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SuperHILAC

Heavy-Ion Linear Accelerator

Summary of Capabilities, Facilities, Operations, and Research

September 1987

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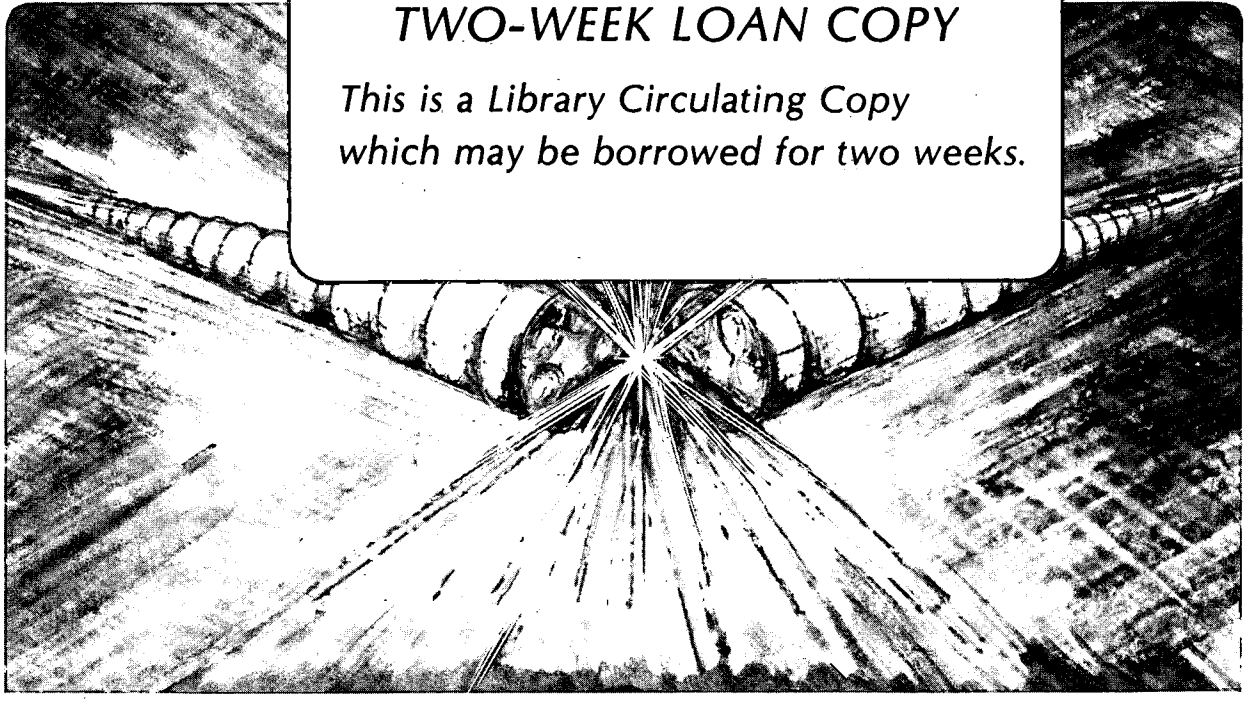

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Lawrence Berkeley Laboratory

SuperHILAC

Heavy-Ion Linear Accelerator

Summary of capabilities, facilities, operations, and research*

Editor: R. J. McDonald

Lawrence Berkeley Laboratory
University of California
Berkeley, CA 94720

September 1987

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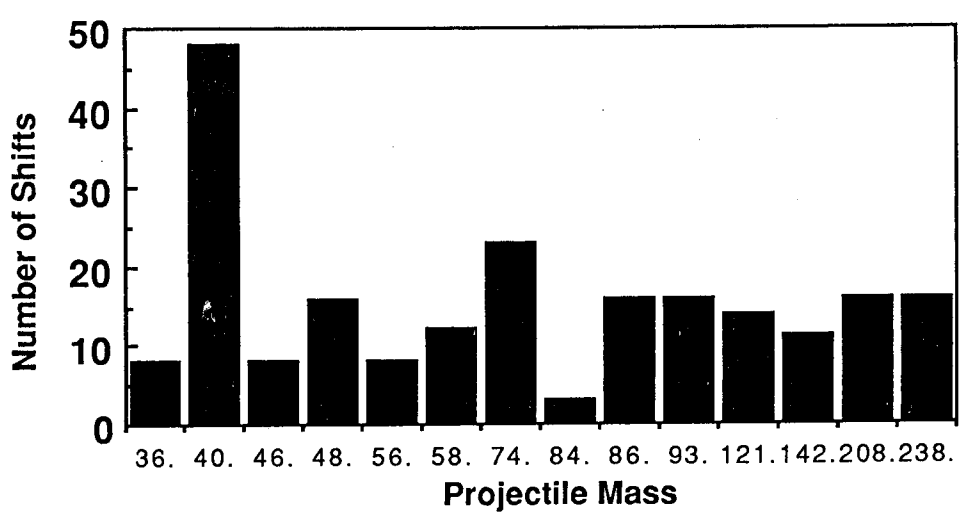
Description of the Accelerator

The SuperHILAC accelerator is the only facility in the United States where beams of very heavy ions (including uranium) can be accelerated to energies above the Coulomb barrier with high intensity. The accelerator operates as an intrinsic component of the LBL Bevalac, for which it serves as the heavy-ion injector. The computer-controlled SuperHILAC can time-share 36 pulses per second with up to three users. Since the Bevalac can only use 2 pulses per second, 34 are available for local users. Two ion species at two different energies can be shared locally, providing "prime" beam to one experiment and "parasitic" beam to another experiment. This efficient time-sharing operation allows the SuperHILAC to provide very-heavy beams at energies ≤8.5 MeV/u to local users without interfering with its mission as an injector to the Bevalac. Indeed, local needs often motivate improvements that benefit Bevalac injection.

At least half of the naturally-occurring elements have been accelerated at the SuperHILAC, and new ones are added each year as experimentalists request them. The graph below shows the number of shifts run for various heavy ions for the year 1986. The fraction of time devoted to the heaviest beams continues to increase. Isotope separation is performed near the source and isotopes of >2% natural abundance have been successfully used as beams. In addition, one injector may utilize expensive separated isotopes and is designed to recover >80% of the material for reprocessing. Although the maximum energy beams available from the SuperHILAC are only 8.5 MeV/u, the wide selection of elements and isotopes available, the high intensities (i.e. >40 particle nano-Amperes (pnA) of U), and the fact that many experiments need energies below 8.5 MeV/u, make the SuperHILAC ideal for a large class of experiments in heavy-ion physics.

Over the years, a rather stable group of users in atomic and nuclear physics has developed, about half of whom come from universities and laboratories other than LBL. A liaison scientist and technician are available to assist users in the planning and execution of experiments. Besides several facility instruments, an electronics pool and data acquisition computers are available. Users are assisted with data acquisition needs by computer programmers who have extensive experience on the system. The SuperHILAC has developed the infrastructure necessary to provide outside users with the resources needed to have successful experiments. This success is reflected in the productivity of the scientists as expressed by their publications.



