the San Andreas Fault (see photos, Fig. 33.1). It was amazing to see the redwood trees and the remains of Earth's movement during the "big one" in 1906!

Fig. 33.1: *Left*: Dave Shirley, Tobias Reich, Yufeng Chen, and Bahtiyar Atabaev; *Right*: Virginia, Yufeng, Tobias, and Bahtiyar; Muir Woods in Spring 1991.

After returning from the experiments with the new ZEKE spectrometer at BESSY, which were unfortunately not successful, I started to work on a gas cell for absorption spectroscopy, together with Zahid Hussain, Ed Moler, and Matt Blackwell. With this setup, we performed systematic studies on how to convert a toroidal grating monochromator at SSRL with moderate resolution into a high-resolution monochromator. The monochromator resolution was derived from measurements of extremely narrow core-excitation resonances in He and Ne in the energy range of 25–65 eV. Dave, Michael Domke, Günter Kaindl and others had done the pioneering experiments at BESSY in 1990, which were the basis for the photoionization experiments at SSRL. Günter Kaindl joined these measurements at SSRL while on a sabbatical leave in Dave's group.

At the end of October 1991, Dave's entire group was taken by surprise by his letter (see Fig. 33.2). Dave wrote that he would leave Berkeley at the end of February 1992 to begin service as Senior Vice President for Research and Dean of the Graduate School at Pennsylvania State University. This unexpected news also made headlines in the *LBL Currents* a week later (see Fig. 33.2). In his meetings with each member of the group, he told us that his principal concern during the next few months would be that we not lose career momentum because of his move. This was very thoughtful of him. Although a few graduate students who had just started decided to join other groups on campus, most of them continued working in Dave's group on ARPES, electron diffraction and electron holography. I started to prepare the ZEKE apparatus for the first measurements at SSRL in single-bunch mode since the earthquake in October, 1989. I am very grateful to Phil Heimann, Bear Petersen, Eric Hudson and Zahid Hussain for their support of those experiments, their advice, and their friendship.

Dave and Virginia stayed in close contact with the group in Berkeley. When they were present there, Dave always had a busy schedule, which Virginia had written for him on a little piece of paper. But there was not only time for individual talks between Dave and each group member, but also for shared meals (see Fig. 33.3).



Lawrence Berkeley Laboratory
1 Cyclotron Road Berkeley, California 94720
[415] 486-4000 • FTS 451-4000

October 28, 1991

To all group members, from Dave.

This letter will convey a message that I have thought mightily about how to transmit, without finding a good answer. I have decided to leave the University of California at the end of February, 1992. The enclosed letter has more information.

I would have preferred to inform each of you separately, and privately, about this decision. I do want to meet with each of you individually as soon as possible, to discuss how to effect this transition as smoothly as possible without disrupting your career. Please see Tina and schedule a meeting with me as soon as you can.

Sincerely,

Dave Shirley

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LAWRENCE BERKELEY LABORATORY
Berkeley, California 94720 November 8, 1991 Vol. 18 No. 41

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Dave Shirley to leave LBL for Penn State

By Lynn Yarris

Former LBL Director David A. Shirley will leave the Laboratory this winter after 33 years. He and his wife, Virginia, are going to Peinsylvania State University, where he will serve as the senior vice president for research and dean of the Graduate School. Virginia, a nuclear chemist, will continue her work with LBL's Particle Data Group.

"It is a great opportunity to make a major contribution to an academic and scientific administration on the move," said the man who headed LBL from 1980 to 1989 as its fourth director. "As much as I enjoy doing research and teaching, I miss administration — the putting together of new initiatives and setting up collaborations that help people work together — more than I thought I would.

"Doing your own research is fun, but it is also very rewarding to be in a position where you can provide the scientific leadership that facilitates the research of others."

Shirley is expected to start his new job on March 1. He will be located on Penn State's main campus at University Park, a small town in central Pennsylvania, not far from Harrisburg.

With a research budget of approximately $300 million, Penn State is ranked eleventh nationally in total research and development expenditures. It is second only to MIT in private industry sponsored research funding, totalling more than $30 million last year. The university plans to break ground by the end of this year for a $400 million research park on a 130-acre lot.

"I miss administration — the putting together of new initiatives and setting up collaborations that help people work together — more than I thought I would."
— Dave Shirley

"They've managed to make things work," Shirley said, noting that Penn State entered the 1980s with a research budget of a little under $70 million. "It's a very exciting place to be right now and I feel I can make a difference. That's a very strong motivation for me."

