

# Lawrence Berkeley National Laboratory

## Recent Work

### Title

8th international conference on electronic spectroscopy and structure

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## Eighth International Conference on Electronic Spectroscopy and Structure

Gathering from 33 countries around the world, 408 registrants and a number of local drop-in participants descended on the Clark Kerr Campus of the University of California, Berkeley, from Monday, August 7 through Saturday, August 12, 2000 for the Eighth International Conference on Electronic Structure and Spectroscopy (ICCESS8). At the conference, participants benefited from an extensive scientific program comprising more than 100 oral presentations (plenary lectures and invited and contributed talks) and 330 poster presentations, as well as ample time for socializing and a tour of the Advanced Light Source (ALS) at the nearby Lawrence Berkeley National Laboratory.

ICCESS8 is the latest in a series of conferences held roughly every three years since 1971. While spectroscopies in which electrons are emitted were the exclusive subjects of the first conference, which was organized by David A. Shirley and led to the series being called the International Conferences on Electron Spectroscopy (ICES), ICCESS8 involved enlarging the scope of the conference to include complementary spectroscopies such as x-ray fluorescence, resonant and non-resonant elastic and inelastic x-ray scattering, near-edge x-ray absorption, that are now often used in conjunction with the various electron spectroscopies. The broader topic of electronic structure was also added to the title. The conference now aims to provide a comprehensive forum for discussing experimental and theoretical aspects of electron and x-ray spectroscopies of all stripes, various forms of spectromicroscopy and microspectroscopy, related phenomena dealing with electronic structure and dynamics, and their applications to the surface, interface, materials, environmental, and biological sciences, as well as to industrial analysis.

Responsibility for organization of ICCESS8 was divided between three major committees, all working under the leadership of the conference co-chairs, Charles Fadley (University of California, Davis, and Berkeley Lab) and Louis Terminello (Lawrence Livermore National Laboratory). The ICCESS International Advisory Committee provided overall guidance; The International Program Committee provided suggestions for and assisted with the development of the scientific program; and the Local Organizing Committee

assisted with the program, arranged many logistical details, and made sure that the conference ran smoothly. These committees also owed a great deal to the “nuts and bolts” work done by staff at the Department of Physics at UC Davis, the ALS, and the Lawrence Livermore National Laboratory. A program for accompanying persons was also assembled by Betsy Smith. The ICES8 sponsors were UC Davis; the ALS; the Seaborg Institute at Livermore, the Canadian Light Source/Centre Canadien de Rayonnement Synchrotron; the Stanford Synchrotron Radiation Laboratory; and the International Union for Vacuum Science, Technique, and Applications (IUVSTA).

In addition to providing the conference meeting facilities, the Clark Kerr Campus site offered accommodations and excellent meals in a quiet, campus-like setting. Conference activities began on Monday evening with a welcoming reception for participants and accompanying persons in the central courtyard. The next morning, following welcomes from Winston Ko (Chair, Department of Physics, UC Davis), Pier Oddone (Deputy Director, Berkeley Lab), Neville Smith (ALS Division Deputy for Science), and conference chairs Fadley and Terminello, the work of the conference began in earnest.

The extensive scientific program meant that conference attendees did indeed put in full days. Each morning featured two plenary lectures, followed by a break and two parallel sessions for oral presentations. After lunch in the Clark Kerr cafeteria, attendees viewed poster presentations and visited vendor booths. The day ended with a second period of parallel oral sessions. Despite the long days, there was time for relaxation. On Tuesday evening there was a conference reception, and on Wednesday after dinner there was a vendor reception. Thursday evening was reserved for the conference banquet.

On Tuesday morning, Peter Johnson (Brookhaven National Laboratory) presented the first plenary lecture “High-resolution photoemission studies of self-energy effects in strongly correlated materials.” Based on angle-resolved photoemission experiments by his group at the National Synchrotron Light Source, Johnson reviewed the use of both energy-distribution and momentum-distribution curves to extract contributions to the self energy and, in particular, to look for non-Fermi-liquid behavior in high-temperature

superconductors. David Muller (Lucent Technologies Bell Laboratories) continued with a presentation on “Atomic-resolution electron energy loss spectroscopy in the scanning transmission electron microscope: understanding the limits to scaling nano-transistors.” Muller demonstrated that there is an electronic transition region from silicon to silicon dioxide in the gate region of an MOS transistor even when the structural transition is atomically abrupt, which leads to a fundamental limit of about 0.7 nm on how thin the gate oxide can be.