Description of Facilities Available at the SuperHILAC

The value of an accelerator laboratory must be judged by the amount and quality of its scientific output. Besides requiring good performance of the accelerator, the experimental facilities must be well suited to the available beams. In addition, the physical and organizational infrastructure must be in place to support both inside and outside research groups. Over the years, SuperHILAC management has been responsive to users' requests to develop facilities for researchers using the machine. In particular, emphasis has been placed on meeting the needs of outside user groups. These needs involve flexible experimental facilities, the availability of electronics and data acquisition systems, and dedicated scientific and technical support staff. The satisfaction of our extensive outside users group attests to the fact that these needs are well met.

The following is a summary of the main facilities available at the SuperHILAC.

Data Acquisition Facilities: Three MODCOMP data acquisition computers are available. A professional staff familiar with both the hardware and software of these computers is available to assist users with their data-acquisition needs. The C (for Coulex) area computer has multiple 6250 BPI tape drives for high-speed data acquisition via a specialized CAMAC system optimized for the High Energy Resolution Array (HERA). The A and B acquisition computers are more general, and allow data acquisition via CAMAC (with or without a STARBURST pre-processor) or a multiplexer system that operates via Direct Memory Access. The main data acquisition program, CDAS, includes a high-speed sorting algorithm and extensive sorting and monitoring capabilities. An additional program, CHAOS, is also available. This program is much more flexible for setting gates and monitor functions, but this flexibility comes at the expense of speed. Another specialized data acquisition system is attached to **SASSY II**. The software group supports these machines as well as the similar machines at the 88" cyclotron. They continually work on upgrades and improvements to the system. Present development includes work on a STARBURST-μVAX system that is expected to replace the aging MODCOMP systems. A prototype is working, and we expect an operational system during the current fiscal year.

Electronics Pool: The SuperHILAC maintains an extensive users electronics pool that is constantly being upgraded to reflect the latest in modular electronics for nuclear and atomic physics applications. Currently, the pool contains several hundred items. Besides this Nuclear Instrumentation Module (NIM) equipment, the pool contains several oscilloscopes and multichannel analyzers, two low-pressure gas regulation systems for gas-filled detectors, and an extensive assortment of cables and connectors.

COULEX: E-11: This area is used for gamma-ray experiments and has been recently enhanced by the installation of the High Energy Resolution Array (HERA). This apparatus, constructed by the Diamond and Stephens group at LBL, is now shared between the 88" Cyclotron and the SuperHILAC. It is an array of 21 Compton-suppressed Ge detectors designed to provide high efficiency in detecting coincident gamma-rays. There are only two other similar arrays in the world at present (TESSA 3 in England, and the 8 π detector in Canada), but only HERA is at an accelerator that can provide the heaviest of ions. Thus, opportunities exist for unique experiments. There is room inside the array for particle detectors as needed for transfer and excitation experiments. Ample electronics and a computer based data acquisition system are a part of this facility.

OASIS: E-42: The On-line Apparatus for SuperHILAC Isotope Separation (**OASIS**) is a target, ion source, magnet, and counting area designed to study exotic isotopes and their decay modes. Much of the work here has concentrated on discovering 24 new isotopes near the proton drip line. A recent upgrade of the beam line now allows full-rigidity beams that may be used to synthesize new isotopes on the neutron-rich side of the line of beta stability. The low-background counting area contains detectors to measure proton, alpha, electron, X-, and gamma-ray radiations. A new Total Absorption Spectrometer is being developed. This instrument will allow the measurement of masses and β-strength functions. OASIS has dedicated electronics, but uses the common data acquisition facility.

Bio-Medical: E-78: This beam line will be configured for Bio-Medical experiments during the coming year.

General Use Reactions Area: E-73: This beam line is a general use area with a 60-inch diameter scattering chamber and accessories that can be configured for a variety of experiments in nuclear reactions. The 60 inch chamber can be replaced by a smaller chamber with a time-of-flight arm extension that has been used to measure individual charge and mass numbers for projectiles in the mass 75 region. This area also uses the general electronics pool and data acquisition system.

General Use Reactions Area: E-71: This beam line is a general use area that can be configured to the users' specification. It is currently configured for neutron multiplicity measurements extending into next year. It uses the general electronics pool and data acquisition system.

SASSY II: E-47: The Small-Angle Separation SYstem (**SASSY II**) is a gas-filled mass separator constructed mainly to search for element number 110, although the instrument will also be valuable in studying the properties of other very heavy transuranic elements. This facility has its own dedicated electronics and data acquisition system.

Atomic Physics: E-79: This beam line has a gas-cell, scattering chamber, and dispersing magnet and is mainly used for coincidence experiments involving ionization of the projectile. X-rays may be measured in coincidence with particular charge states of the projectile. This area uses the general electronics pool and data acquisition system.

Atomic Physics: E-84: This area is used for atomic spectroscopy. Equipment includes a GCA/McPherson curved grating UV spectrometer, a Dual-Johnann spectrometer, and a charge-dispersing magnet for experiments to study highly-excited heavy ions. The area has most of its own electronics and data acquisition system.

General Use Gamma-ray Area: E-87: This beam line was constructed for various types of particle-gamma experiments and can be configured to the specifications of the user. At one time a 30 inch chamber was used for light-ion emission and gamma-ray anisotropy experiments. Presently, a small scattering chamber with a stopping ion chamber and avalanche detector are available for particle-particle-gamma experiments. This facility uses the common electronics and data acquisition system.

Atomic Physics: E-75: This beam line is currently available.

Atomic Physics: E-76: This beam line is currently available.

SuperHILAC Programs,

1982-1987

At the September 1987 expanded meeting of the SuperHILAC Program Advisory Committee (SPAC) , the principal investigators were asked to contribute information on the progress of their programs during the last five years. The format decided upon was approximately a one page (double spaced) description of their program, including plans for the near future (3 years); a list of collaborators; and a list of publications. A list of the attendees of that meeting is on page 5.

In the interest of presenting an easier to read document, these contributions were re-formatted as follows: All the descriptions of the programs come first so it is easy to obtain an overall view of the program without sifting through intervening pages. Lists of collaborators are next, divided into categories of group members, collaborators and visitors, and graduate students; and lists of publications (journals and published conference proceedings) are last. Note that some groups only submitted refereed publications and not conference proceedings, so the total number of proceedings would be much higher if these were submitted.