Shirley will administer programs which last year had an enrollment of more than 10,000 graduate students. He will also help develop Penn State's academic and fiscal policy, and will represent the University's research and graduate study interests to federal and state governments, private industry, and the international community.

"My role will be to think of new ways to accommodate more research with the resources that can be garnered by the institution," he said.

As director of LBL, Shirley led the Laboratory's transition from its historical emphasis on high-energy physics research to its broad-based research agenda of today. He is credited with bringing to the Lab the Advanced Light Source (ALS), the Advanced Materials Laboratory, and the Surface Science

(Continued on page 2)

Fig. 33.2: Dave's decision – October 1991 – to leave Berkeley and move to Penn State in early 1992. Note his statement on the right that, "As much as I enjoy doing research and teaching, I miss administration – the putting together of new initiatives and setting up collaborations that help people work together – more than I thought I would".

Fig. 33.3: *Left*: Barry (Bear) Petersen and Virginia Shirley; *Right*: Zahid Hussain, David Shirley, and Charles (Chuck) Fadley. At a restaurant in Berkeley, 1993.

Fig. 33.4: Dave's group in Berkeley in 1993; *from left to right*: Yufeng Chen, Tony Huff, Bear Petersen, Virginia and David Shirley, Zahid Hussain, Ed Moler, Scot Kellar, and Tobias Reich.

Since Dave did not start a new research group at Penn State, none of us had to leave Berkeley and move to Pennsylvania. I became affiliated with Penn State after Dave's departure from Berkeley, and so I was very excited when I could visit Dave and Virginia for a few days at their new home in December, 1992. Since Dave was very busy, I could use his office and work on a manuscript. Virginia and I met for lunch on campus, and I remember that she told me about her work as editor of the famous *Table of Isotopes*. During that visit, I took my favorite photo of Dave and Virginia (see Fig. 33.5). I will always treasure the memory of Virginia and Dave Shirley.

Fig. 33.5: Virginia and David Shirley at State College, PA, Christmas 1992. The picture was taken by Tobias Reich during his visit to Penn State in December 1992.

34. Alex Bradshaw, *emeritus* Professor, Max-Planck-Gesellschaft
Significant Contributions to an Important Topic

Scientific research requiring X-radiation changed fundamentally in the 1960s due to the exploitation of "synchrotron radiation" (SR) produced hitherto as an unwanted waste product in electron synchrotrons and storage rings (first- and second-generation SR sources). By the 1970s, the possibility of generating unheard of amounts of soft and hard X-radiation by putting magnetic field “insertion devices” into the straight sections of a storage ring had gained a foothold at several accelerator facilities worldwide. In addition, because of the extremely compact pulses of electron beams, the radiation source had an intrinsically high photon density and collimation (or brilliance). Several projects worldwide were initiated to develop the next generation of synchrotron radiation light sources, leading to the many dedicated, third generation light sources at present available. One of the major pioneers in this development was David Shirley, whose foresight, scientific leadership, and enthusiasm have made a lasting impression on the field. To this day, he and his colleagues at the Advanced Light Source (ALS) in Berkeley, which went into operation in October 1993, were pioneers in the further development of SR sources of the third and subsequent generations.

Because the photon energy range of these sources depends fundamentally on the energy of the electrons, the SR centres of the world have specialized in producing either soft (up to several keV) or hard X-radiation, the two being vastly different in physical size of the storage ring. It was already clear to David Shirley in the 1970's when he made the original proposal for the ALS that the characteristics of the radiation from its insertion devices would open up new fields of research in chemistry and physics. Several areas of immediate interest to him personally, and in which he carried out much high-level research, are based on the excitation of the 1s core levels of carbon, nitrogen and oxygen.

The synchrotron radiation community has lost one of its outstanding members.

Alex Bradshaw

Fig. 34.1: Heinz Haas (speaker) and Alex Bradshaw (chairman) at a session of the Symposium for David Shirley’s 80th birthday, July 4th, 2014 in Berlin.