Berkeley Lab Director Charles Shank opened the Wednesday proceedings with his own welcome, noting the vitality of a field that has endured for 30 years and pointing out the growing importance of ultrafast time-resolved experiments in the femtosecond regime. In the following plenary lecture “Intermolecular Coulombic decay in clusters and weakly bound systems,” Lorenz Cederbaum (Universität Heidelberg) discussed a model for the rapid decay that occurs by electron emission in inner-valence ionized molecular clusters, but not in monomers of species such as water. In the model, an efficient Coulombic mechanism transfers energy to neighboring monomers, thereby allowing electrons to escape. Ernst Bauer (Arizona State University) then spoke on “Spectromicroscopy: present and future.” Bauer focused on the x-ray photoemission electron microscope (XPEEM), calling attention to both synchrotron-radiation excited measurements and the versatility possible with the addition of an electron source in the same instrument for LEEM and LEED measurements and, in separate projects at BESSY II and the ALS, the development of aberration-corrected electron optics for higher spatial resolution in the XPEEM.

Plenaries on Thursday began with Yves Baer (University of Neuchatel) speaking on “High-resolution UV-photoemission of solids: success, limitations, and the future.” Baer reviewed three examples: Kondo systems involving cerium, where it is important to distinguish bulk from surface effects, the strong electron-phonon interaction affecting the beryllium (0001) surface state, and the breakdown of the quasi-particle concept in a one-dimensional metal formed by linear chains of gold on a vicinal surface of silicon (111). Joseph Nordgren (Uppsala University) continued with a presentation on “X-ray emission

and resonant inelastic scattering—present and future.” He reviewed the features and advantages of x-ray emission and resonant scattering techniques and discussed their applications to gas-phase and adsorbed molecules, high-temperature superconductors and other materials with correlated electron systems, buried layers, water and solutions, and uranium oxides. Nordgren also described a new technique for extracting molecular dynamics information and a design for a new high-resolution—high-throughput emission spectrometer.

Joachim Ullrich (Universität Freiburg) began the Friday plenary session with a presentation on “Three-dimensional imaging of ions and electrons produced in photoexcitation.” Ullrich reviewed the use of a “reaction microscope” capable of the simultaneous determination of the complete momentum vectors for up to 10 electrons and recoil ions emerging from atomic or molecular fragmentation reactions. He illustrated several examples involving synchrotron radiation, the fields from passing charged particles, and intense lasers as the source of the excitation. Thomas Fauster (Universität Erlangen-Nürnberg) finished the morning’s plenary session with a review of “Time-resolved photoemission from image-potential states.” Fauster described two-photon, laser-excited photoemission in which the electron is first excited to an image-potential Rydberg state and then excited to the vacuum, and he illustrated for copper surfaces ways to study the lifetime and decay mechanisms for both low- and high- $n$  states.

The last day of the conference began with Han Woong Yeom (Yonsei University) speaking on “Self-organized quantum wires on semiconductor surfaces: the new frontier provided by reduced dimensionality.” Yeom reviewed the results to date of a search by his group using scanning tunneling microscopy and high-resolution photoelectron spectroscopy and diffraction for anomalous phenomena anticipated in one-dimensional nanostructures, including metallic indium chains on a silicon (111) surface that exhibited a one-dimensional charge density wave resulting from a Peierls instability. The final plenary lecture was by Klaus Kern (Max-Planck-Institut für Festkörperforschung) on “Scanning tunneling microscopy as a local probe of electron density and dynamics.” After tickling the audience’s fancy with a “movie” of copper-atom motion on a copper

(111) surface, Kern demonstrated several capabilities of the STM, including mapping the surface potential of the Ag (111) surface, whose herringbone reconstruction induces a periodic potential modulation.