For reasons that are only historical, the programs are divided into the topics of 1) nuclear reactions, 2)nuclear structure, 3) atomic physics, and 4) exotic nuclei; and principal investigators within these topics are in alphabetical order. One notes some overlap in both the people involved and the publications produced. This is due to the large amount of cooperation and collaboration that occurs among users, allowing a pooling of expertise that well serves the productivity of individual scientists and groups. Complete editing out of this duplication was considered, but was not done for fear of mis-representing the contribution of each principal investigator. Publications with an (*) in front of them have been listed previously. Thus, although re-formatted, the documents represent the actual contributions of the individual investigators. For purposes of counting, eliminating duplication, one finds the following:

Principal Investigators:	~20
Research Scientists:	~170
Graduate Students:	~64
Journal Publications:	~150
Published Conference proceedings:	>59

SuperHILAC Program Advisory Committee Meeting
September 10-11, 1987
List of attendees

SuperHILAC Operations:	Dr. Richard Gough, Deputy Division Leader, A&FRD Dr. Jose Alonso, Bevalac Operations Manager Mr. Bob Stevenson, Deputy Bevalac Operations Mgr. Mr. Fred Lothrop, Scheduling Dr. Richard McDonald, Liaison Scientist Dr. Margaret McMahan, Liaison Scientist Dr. Benedict Feinberg, Accelerator physicist
Nuclear Science Division:	Dr. James Symons, Associate Director, Division Leader, NSD Dr. Janis Dairiki, Assistant Division Leader, NSD Dr. Richard Diamond, SuperHILAC Scientific Director
SPAC:	Dr. Teng-Lek Khoo, Argonne National Laboratory Prof. Walter Meyerhof, Stanford University Dr. J. Rayford Nix, LASL Prof. Peter Armbruster, GSI Darmstadt
SHUEC:	Prof. John Alexander, SUNY at Stony Brook Dr. Ken Toth, Oak Ridge National Laboratory Dr. Richard Diamond, LBL
Principal Investigators:	Prof. Stanley Bashkin, University of Arizona Prof. Eugene Bernstein, Western Michigan University Dr. Jim Carroll (representing Prof. George Igo), UCLA Prof. Doug Cline, University of Rochester Prof. Karsten Danzmann, Stanford Dr. Pat Egan (representing Dr. Daniel Dietrich), LLNL Dr. Al Ghiorso, LBL Prof. Darleane Hoffman, U. C. Berkeley and LBL Prof. John Huizenga, University of Rochester Prof. Morton Kaplan, Carnegie-Mellon University Prof. Walter Meyerhof, Stanford Dr. J. Michael Nitschke, LBL Prof John Rasmussen, U. C. Berkeley and LBL Dr. Fred Schlachter, LBL Prof. W.Udo. Schröder, Rochester University Prof. Joshua Silver, Oxford University Dr. Frank Stephens, LBL Dr. Ken Toth, ORNL Prof. Vic Viola, Indiana University

Programs in Nuclear Reactions

Principal Investigator: Professor J. M. Alexander
State University of NY at Stony Brook

There is a great deal of current interest in the evolution of nuclear properties and behavior as increasingly larger amounts of energy and angular momentum are introduced. Studies probing these fundamental aspects are presently being pursued in three energy domains: (a) the region of temperature (T) < 5 MeV where composite nuclei are held together by their mean field; (b) the intermediate energy region of 5 < T < 20 MeV where unbound nucleonic clusters may briefly exchange energy before shattering into many particles or fragments; and (c) the relativistic energy region where subnucleonic particles may be instanteously deconfined. Recent extensive activity in the intermediate energy region has shown great need for a strong foundation of knowledge of nuclear properties at lower temperatures (T < 5 MeV) in order to interpret results for higher temperature (T > 5 MeV). The current scope of our program involves bridging the gap between these two domains. A variety of accelerators is being used with beams from near barrier energies to 100 A MeV.

A major theme of our research is the study of nuclear reaction processes near the limits of stability. One can classify the topics as follows.

Fission processes near the limit of centrifugal stability

Fission and evaporative particle emission near the limits of energy containment.

Evaporative particle emission near and beyond the limits of instability toward fission.

Complete fusion processes.

Blurring of the boundary between complete and incomplete fusion.

Probing the shapes and/or sizes of hot nuclei.

Theory and simulations of fission and evaporation-like processes.

The pursuit of these goals requires a wide range of projectile masses and energies. Thus many accelerators have been used, Stony Brook, Argonne, Atlas, GANIL, LBL Cyclotron and SuperHILAC. The very heavy projectiles of A > 80 play a very important role. In addition to providing for the special aspects of reversed kinematics, these heavy ions allow one to construct composite nuclei with very high energy and spin. These very hot and thermalized nuclei are most easily studied at low projectile velocities where the complications of incomplete fusion and direct reactions are minimized.

Principal Investigator: Professor Morton Kaplan
Carnegie-Mellon University

The experimental research program at the LBL SuperHILAC is directed towards gaining an understanding of the behavior of very hot nuclear matter and the transitions which result in nuclear de-excitation or the formation of new nuclear states. We study the nuclear reactions between energetic very-heavy-ion projectiles and complex nuclei, and explore the evolution of reaction mechanisms and decay properties with increasing excitation energy and angular momentum. Our work emphasizes the exploitation of light-charged-particle emission as a sensitive probe and indicator of the degree of thermal equilibrium and collective shape changes achieved at various states of reaction. The current phase of our program has several major thrusts: (1) studies of particle-particle correlations and fragment-particle correlations in reversed kinematics; (2) relationships between evaporated Intermediate Mass Fragments (Li, Be, B, ..., Ne) and proton or alpha emission; and (3) investigation of alpha and intermediate mass fragment emission during the descent from saddle-to-scission. In each of these scientific arenas, the experiments are carried out at the SuperHILAC because very-heavy-mass projectile beams are required with high intensity.

Principal Investigators: Prof. L. G. Moretto and Dr. G.J. Wozniak
U.C. Berkeley and Lawrence Berkeley Laboratory

The main thrust of our research has been the observation of intermediate mass fragments ($2 \geq Z \geq (Z_t+Z_p)/2$) utilizing reverse kinematics. Projectiles of ^{139}La, ^{74}Ge, and ^{93}Nb from the LBL SuperHILAC bombarded targets of ^{9}Be at energies in the 6-8.5 Mev/u range and the energy, angle, and charge of the final state products were measured utilizing gas-ΔE Si E position-sensitive detector telescopes. The utilization of reverse kinematics, which focuses the products forward, simplifies detector design, and two new detector systems, WEDGE and GASP, were developed. The results show that the whole range of fragments from Z=2 to $Z=(Z_t+Z_p)/2$ are observed and can be explained by the statistical decay of a compound nucleus. Besides the intrinsic importance of this work, it was the beginning point for extensions of the systematics of these reactions to the 11-19 MeV/u energy range at the GSI Unilac and the 25-50 MeV/u range at the LBL Bevalac.

As a continuation of earlier work involving the angular momentum transfer and alignment in heavy-ion reactions, we studied discrete γ-rays from the ^{80}Kr + ^{176}Yb reaction. Six Compton-suppressed Ge detectors were used to measure γ-rays in coincidence with projectile-like fragments detected in a stopping ion chamber and the kinematic partner in an avalanche counter. This data provided information on the division of excitation energy as a function of reaction Q-value.