Memories of a Felicitous Life – David A. Shirley, 1934-2021

Appendix A: Shirley Alumni and Visitors (chronological list)

(For legend see below)

	Name (Years)	First names	Title	Address, eMail	Remarks
1	Rasmussen Col (59--)	John O.	Prof.	jorasmussen@lbl.gov	Msg. 10.06.
2	Johnson Col (59--)	Charles Edward	Prof.	(Harwell, ANL, Univ. of Tennessee)	
3	Kaplan Col (60-62)	Morton	Prof.	--- Yale, Carnegie-Mellon Univ., 1970-2008	† 19.09.2013
4	Schooley Col (59--)	James F.	Dr.	(NBS/NIST 1960-1990)	† 18.04.2020
5	Lovejoy (1959-61)	C. A.		(no citations after 1963)	
6	Navarro (1959-62)	Quirino Oli	Prof.	--- (Philippines Atomic Energy Agency)	† ca. 2005
7	Haag (1960-62)	J.			
8	Barrett Col (62--)	Paul H.	Prof.	(PhD'51, UCB; *emeritus* Prof. at UCSB)	† 30.07.2019
9	Grant (1960-63)	Ronald W.		(Rockwell Sci.Cent. - 1996)	
10	Westenbarger (59-63)	Gene A.	Prof.	(Ohio Univ., Athens) westenbg@ohio.edu	Msg. - DAS
11	Matthias PD+ (63-69)	Eckart	Prof.	barbeck.matthias@t-online.de	Msg. - DAS
12	Levy (1960-64)	Richard M. (Dick)	Dr.	(Varian Medical Systems)	
13	Stone PD (1963-65)	Nick J.	Prof.	(Oxford) n.stone1@physics.ox.ac.uk	
14	Hagström PD (64-66)	Stig B. M.	Prof.	--- (Xerox-PARC, Stanford)	† 28.05.2011
15	Nowik Col (64-65)	Israel	Prof.	nowik@vms.huji.ae.il	Msg. - DAS
16	Blok (1961-65)	Johan	Dr.	(VU Amsterdam)	
17	Frankel (1961-65)	Richard B. (Dick)	Prof.	rfrankel@calpoly.edu	Msg. - DAS
18	Wickman (1961-65)	(Herbert) Hollis	Prof.	Oregon State University, NSF	
19	Edelstein Col (64--)	Norman	Dr.	(LBL) NMEdelstein@lbl.gov	
20	Holliday (1964-66)	(R.) James (Jim)	Prof.	--- (JohnBrown Univ Siloam Springs AR)	† 8.08.2012
21	Faltens (1962-67)	Marjorie O.	Dr.	(Alamo, CA) (c/o Afaltens@lbl.gov)	
22	Quitmann Col(67-69)	(Hans) Dieter	Prof.	quitmann@physik.fu-berlin.de	† 14.03.2018
23	Jacklevic Col(1967-)	Joseph M. (Joe)	Dr.		
24	Templeton PD (67-72)	James E. (Jay)	Dr.	(Annapolis, MD; Alexandria, VA)	
25	Rao Col (1967-70)	Gottipaty N.	Prof.	rao@adelphi.edu	Msg. - DAS
26	Huntzicker (63-68)	James J. (Jim)	Prof.	huntzicj@ohsu.edu	Msg. - DAS
27	Rosenblum (64-69)	Steven S. (Steve)	Dr.	steve@rosenblums.us	
28	Gabriel Col (68-69)	Helmut	Prof.	gabrielh@physik.fu-berlin.de	
29	Klein PD (1968-69)	Erwin	Prof.	erwinaklein@zedat.fu-berlin.de	
30	Bagus Col (1969--)	Paul	Prof.	(IBM, University of North Texas)	
31	Barclay (1964-69)	John A.	Dr.	jabarclay@comcast.net (auch LinkedIn)	
32	Easley (1963-69)	Warren C.	Dr.	warren.easley@frontier.com (1.05.14)	
33	Haas PD (1968-70)	Heinz	Dr.	heinz.haas@cern.ch	
34	Kaindl PD+ (69-73)	Günter	Prof.	kaindl@physik.fu-berlin.de	
35	Koicki Col (69-70)	Stevan	Prof.	--- (Boris Kidric Institute, Belgrade)	† 11.09.2007
36	Phillips PD (1969-70)	--	Dr.		
37	Brewer (1965-70)	William D. (Bill)	Prof.	william.brewer@fu-berlin.de	
38	Fadley (1964-70)	Charles S. (Chuck)	Prof.	chuck.fadley@gmail.com	† 1.08.2019