A total of 93 additional invited and contributed oral presentations gave participants a chance for a more in-depth look at current topics of interest. Major research areas can be judged from the following session titles: Strongly Correlated Materials; Atomic, Molecular, and Optical Physics (three sessions); Soft X-Ray Emission, Resonant/Nonresonant Elastic and Inelastic Scattering (two sessions); Nanostructures (two sessions); Microscopy (two sessions); Magnetic Materials; Nanostructures/Electronic Structure; Magnetic Systems; X-Ray Absorption and Electron Scattering; Holography and New Techniques; Industrial Applications and Analytical Methods; Magnetic Materials-Microscopy; Time-Resolved Phenomena; Surfaces, Adsorbates, and Interfaces; Fermi Surfaces and Phonons; and Biological and Environmental Systems

When conference activities began on Monday evening, the initially overcast skies and accompanying chilly weather invited recollections of Mark Twain's infamous comment, "The coldest winter I ever spent was a summer in San Francisco." However, as the week progressed, the weather cleared, and by Thursday evening it was ideal for the splendid outdoor banquet that was held in the attractively landscaped central courtyard of the Clark Kerr Campus, which is surrounded by California-mission-styled buildings.

The after-dinner speaker was Honorary Conference Chair David Shirley (Berkeley Lab), who initiated the ICES series by organizing the original 1971 conference at Asilomar on the California Coast about 125 miles south of Berkeley. Shirley recalled that in the 1960s as photoelectron spectroscopy became a practical tool for research, it seemed time to have a forum to exchange ideas and chart the course of the field. At the first ICES there were 225 participants from 12 countries. Shirley judged the turnout for ICES8 to be especially encouraging because of the many younger investigators (about 40% of the total), who are busily injecting new vitality in this mature but continuously evolving field

of research. Music was provided by the Mighty Avalanche Choir, a San Francisco group specializing in American folk and blues music, as arranged by Dick Brundle (who was also the chair of ICES4).

As with past ICESS Conferences, a prize for the best poster by a student working toward a Ph.D. degree or equivalent was given. Two winners, selected by a committee chaired by Harald Ade (North Carolina State University) and announced at the banquet, were Niko Pontius (Forschungszentrum Jülich) for a poster titled “Time-resolved photoelectron spectroscopy of small metal cluster anions” and Giorgio Turri (INFM TASC, Trieste, and Politecnico di Milano) for a poster on “Correlation effects in Auger cascade studied by angle resolved coincidence electron spectroscopy: the  $1s \rightarrow 3p$  excitation in neon.”

At the end of ICESS8, as outgoing chair of the ICESS International Advisory Board, Fadley announced that the board had unanimously accepted a proposal to hold ICESS9 at Uppsala University in summer, 2003. The host will be the Uppsala Institute of Physics with Ulrik Gelius (incoming chair of the International Advisory Board) and Nils Martensson as co-chairpersons. Gelius then previewed the facilities that will be available at Uppsala and noted that the meeting will be in time to celebrate the 85th birthday of Kai Siegbahn, one of the fathers of electron spectroscopy who received a Nobel Prize for his work. For information on ICESS9, please contact Professor Gelius at [Ulrik.Gelius@fysik.uu.se](mailto:Ulrik.Gelius@fysik.uu.se).

The complete final program and participant list for ICESS8 are available in downloadable (PDF) format at <http://www-als.lbl.gov/icess>, together with a photo gallery. The proceedings of ICESS8, including both invited and contributed papers, will be published as a special issue of the *Journal of Electron Spectroscopy and Related Phenomena*, with Adam Hitchcock (McMaster University) and Tong Leung (University of Waterloo) as editors.

Art Robinson

FIGURE CAPTIONS



(1) XBD200008-01157.TIF

ICESSE8 Attendees gathered for a group photo in the Grand Court. of the Clark Kerr Campus of the University of California, Berkeley.



(2) XBD200008-01087-049.TIF



Phil Woodruff (University of Warwick), Peter Johnson (Brookhaven National Laboratory), and Anders Nilsson (Uppsala University) engage in a discussion during a poster session.



(3) XBD200008-01087-022.TIF

Harald Ade (North Carolina State University) studies the results of Michael Feser's (SUNY Stony Brook) research as Joerg Schaefer (ALS) looks on.



(4) No number

Conference co-chairs Chuck Fadley of the University of California, Davis (second from right) and Lou Terminello of the Lawrence Livermore National Laboratory (right) posed during the conference banquet with Masayuki Uda of Waseda University (left) and Beth Mucatel (second from left).