In collaboration with a Stanford group, we have studied the K-shell ionization probabilities in the reactions of U + U and have used this information as an "atomic clock" to measure the sticking time of the two nuclei.

An additional experiment searched for ternary fission in ^{244}Cm and determined that low-Z events observed via radio-chemical procedures are a result of very asymmetric binary decay rather than ternary as hypothesized from the earlier work. Additional studies of fission are very attractive utilizing these techniques at the SuperHILAC, and the group currently has beam time available to pursue this.

Principal Investigators: Professors W.U. Schröder and J. R. Huizenga
University of Rochester

The fundamental goal of the research program of the University of Rochester group is to explore the statistical dissipation and equilibration processes occurring in nuclear systems that are initially far from equilibrium. It is investigated to what extent the fragmentation of a dinucleus that is formed transiently in a damped reaction is the result of dynamic and static driving forces. Mass and angular distributions of inherently unstable composite nuclei that decay in a fission-like mode are studied. It is of interest to explore what transport processes govern the large-amplitude fluctuations in mass asymmetry in such reactions and what relaxation times are associated with collective, angular-momentum-bearing modes of such nuclei excited during their descent to scission. Significant efforts will be devoted to the investigation of the shape of the dinuclear energy partition function providing information on the heat convection and other energy equilibration mechanisms in damped and fusion-like reactions. Advanced experimental technology is applied in experiments addressing this latter topic by measurement of the joint multiplicity distribution of neutrons from correlated reaction fragments. The experiments planned for the SuperHILAC over the next three years comprise a major fraction of the experimental program of our group. We project a need for two ten-day experiments per year to complete the above projects.

Principal Investigator: Professor V. E. Viola
Indiana University

Our investigations of damped collisions have concentrated on obtaining simultaneous mass and charge distribution measurements as a function of projectile-target mass asymmetry and projectile N/Z ratio. These measurements have employed a time-of-flight particle-identification telescope developed by our group for use with the high intensity beams from the LBL SuperHILAC. In addition to providing high resolution (~0.6 units in Z and A) data for the study of nucleon-exchange and energy-dissipation processes, this device has also proven valuable in deriving new results concerning excitation energy division in damped collisions. By using kinematic coincidence fragment-fragment angular and velocity correlation techniques, it is possible to obtain simultaneous determination of both primary and secondary fragment masses, from which fragment excitation energies can be derived. The present distribution of effort in this program is as follows:

(1) Experiment - A proposal has been submitted to study nucleon exchange and energy dissipation as a function of projectile N/Z for ^{70}Ge- and ^{76}Ge-induced reactions, in order to study the N/Z equilibration process for a non-closed shell projectile.

(2) Data Analysis - Excitation energy distributions have been measured for the E/A = 8.5 MeV ^{74}Ge + ^{165}Ho reaction and are presently being analyzed. In addition, data have been taken on the energy dependence of fragment yields from the E/A = 6.0-13 MeV ^{56}Fe + ^{238}U reaction, at this stage only data at E/A = 8.8 MeV are complete.

(3) Theory Comparison - We are presently collaborating with W. U. Schröder and J. R. Huizenga at the University of Rochester in attempts to interpret our Z and A distribution data for ^{58}Ni and ^{64}Ni incident on ^{238}U in terms of a statistical nucleon-exchange model. While qualitative agreement is found, significant differences between theory and experiment also exist. It is important to understand whether these differences arise from uncertainties in the theoretical potential energy surfaces, or inadequacies in the dynamics of the statistical models which form the basis of these calculations. A related question concerns the conversion of radial kinetic energy into internal fragment excitation and the time evolution of the equilibration process. Efforts to reconcile our excitation-energy-distribution results with both theory and the interpretation of nuclidic yield data represent an important component of our ongoing program relating to damped collisions.

Programs in Nuclear Structure

Principal Investigator: Professor D. Cline
University of Rochester

Coulomb excitation is the preeminent probe of the collective shape degrees of motion which dominate nuclear structure in the yrast domain. The SuperHILAC coupled with the HERA gamma-detector array provides a unique facility for exploiting Coulomb excitation to study these important degrees of freedom. The highest Z beams from the SuperHILAC are essential for Coulomb excitation work while the HERA array is necessary to perform the particle-gamma-gamma coincidences required to determine the decay scheme of the excited nucleus. During the past decade the Rochester-LBL-Uppsala-Warsaw collaboration has developed the experimental and analysis techniques required to measure essentially the complete set of ≈200 E2 matrix elements for the lowest 30 states Coulomb excited in nuclei. The extent and completeness of the measured data set of matrix elements adds a new dimension to the study of quadrupole collectivity in nuclei. In particular, it allows exploitation of the Cline rotational-invariant technique to determine directly from the data the centroids and fluctuation widths of the quadrupole moments in the intrinsic frame which are the major shape degrees of freedom. Major technical advances made during 1987 have extended the usefulness of this technique. This research program has discovered coexistence of differently shaped collective bands in the mass 100 region, determined for the first time the collective behavior throughout the prolate to oblate shape transition in the mass 190 region and discovered anomalies in the gamma-band E2 properties in ^{168}Er. Our recent measurements of the E2 and M1 properties of ^{165}Ho and ^{235}U aim to help solve the long-standing problem of attenuation of Coriolis forces in odd-A deformed nuclei. In addition this program will continue to investigate the limits of validity of collective models, interplay of single-particle and collective degrees of freedom, shape coexistence and shape transitions.

Single-nucleon transfer reactions are the probe of choice for single particle structure, while two-nucleon transfer selectively studies two-particle correlations in nuclei. One-and two-nucleon transfer reactions induced by heavy ions provide a means of studying transfer between high-spin states Coulomb excited prior to transfer. Our Oak Ridge work, using Sn beams, has shown; 1) that transfer reactions comprise a major fraction of the total

reaction cross section near the Coulomb barrier, 2) these reactions populate cold states to spin 30 in the yrast domain of the product nuclei and provide a means of populating high-spin states in transuranic nuclei unperturbed by the fission decay channel which plagues most other reactions, 3) the resultant gamma-ray spectra are clean, 4) 2-neutron transfer to the ground band exhibits an oscillatory behavior with separation distance and is enhanced by up to a factor of 500 at the largest separation distances. The Rochester-LBL-Knoxville collaboration is using the unique capabilities of the SuperHILAC plus HERA to study the spectroscopy of transuranic nuclei and plans on investigating the Coriolis quenching of pairing at high spin. The possibilities of searching for nuclear Josephson and diabolical pairing effects are also under consideration.

It is anticipated that about two to four weeks per year of SuperHILAC beam time will be needed to continue this program during the next three years.