39	Thomas Col (1970--)	T. Darrah	Prof.	T.Darrah.Thomas@oregonstate.edu	
40	Mahnke PD (70-72)	Eberhard	Prof.	mahnke@helmholtz-berlin.de	
41	Salomon (1966-71)	Dan B.	Dr.	dr.dan.salomon@gmail.com	
42	Soinski (1965-71)	Arthur James (Art)	Dr.		
43	Rinneberg PD (71-73)	Herbert (Herb)	Dr.	herbert.rinneberg@t-online.de	
44	Ley PD (1972-73)	Lothar	Prof.	lothar.ley@physik.uni-erlangen.de	
45	Pollak (1967-72)	Roger A.	Dr.	rap4@me.com	
46	Hung (1968-72)	Sammy T.-C.	Dr.	sammyhungmd@yahoo.com	
47	Bacon (1967-72)	Frederick (Fred)	Prof.	fred.bacon@metrostate.edu	
48	Streeter (1968-72)	Rick	Dr.	(LinkedIn) Canada?	
49	Krane PD (1972-74)	Kenneth S. (Ken)	Prof.	kranek@ucs.orst.edu	Msg. - DAS
50	Koster (1968-73)	Tom	Dr.	(VP, UC Berkeley, retired 2005)	
51	Chan (1969-73)	Dorothy	Dr.	(married name?)	
52	Davis (1969-73)	D. W. (Rich)	Dr.	(no pubs after 1974)	
53	Apai (1969-74)	Gustav R. (Gus)	Dr.	(110 Bay Knoll Rd., Rochester NY 14622)	
54	Suzer (1970-76)	Sefik	Prof.	suzer@fen.bilkent.edu.tr	
55	Stöhr PD (1975-77)	Joachim (Jo)	Prof.	stohr@slac.stanford.edu	
56	Banna (1971-75)	M. Salim		--- (Vanderbilt U., Oregon State U.)	† ca. 1990
57	Kowalczyk (1971-75)	Steven P.	Dr.	s.kowalczyk@att.net	
58	Martin (1972-76)	Richard	Dr.	rlmartin@lanl.gov	
59	Lee (1973-77)	Shuit-Tong			
60	Winograd (1973-77)	Nicholas	Prof.	nxw@psu.edu	
61	McFeely (1973-77)	(Fenton) Read	Dr.	read_mcfeely@yahoo.com	
62	Schwartz (1974-77-)	G. P.			
63	Denley (1974-78)	D. R. (Dave)			
64	Mills (1974-78)	Bernice E.			
65	Williams (1975-78)	(Richard) Stan	Dr.	(HP Labs)	Msg. - DAS
66	Rosenberg (1975-79)	Richard	Dr.	rar@aps.anl.gov	
67	Thornton PD (77-79)	Geoffrey (Geoff)	Prof.	g.thornton@ucl.ac.uk	Msg. - DAS
68	Wehner (1975-79)	P. S.			
69	White (1975-79)	Michael G. (Mike)	Prof.	mgwhite@bnl.gov	
70	Hussain PD (1979--)	Zahid	Dr.	zhussain@lbl.gov	
71	Kevan (1976-80)	Stephen D. (Steve)	Prof.	kevan@uoregon.edu	Msg. - DAS
72	Lu (1976-80)	Benjamin C.-Y.	Prof.	(Univ. of Ottawa ?)	
73	Mason PD (76-80)	M. Gary	Dr.	--- (Eastman Research, Rochester NY)	†
74	Poliakoff (1977-80)	Erwin	Prof.		
75	Tobin (1978-82)	James G. (Jim)	Dr.	(tobin1@llnl.gov) tobinj@uwosh.edu	
76	Becker PD (1981-82)	Uwe	Prof.	--- (TU Berlin, Fritz-Haber-Institut)	† 15.11.2013
77	Kerkhoff (1981-82)	Hans-Georg	Dr.	IT-SiBe@ptb.de hans.kerkhoff@ptb.de	
78	Lee Col (1981--)	Yuan T.	Prof.	(Academia Sinica, Teipei)	
79	Southworth (1977-81)	Steven H. (Steve)	Dr.	southworth@anl.gov	Msg. - DAS
80	Umbach Col (1981)	Eberhard	Prof.	eberhard.umbach@kit.edu	