Principal Investigators: Drs. R. M. Diamond and F. S. Stephens
Lawrence Berkeley Laboratory

During the past two years, our program has made use of two capabilities which together are unmatched anywhere else in the world, namely the combination of very heavy ions from the SuperHILAC and the gamma-ray detection properties of HERA, our multi-Ge, Compton-suppressed array. The program has three main components.

One has to do with selected topics in high-spin studies making use of the special characteristics of very heavy-ion beams. This includes magnetic moment and transient field measurements (which have been done in collaboration with a Chalk River group) and lifetime determinations using Doppler-shift techniques that exploit inverse reactions to obtain very large recoil velocities. This year we used the nearly symmetric reaction, ^{74}Ge + ^{82}Se, to produce the superdeformed band in ^{152}Dy. By comparing its yield to that of the total ^{152}Dy channel, we were able to show that there is no enhancement in the symmetric reaction over that of the asymmetric one used by the Daresbury group to discover the band, namely, ^{48}Ca + ^{108}Pd. A small enhancement observed over our earlier reaction, ^{40}Ar + ^{116}Cd, can be explained by the lower angular momentum obtained in the latter case. So there is no evidence for an entrance-channel effect as had been suggested.

A second program is a collaborative study with groups from the Universities of Rochester and Uppsala of multiple Coulomb excitation. Lead, rare-earth, and xenon beams are run at the SuperHILAC, nickel beams at Rochester, and oxygen at Uppsala. By using this variety of ions and obtaining data over a wide range of scattering angles, the hundreds of matrix elements involved in the production of dozens of high-spin states can be determined model independently by a least-square fit program developed over the past few years at Rochester. These matrix elements test the available nuclear models in a much more stringent way than just the determination of the energy levels themselves. We found that no model can fit all the data obtained for some types of nuclei. This program has now been broadened to include Coulomb excitation plus particle transfer, with additional collaborators from the Universities of Tennessee and California. When a large projectile approaches a target nucleus, there is first Coulomb excitation to excited states and then at the turning point, particle exchange can occur, followed by additional Coulomb excitation as the nuclei separate. This process allows for the study of transfer between excited states, and a comparison of one- and two-particle yields gives information on how the pairing correlations influence the transfer. We also hope to learn how these correlations change with spin. These studies are making use of a new six-sided avalanche detector system built at Rochester that can be used inside HERA.

A third program is a collaboration with a group from Stanford University to study the 180°-correlated equal-energy photons produced by very heavy ions on similarly high-Z targets. This is the gamma-ray analog of the narrow positron-electron sum-energy peaks that have been observed at G.S.I. over the past several years. In an experiment this Spring, we did observe a narrow sum-energy peak in the gamma-ray spectrum from uranium ions on thorium targets at 1062 keV. This comes from two equal-energy photons emitted at 180° to each other, apparently from something traveling with about the center-of-mass velocity of the system. This energy does not correspond to any known e^+ - e^- line, but it is too low to have been observed in those experiments. Thus we are left with an intriguing experimental result that requires further investigation in the next program period.

We hope to continue all these programs in the coming year, and are making efforts to improve our experimental techniques in order to solve the exciting problems posed.

Atomic Physics

Principal Investigators: Professors E. M. Bernstein and J. A. Tanis
Western Michigan University

Fundamental atomic interactions involving two or more electrons are investigated for highly-charged, heavy-ion projectiles from the LBL SuperHILAC incident on gas targets. The main emphasis is on mechanisms in which electron correlation effects play a significant role. Coincidence techniques are used to identify and isolate the individual interaction mechanisms. The coincident pairs detected are: (a) X-rays/projectile ions, (b) recoil target ions/projectile ions, and (c) X-rays/X-rays. The work done to date has concentrated on studies of resonant transfer and excitation (RTE) which occurs when electron capture and projectile excitation take place together in a single collision due to a correlated electron-electron interaction. These experiments have established the existence of RTE and indicated a close link between RTE and dielectronic recombination (DR). Specific studies involving K-shell excitation determined the dependence of RTE on projectile atomic number ($16 \leq Z \leq 23$) for He targets and determined the charge-state dependence of RTE for calcium ions ($q = 10+$ to $19+$) incident on H_2. These results are in reasonable agreement with theoretical calculations based on calculated DR cross sections. Evidence for RTE involving excitation of the projectile L-shell has also been obtained.

Our plans for the near future include further studies of L-shell RTE. Other planned investigations to ascertain if electron correlation effects are present are studies of: (a) multiple electron capture associated with K-shell excitation and (b) transfer ionization in which electron capture to the projectile is accompanied by the loss of additional electrons from the target.

The SuperHILAC is particularly suited for the planned experiments since the projectile energy and charge state can be varied easily and we are able to obtain high charge states at relatively low energies. Also, there is a big advantage in having a dedicated beam line available.

Over the next three years we will require approximately two weeks of beam time per year at the SuperHILAC for these studies.

Principal Investigators: Dr. Daniel Dietrich and Professor J. Silver
Lawrence Livermore National Laboratory and Oxford University

The LLNL heavy ion spectroscopy group has studied relativistic and quantum electrodynamic effects in very highly ionized atoms with a particular emphasis on multi-electron effects. To accomplish this we have focused primarily on the n=3 to 2 radiation from neon-like ions. We have also studied the n=2, $\Delta n=0$ transitions in lithium- and helium-like ions by observing the XUV radiation emitted by both fast ions and recoil ions. In addition we have, with the University of Oxford, developed what promises to be the best technique for the future of precision ground-state Lamb-shift measurements in hydrogenic systems.

1) Experiment: We have developed a unique dual Johnann crystal spectrometer which allows broad spectral coverage ($25° \leq \Theta_{Bragg} \leq 65°$) while at the same time maintaining excellent precision ($\approx$100 ppm or 1 eV out of 10 keV). This spectrometer has allowed us to do pioneering work in the field of precision multielectron spectroscopy. We also have used this instrument, with the Oxford group, to perform the first simultaneous observation of Lyman α (n=2 to n=1) and Balmer β (n=4 to n=2) in any ionized hydrogenic system. For the lithium-like measurements we have used a 2 meter grazing incidence spectrometer, observing radiation from a fast beam, and the helium-like work was done with Oxford University by observing recoil ions with their one meter vacuum ultraviolet normal incidence spectrometer. We are also attempting to improve the precision of our hydrogenic measurements by utilizing axial observation on both fast ion and recoil ion sources.

2) Theory: When the neon-like measurements were first made the experimental uncertainties were several times better than estimates of the theoretical accuracies. However, in the last few years the calculations have been improved and there appears to be a significant discrepancy arising in the treatment of the self energy of a strongly bound electron in a multi-electron environment. The hydrogenic theory is felt to be accurate to 25 times the best current experimental uncertainties, hence the effort to improve on hydrogenic techniques.

3) Future work: In addition to continuing the above mentioned work we are starting a program to understand population mechanisms by the simultaneous use of high resolution photon and electron spectroscopy. The aim of this work is to develop new techniques for measuring cross sections for elementary electron-ion interactions.

Principal Investigator: Dr. Harvey Gould
Lawrence Berkeley Laboratory

We measured electron capture and loss cross sections for Pb (Z=82) and Xe (Z=54) ions in nitrogen. Cross sections for xenon charge states from 21+ to 45+ were measured and Pb cross sections from 35+ to 70+ were measured. Energies from 2.4 MeV/u to 8.5 MeV/u were used. We determined the energy dependence and charge state dependence of the cross sections and compared capture and loss cross sections with semi-classical theory.

The results of these measurements were used to determine the vacuum requirements for the Bevalac vacuum liner. We found that it would be possible for the Bevalac to accelerate lower charge state ions than had previously been thought. This mode of operation yields much higher intensities and is now the standard tuning mode for many experiments.

The techniques and equipment developed in this experiment were later used for Bevalac experiments on relativistic few electron uranium.

Principal Investigator: Professor W. E. Meyerhof
Stanford University

Work at GSI has shown that in U + Th, U + Ta, U + U reactions near 6 MeV/u, at least three e^+e^- lines are found which appear to originate from the decay of a neutral particle. Theoretically, two- or three-photon decay of this particle should also be possible.

Our main program at the SuperHILAC is a search for 180°-correlated, equal energy, two-photon events in 6 MeV/u U + Th and similar heavy-ion reactions.

A year ago, a search with two detector pairs from the Stephens-Diamond HERA array set an upper limit for any correlated two-photon decay. Repetition of this experiment with seven detector pairs and with longer running time, yielded a summed energy line at 1062 ± 1 keV which meets all the criteria for two-photon decay of a neutral object moving with a mean velocity equal to the c.m. velocity of the nuclear collision, and a velocity spread approximately 1/3 of this value. In our next experiment, we will examine at least one other system and search for the 1062 keV line. If it is found, we will start to determine its excitation function. Unfortunately, each "point" takes approximately two weeks of SuperHILAC time.

As part of our regular high-energy atomic physics research, we studied the ionization and capture processes of highly charged Ca ions ($Ca^{20+,19+,18+}$) from the SuperHILAC passing through various gases. By measuring the charge distribution emerging from the target region in coincidence with K X-rays from the projectile and the target, special processes could be selected which present a more severe test of theory than total cross sections. In future experiments, we intend to determine the impact parameter dependence of ionization and capture processes.

Exotic Nuclei

Principal Investigator: Dr. A. Ghiorso
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SASSY II is a second generation gas-filled magnetic separator. It is designed to isolate evaporation residues made with minuscule cross sections. The chief objective to be addressed by this instrument is the continued exploration of the region of the heaviest elements; for this reason it is mandatory to attain an overall detection efficiency that approaches 100% since the cross sections that will be encountered range from 10^{-33} cm^2 to below 10^{-36} cm^2. The separator is essentially completed and is now undergoing various tests and calibrations with various heavy-ion reactions that have relatively large cross sections (~10^{-30} cm^2).

There is an extensive region of the heaviest elements that is accessible to SASSY II. This region is important because there is now good evidence which indicates that the fission barriers of the heaviest nuclides are not decreasing as rapidly as previously predicted and as a consequence many unknown nuclides should be accessible with a high efficiency instrument. This clearly means that beam currents of very high intensity must be used, i.e., one particle microampere or more, so that such experiments can be made in reasonable times. In this country only the SuperHILAC is presently capable of delivering the necessary high currents of the medium weight heavy ions.

Principal Investigator: Professor D.C. Hoffman
Univ. of California, Berkeley and Lawrence Berkeley Laboratory

Research at the SuperHILAC has been directed toward the use of deep inelastic transfer and "cold fusion" processes to produce new isotopes or elements and to obtain an understanding of the mechanisms involved. Reactions of Kr and Xe projectiles with heavy actinide targets such as ^{248}Cm and ^{249}Cf have been investigated. Determination of the mass-yield distributions in the reactions of ^{40}Ar, ^{84}Kr, and ^{130}Xe ions with ^{238}U led to the confirmation of the deep-inelastic transfer process. A detailed search for Superheavy Elements in a number of reactions (such as ^{248}Cm + ^{48}Ca) was made. A thorough investigation of spontaneous fission activities in the region of element 100 to 105 has also been made. These studies were the basis for the Ph.D. dissertations of Kenton J. Moody, Robert Welch, and K. E. Gregorich.

Comparisons of actinide production via transfer reactions between ^{40}Ca and ^{48}Ca projectiles with ^{248}Cm targets are being made using radiochemical separation techniques to see if production of neutron-rich heavy element products could be enhanced by use of the neutron-rich projectile ^{48}Ca. To date it appears that ^{48}Ca is no more effective than ^{18}O for products up to 4 atomic numbers larger than the target, but additional studies will be required.

New studies of electron-capture delayed fission will be undertaken at the SuperHILAC on the neutron deficient isotopes of Am. These studies complement work (on light Bk isotopes) currently underway at the 88-Inch Cyclotron. In both cases, the nuclei of interest are separated from other activities by fast radiochemistry, and their decay is observed by various correlation techniques. These two studies should allow us to conduct investigations into the systematic behavior of delayed fission processes.

Principal Investigator: Dr. J. M. Nitschke
Lawrence Berkeley Laboratory

A total of 24 new ß-delayed proton precursors and several new γ emitters and new decay branches in the region of $56 < Z < 72$ and $N < 82$ have been identified with the OASIS on-line mass separator facility at the SuperHILAC. Proton spectra and half-lives were measured for all precursors. Additional properties determined for many of the isotopes include spins and parities of the precursors, final state feedings, proton branching ratios, (Q_{EC}-S_p) energy differences, and new levels in the proton decay daughters. Mixed ß-delayed proton decay from precursor isomers and ground states has been observed. The proton decay has been compared to statistical model calculations using Gamow-Teller (GT) ß-strength functions obtained from RPA calculations with Nilsson model wave functions. For the N = 81 precursors ^{151}Yb, ^{149}Er, and ^{147}Dy, pronounced structure in the proton spectra has been observed. An interpretation of this structure in the framework of "doorway" states is proposed.

With the completion of the high rigidity E42 beam-line at the SuperHILAC a new component will be added to the OASIS experimental program: The production of neutron rich isotopes via deep inelastic collisions (DIC's). During the next running period the production of the new isotopes ^{174}Er and ^{171}Ho with beams of ^{176}Yb or ^{186}W will be attempted. Later, in collaboration with the astrophysics group, a search will be made for a high spin isomer in ^{180}Lu that could play an important role in the nucleosynthesis of nature's rarest isotope ^{180m}Ta, again using DIC's with ^{186}W on ^{natl}W. In the longer term future, after having gained some experience with this production method, it is planned to synthesize new actinide isotopes using ^{238}U beams.