81	Kobrin (1978-82)	Paul H.	Dr.	pkobrin@vcccd.edu (LinkedIn)	
82	Lindle (1978-82)	Dennis	Prof.	--- (lindle@unlv.nevada.edu)	† 04.10.2014
83	Pollard (1978-82)	James E. (Jim)	Dr.	(james.e.pollard@aero.org)(Aerospace Corp.)	
84	Rosenblatt (1978-82)	Daniel H. (Danny)	Dr.	(Samsung Microw. Semicon)	
85	Trevor (1978-82)	Dennis J.	Dr.		
86	Truesdale (1978-82)	Carlton M. (Trues)	Dr.	https://plus.google.com/ (LinkedIn)	
87	Barton (1980-83)	John J.	Dr.	johnjbarton@johnjbarton.com (IBM)	
88	Piancastelli PD (83--)	Maria-Novella	Prof.	maria-novella.piancastelli@fysik.uu.se	
89	Bahr (1980-84)	Charles C. (Charlie)	Dr.	(Alcatel-Lucent) charlesbahr@gmail.com	Msg. - DAS
90	Heimann (1980-84)	Philip A. (Phil)	Dr.	paheim@slac.stanford.edu	
91	Klebanoff (1981-85)	Leonard E. (Lenny)	Dr.	lekleba@sandia.gov (1.05.14)	Msg. - DAS
92	Schach von Wittenau (1982-85)	Alexis E.	Dr.	(LLNL) schachvonwittenau1@llnl.gov	
93	Ferrett (1982-86)	Trish A.	Prof.	TFerrett@Carleton.edu	
94	Reutt-Robey (83-86)	Janice	Prof.	rrobey@umd.edu	
95	Leung (1984-88)	K.-T.		(Virginia Polytech)	
96	Parks (1983-88)	C. C.			
97	Robey (1984-88)	Steven W.			
98	Terminello (1984-88)	Louis J.	Prof.	(PNNL) ljterminello@gmail.com	Msg. - DAS
99	Medhurst (1985-89)	L. J.			
100	Niu (1985-89)	Baohua		(BNL; Intel, Hillsboro, OR)	
101	Zhang (1986-90)	Xi Sheng			
102	Wang (1986-90)	Lai-Sheng	Prof.	Lai-Sheng_Wang@Brown.edu	Msg. - DAS
103	Wang (1986-91)	Li-Quong	Dr.	Li_Qiong_Wang@brown.edu	Msg. - DAS
104	Liu (1988-92)	Sen-Hai			
105	Huang (1989-93)	Zhengquing			
106	Pradeep (1989-93)	T.		(IIT Madras)	
107	Remmers (1989-93)	G.			
108	Zheng (1990-93)	Yuangang		(Purdue, Ohio State, Microsoft)	
109	Bai (1990-94)	Yawen		(Queen's Univ. Belfast)	
110	Ji (1990-94)	Zhong-Gang		(Chinese Academy)	
111	Hudson (1990-96)	Eric	Prof.	eric.hudson@lamresearch.com	
112	Petersen (1991-94)	Barry L. (Bear)			
113	Reich PD (1991-94)	Tobias	Prof.	tobias.reich@uni-mainz.de	
114	Wu (1991-96)	Hausheng		(UCLA)	
115	Huff (1991-96)	W.R.A. (Tony)			
116	Moler (1991-96)	Edward J. (Ed)		(La Plata)	
117	Chen (1991-96)	Yufeng			
118	Tao (1992-98)	Fu-Ming		(Cal State Fullerton)	
119	Kellar (1995-99)	Scot A.		sakellar@lbl.gov (1.05.14)	

Abbreviations: Col. = Collaborator, colleague; PD = Postdoc; (others were graduate students);
Msg. = eMail message sent to Dave Shirley (via organizers, 2014) | no working e-mail
Version: October 2014, rev. June 2021

Memories of a Felicitous Life – David A. Shirley, 1934-2021

Appendix B: *In Memoriam*

As can be seen in Appendix A, a number of David Shirley's colleagues, associates and former students preceded him in death. They are marked by a black bar (with date) in the last column of the list in Appendix A. We honor them here, again listed in chronological order.

James F. (Jim) *Schooley*: Colleague, 1959-60. Later NBS/NIST (1960-1990).
Died April 18th, 2020.

Quirino Oli Navarro, Grad. student, 1959-62. Later at Philippine Atomic Energy Agency.
Died 2005.

Morton Kaplan: Colleague, 1960-62. Later Yale, Carnegie-Mellon Univ. (1970-2008).
Died Sept. 19th, 2013.

Paul H. Barrett, Visiting Scientist, 1962-63. UC Santa Barbara (1951-1990).
Died July 30th, 2019.

Stig B.M. Hagstrom, Postdoc 1964-66. Later Linköping, Xerox-PARC, Stanford, Swedish Academy. Died May 28th, 2011. See Chapter 1.