An instrument of great importance for future research with OASIS is the new Total Absorption Spectrometer (TAS). It will allow the measurement of masses and beta-strength functions specifically of proton-rich nuclei. It will have limited precision due to the use of NaI(T1), but high sensitivity because of its near 4π geometry. The measurement of beta-strength functions is particularly important since it determines, in a completely decoupled way, the entrance channel for beta-delayed proton decay. Presently a theoretical Nilsson/RPA model by J. Krumlinde and P. Möller is used, which is in dire need of being checked experimentally.

The OASIS group consists presently of two graduate students, one post-doc and a group leader. Collaborations are entertained with researchers from ORNL, U. of South Carolina, LLNL, U. of Lund (Sweden), and Soreq (Israel).

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Publications related to the LBL SuperHILAC (1982-87)

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L.C. Vaz, D. Logan, J.M. Alexander, E. Duek, D. Guerreau, L. Kowalski, M.F. Rivet, and M.S. Zisman: Products of 3<Z<9 from Long-Lived Intermediates in the Reactions 336 MeV 40Ar + Ag 154Sm and Au. Z. Phys. A311, (1983), 89-98.

E. Duek, L. Kowalski, and J.M. Alexander: The Code LINDA: A Monte Carlo Reaction Simulation for Correlated Fragments and Evaporation Residues Formed in Nuclear Reactions. Computer Phys. Communications 34, (1985), 395-413.

N.N. Ajitanand, R. Lacey, G.F. Peaslee, E. Duek, and J.M. Alexander: GANES: A Computer Program for the Simulation of Light Particle Evaporation in Heavy Ion Reactions. Nuclear Instruments and Methods in Physics Research, A243, (1986), 111-120.

Carnegie-Mellon (Kaplan) Group Alone
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M. Kaplan, D.J. Moses, D.O. Erikson, M. Kildir, D.R.G. Logan, M.S. Zisman, and R.J. McDonald: Light Charged-particle Emission and Fission in $^{238}U + ^{238}U$ Collisions at 1740 Mev., Z. Physik A313(1983) 31

Alexander & Kaplan Groups Together:
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M. Rajagopalan, D. Logan, J.W. Ball, M. Kaplan, H. Delagrange, M.F. Rivet, J.M. Alexander, L.C. Vaz, and M.S. Zisman: Charged Particle Emission from 194Hg Compound Nuclei: Energy and Spin Dependence of Fission- Evaporation Competition, Phys. Rev. C25, (1982), 2417-2429.

M.F. Rivet, D. Logan, J.M. Alexander, D. Guerreau, E. Duek, M.S. Zisman, and M. Kaplan: Energy Equilibration in Composite Nuclei at High Energy and Spin: Correlations Between Evaporative 1H, 4He, and Fission. Phys. Rev. C25, (1982), 2430-2449.

M. Kildir, D. Logan, M. Kaplan, M.S. Zisman, D. Guerreau, J.M.Alexander, and L.C. Vaz: Studies of 4He Emission in Both Fusion-Like and Inelastic Reactions of 340 MeV 40Ar + 238U. Z. Phys. A306, (1982), 323-334.

E. Duek, L. Kowalski, M. Rajagopalan, J.M. Alexander, D. Logan, M.S. Zisman, and M. Kaplan: Correlations Between Fission Fragments for 172 MeV 20Ne + 197Au: A Case Study for Incomplete Fusion. Z. Phys. A307, (1982), 221-235.

E. Duek, L. Kowalski, M. Rajagopalan, J.M. Alexander, T.W. Debiak, D. Logan, M. Kaplan, M.S. Zisman, and Y LeBeyec: Coincidence Studies of Heavy Fragment Pairs in the Reaction 343 MeV 40Ar + 197Au. Z. Phys. A307, (1982), 237-245.

E. Duek, N.N. Ajitanand, J.M. Alexander, D. Logan, M. Kildir, L. Kowalski, L.C. Vaz, D. Guerreau, M.S. Zisman, and M. Kaplan: New Probe of Intermediate Reaction Times: Near-scission Emission of ^{4}He for 334 MeV ^{40}Ar + ^{238}U., Physics Letters B131 (1983) 297

M. Kaplan, M. Kildir, N.N. Ajitanand, J.M. Alexander, and E. Duek: Pre-and Near Scission Emission of Particles in Heavy Ion-Induced Fission. Phys. Rev Lett. 51, (1983), 1492.

N.N. Ajitanand, J.M. Alexander, H. Delagrange, E. Duek, D.O. Eriksen, D. Guerreau, M. Kaplan, M. Kildir, L. Kowalski, R. Lacey, D. Logan, D.J. Moses, G. F. Peaslee, L.C. Vaz, and M.S. Zisman: Multiplicities for Evaporative 4He Emission in Heavy Ion Reactions: Relationships to Spin and Lifetime Expectancy of the Composite Nucleus. Z. Phys. A316 , (1984), 169-176.

E. Duek, N.N. Ajitanand, J.M. Alexander, D. Logan, M. Kildir, L. Kowalski, L.C. Vaz, D. Guerreau, M.S. Zisman, M. Kaplan, and D.J. Moses: Mechanisms for Emission of 4He in the Reactions of 334 MeV 40Ar with 238U. Z. Phys. A317, (1984), 83-99.

M. Kildir, D. Logan, D.O. Eriksen, D.J. Moses, M. Kaplan, E. Duek, L.C. Vaz, N.N. Ajitanand, and J.M. Alexander: Fission Reactions of 469-MeV 56Fe + 238U. Z. Phys. A317, (1984), 83-99.

D.J. Moses, M. Kaplan, J.M. Alexander, D. Logan, M. Kildir, L.C. Vaz, N.N. Ajitanand, E. Duek, and M.S. Zisman: Particle Spectra from Reversed Kinematics: Powerful Probes of Hot Rotating Nuclei. Z. Phys. A320, (1985), 229-236.

N.N. Ajitanand, G. La Rana, R. Lacey, D.J. Moses, L.C. Vaz, G.F. Peaslee, D.M. de Castro Rizzo, M. Kaplan, and J.M. Alexander: Clues to the Shapes of Very Hot Nuclei: Calculated Patterns for Evaporative Emission from Deformed Nuclei. Phys. Rev. C, 34, (1986), 877-889.

R. Lacey, N.N. Ajitanand, J.M. Alexander, D.M. de Castro Rizzo, G.F. Peaslee, L.C. Vaz, G. La Rana, M. Kaplan, D.J. Moses, W. Parker, D. Logan, and P. DeYoung: Large-Angle Correlations in Evaporative Particle Emission: Shape Distortion? Surface Expansion? Journal de Physique, C4, (1986), 289-303.

G. La Rana, D.J. Moses, W.E. Parker, M. Kaplan, D. Logan, R. Lacey, J.M. Alexander, and R.J. Welberry: A Need for New Physics in Statistical Models of Nuclear Deexcitation. Phys. Rev. C35, (1987), 373-376.