Fig. B.1: Stig B.M. Hagstrom, taken shortly before his death in 2011.

R. James (Jim) *Holliday*, Grad. student 1964-66. Later Univ. Minnesota, John Brown Univ. Died August 8th, 2012.

Dieter Quitmann, Visiting Scientist 1967-69. Later *Freie Universität Berlin* (1969-98). Died March 14th, 2018.

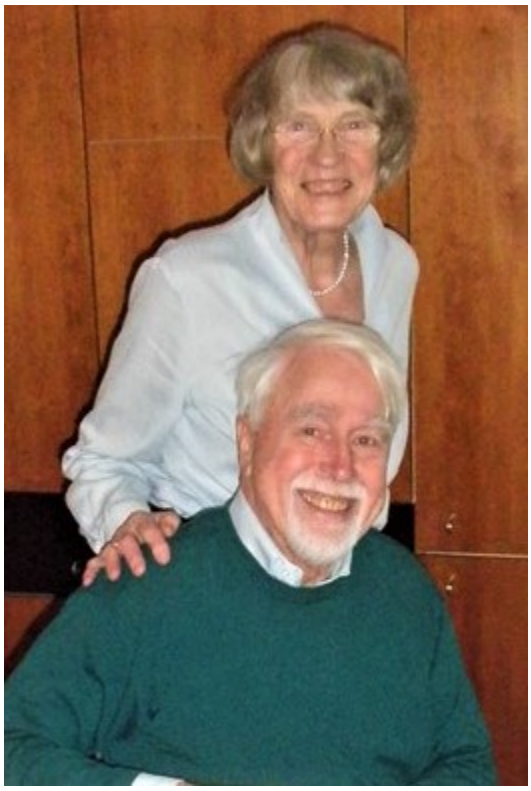

Fig. B.2: Dorothea and Dieter Quitmann, at the 45th anniversary celebration of their arrival in Berlin, October 2014. See Chapter 1.

Stevan Koicki, Visiting Scientist 1969-70. Boris Kidric Institute, Serbian Acad. Sciences. Died Sept. 11th, 2007. See Chapter 17.

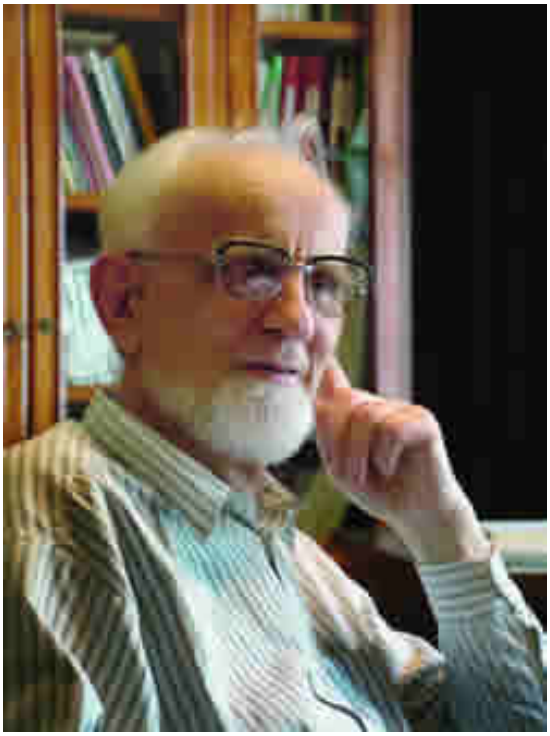

Fig. B.3: Stevan Koicki, in his later years, taken around 2005.

Charles S. (Chuck) *Fadley*, Grad. student 1964-70. Later Univ. Hawaii, UC Davis/ALS. Died August 1st, 2019.

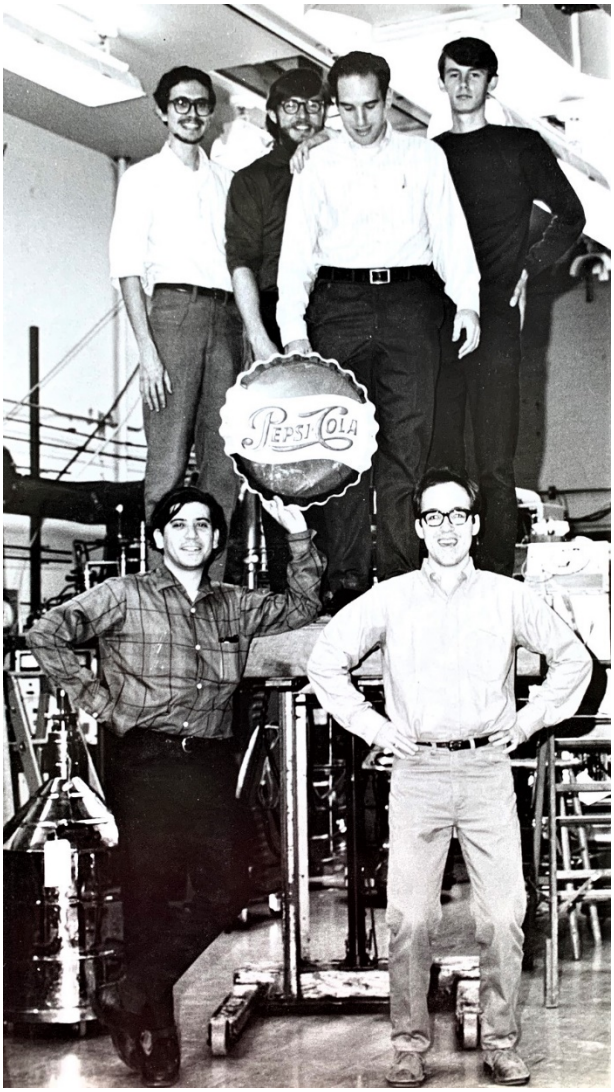

Fig. B.4: Students in the Shirley Group, Fall 1969. *Above, from left*: William Brewer, Charles Fadley, Roger Pollak, Rick Streeter. *Below*: Dan Salomon, Gustav Apai.

Fig. B.5: Charles S. Fadley, at the evening gathering of the Shirley symposium, July 2014.

M. Salim Banna, Grad. Student, 1971-75. Later Vanderbilt Univ, Oregon State Univ. Died 1990.

M. Gary Mason, Visiting Scientist 1976-80. Eastman Research, Rochester. Date of death unknown.

Dennis Lindle, Grad. student 1978-82. Later University of Nevada, Las Vegas.
Died Oct. 4th, 2014.

Uwe Becker, Postdoc 1981-82. Later *Fritz-Haber-Institut*/MPG and Techn. Univ. Berlin.
Died November 15th, 2013.

Fig. B.6: The 'gas-phase group', Shirley group members at SSRL, 1980. *From left*: Carlton Truesdale, Dennis Lindle, Uwe Becker, Steve Southworth, Paul Kobrin.

Memories of a Felicitous Life – David A. Shirley, 1934-2021

Appendix C: Additional Photos – A Life in Pictures

Fig. C.1: Asilomar, 1971: *1st International Conference on Electron Spectroscopy* (ICES). Another conference series, begun in Asilomar – and the birth of the HP Photoelectron Spectrometer. *From left*: Fred Grimm, Oak Ridge National Laboratory; David Shirley, Berkeley; Don Hammond, HP Labs; and Kai Siegbahn, Uppsala.

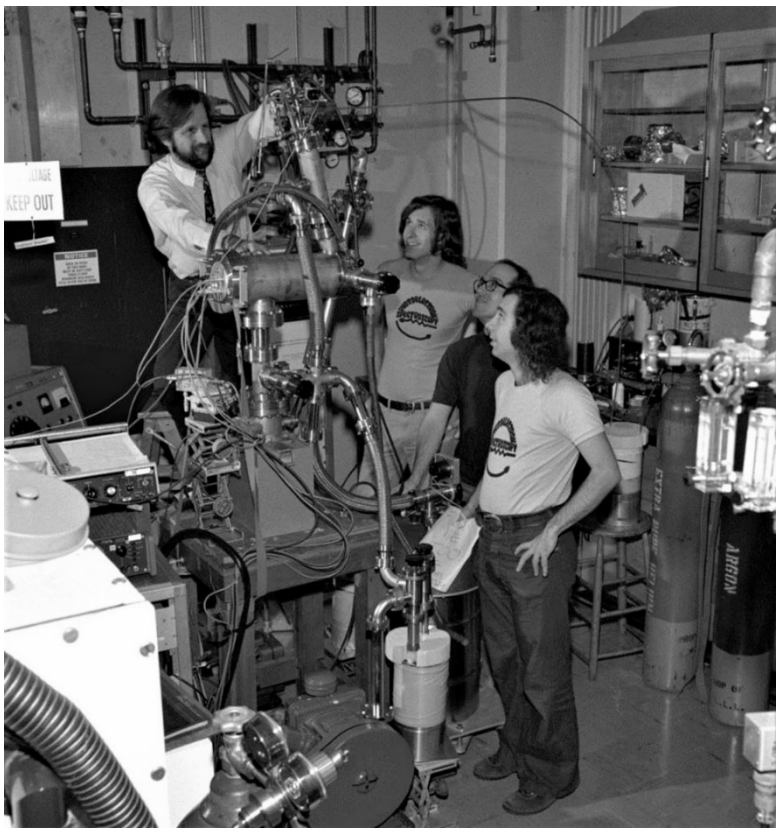

Fig. C.2: David Shirley manning the HP-Photoelectron Spectrometer in March 1975.

Watching, *from left*: Read McFeely, Gus Apai, and Steve Kowalczyk.

Fig. C.3: *From left*, Björn Matthias, Eckart Matthias, David Shirley, Jr., David Shirley, and Charles E. Johnson. Dave and Eckart with their oldest sons, planning an excursion to Yosemite; taken in Berkeley, 1975.

Fig. C.4: David and Virginia Shirley on a riverboat, passing through the Danube Gorge near the *Weltenburg* Monastery, after the Spring Meeting of the German Physical Society in Regensburg, March 1990. Dave delivered an invited lecture at the meeting.

Fig. C.5: A photo of the Kaindl research group in Spring 1990, in front of the physics building, FU Berlin. *In the center*, David Shirley, Günter Kaindl, and Israel Nowik.

Fig. C.6: A group on the terrace of Günter Kaindl's house in Berlin-Schlachtensee, Fall 1989, when Dave and Israel were guest researchers in Günter's research group. *From left*: David Shirley, Israel Nowik, Rivka Nowik, Ursula Kaindl, Virginia Shirley.

Fig. C.7: A group on the *Neva* river in St. Petersburg, June 1997. See Chaps. 16, 29, 30. *From left*: Serguei Molodtsov, Clemens Laubschat, Kai Starke, and Birgit Dabisch.

Fig. C.8: Barbara and David Shirley with Günter and Ursula Kaindl, in front of the *Church of the Resurrection* in St. Petersburg, June 1997. See Chap. 16.

This church was erected on the site of the assassination of Tsar Alexander II by an anarchist's bomb on March 15th, 1881. It is thus called 'the Church on the Blood' in Russian.

Fig. C.9: *From left*: Michael Domke and his wife, Barbara and David Shirley, Clemens Laubschat and Eugen Weschke, in front of Katherine's Palace at *Tsarskoje Selo* (*Puschkina*), near St. Petersburg. July 3rd, 1997. See Chap. 16.

Fig. C.10: Relaxing at our favorite Ristorante-Bar '*del Gigio*' after a successful ski run from *Marmolada*, March 13th, 1999. *From left*: Barbara and David Shirley, Hermann Wurster, Karin Wurster, and Ursula Kaindl. See Chap. 16.

Fig. C.11: Meeting the Rector, *Bilkent* University, Ankara, Turkey, 2001.
Center: David Shirley and Sefik Suzer.

Fig. C.12: David Shirley lecturing at the *Bilkent* University, Ankara, Turkey, Sept. 11th, 2001.

Fig. C.13: Lothar Ley, Barbara and David Shirley at the *Stäv* Restaurant, Berlin, July 3rd, 2014.

Fig. C.14: Another view of Lothar Ley, discussing with great enthusiasm, and Barbara and David Shirley at the *Stäv* Restaurant, Berlin, July 3rd, 2014, before the 80th Birthday Symposium for Dave.

Fig. C.15: Dave and Barbara 'making the picture', *Lenbachhaus* Museum, Munich, July 11th, 2014. The painting at upper left, called '*Ehepaar*' (married couple), is by the Austrian artist Maria Lassnig.

Fig. C.16: Dave and Barbara looking upside down at an upside-down painting by Georg Baselitz (b. 1938); in a special exhibition at the Franz Marc Museum, *Kochel am See*, Bavarian Alps, July 12, 2014.

Fig. C.17: Dave and Barbara during the Evening Reception at the *Magnus-Haus* Berlin following the Birthday Symposium for Dave's 80th, July 4th, 2014.

Fig. C.18: David Shirley and Günter Kaindl, enjoying an afternoon in the Redwoods of California, July 2017.