D.J. Moses, M. Kaplan, M. Kildir, D.R.G. Logan, G. La Rana, W.E. Parker, R. Lacey, G.F. Peaslee, J.M. Alexander, N.N. Ajitanand, L.C. Vaz, and M.S. Zisman: Light Charged Particle Emission in 485 MeV 56Fe + 197Au Reactions: Correlations with Heavy Fragments and Relationships to Spin and Lifetime. Nucl. Phys., A465, (1987), 339-364.

R. Lacey, N.N. Ajitanand, J.M. Alexander, D.M. De Castro Rizzo, P. DeYoung, M. Kaplan, L. Kowalski, G. La Rana, D. Logan, D.J. Moses, W.E. Parker, G.F. Peaslee, and L.C. Vaz: Surprising Properties of the Nuclear Stratosphere Indicated by Energy Spectra and Large-Angle Correlations Between He and H or He. Phys. Lett. B191, (1987), 253-256.

D.J. Moses, M. Kaplan, G. La Rana, W.E. Parker, R. Lacey, and J.M.Alexander: Nuclear Shape Deformations in 485-MeV 56Fe + 197Au Reactions. Phys. Rev. C36, (1987), 422-424.

Moretto / Wozniak Group, Lawrence Berkeley Laboratory
Principal Investigators: Prof. L.G. Moretto and Dr. G.J. Wozniak

R.J. McDonald, A.J. Pacheco, G.J. Wozniak, H.H. Bolotin, L.G. Moretto, C. Schuck, S. Shih, R.M. Diamond, and F.S. Stephens: Evidence for Spin Fluctuations in the Deep-Inelastic Reaction ^{165}Ho + ^{165}Ho at 8.5 MeV/u. Nucl. Phys. A373, (1982), 54.

L.G. Moretto: Statistical Fluctuations in Heavy Ion Collisions. Lecture Notes in Physics 158, "Dynamics of Nuclear Fission and Related Collective Phenomena", P. David, T. Mayer-Kuckuk and A. Van der Woute, eds. Springer-Verlag (1982).

J.E. Draper, J.O. Newton, L.G. Sobotka, H. Lindenberger, G.J. Wozniak, L.G. Moretto, F.S. Stephens, R.M. Diamond, and R.J. McDonald: Dependence of the Giant Dipole Strength Function on Excitation Energy. Phys. Rev. Lett. 49, (1982), 434.

L.G. Sobotka, R.J. McDonald, G.J. Wozniak, D.J. Morrissey, A.J. Pacheco, and L.G. Moretto: Alpha-particle Emission from the Deep-inelastic Reaction 1354 MeV ^{165}Ho + ^{181}Ta. Phys. Rev. C25, (1982), 1693.

A.J. Pacheco and L.G. Moretto: The Effect of Statistical Fluctuations on the Measurement of the Total Energy and the Multiplicity of γ Rays Following Deep-Inelastic Reactions. Z. Phys. A306, (1982), 259.

L.G. Moretto: Energy Equilibration and Anomalous Mass Drift in Heavy Ion Collisions. Z. Phys. A310, (1983), 61.

A.J. Pacheco, G.J. Wozniak, R.J. McDonald, R.M. Diamond, C.C. Hsu, L.G. Moretto, D.J. Morrissey, L.G. Sobotka, and F.S. Stephens: Angular-Momentum Transfer and Alignment in Deep-Inelastic Reactions for Nearly Symmetric Heavy-Ion Systems. Nucl. Phys. 397, (1983), 313.

G.J. Wozniak, G.J. Mathews, R.P. Schmitt, R. Regimbart, H. Hubel, R.M. Diamond, and L.G. Moretto: A Study of Charge, Energy and Angular Momentum Transfer in The ^{56}Fe + ^{197}Au and ^{56}Fe + ^{107,109}Ag Reactions at 7.2 and 8.3 MeV/Nucleon. Nucl. Phys. 402, (1983), 322.

L.G. Sobotka, R.J. McDonald, G.J. Wozniak, D.J. Morrissey, A.J. Pacheco, and L.G. Moretto: Alpha-Particle Emission from The Reaction 1354 MeV ^{165}Ho + ^{181}Ta. Phys. Rev. C28, (1983), 219.

L.G. Moretto: The Phenomenology of Deep-Inelastic Processes. Nucl. Phys. A409, (1983), 115.

L.G. Moretto and G. Guarino: The Soggy Saddle Theory of Fission. IL Nuovo Cimento 79, (1984), 149.

L.G. Moretto: Multifragmentation and the Partition of Angular Momentum: General Statistical Theory. Phys. Rev. C29, (1984), 843.

L.G. Moretto: New Statistical and Non-Statistical Effects in Deep Inelastic Heavy Ion Collisions. Il Nuovo Cimento 81A, (1984), 21.

L.G. Moretto and E.G. Lanza: A Feedback Process Controlling Energy Partition and Mass Exchange Between Heavy Ions. Nucl. Phys. A428, (1983), 137.

L.G. Moretto and G.J. Wozniak: The Role of Rotational Degrees of Freedom in Heavy Ion Collisions. Ann. Rev. Nucl. Part. Sci. 34, (1984). 189.

L.G. Sobotka, M.A. McMahan, R.J. McDonald, C. Signarbieux, G.J. Wozniak, M.L.Padgett, J.H. Gu, Z.H. Liu, Z.Q. Yao, and L.G. Moretto: Compound Nucleus Decay Along the Mass Asymmetry Coordinate and the Role of The Businaro-Gallone Point. Phys. Rev. Lett. 53, (1984), 2004.

L.G. Sobotka and L.G. Moretto: Partitioning of Nuclei. Phys. Rev. C31, (1985), 668.

D.J. Morrissey, G.J. Wozniak, L.G. Sobotka, R.J. McDonald, A.J. Pacheco, and L.G. Moretto: Sequential Fission Angular Distributions from Mass-Asymmetric Heavy Ion Reactions. Nucl. Phys. A442, (1985), 578.

L.G. Sobotka, G.J. Wozniak, R.J. McDonald, M.A. McMahan, R.J. Charity, L.G. Moretto, Z.H. Liu, F.S. Stephens, R.M. Diamond, M.A. Deleplanque, and A.J. Pacheco: Excitation Energy Division in the First 160 MeV of Total Kinetic Energy Loss for the Reaction: 684 MeV ^{80}Kr + ^{174}Yb. Phys. Lett. B175, (1986), 27.

J.D. Molitoris, Ch. Stoller, R. Anholt, W.E. Meyerhof, D.W. Spooner, R.J. McDonald, L.G. Sobotka, G.J. Wozniak, L.G. Moretto, M.A. McMahan, E. Morenzoni, M. Nessi, and W. Wölfli: K-Shell Ionization in 7.5- and 8.6/a.m.u. U + U Collisions at Very Small Impact Parameters. Z. Physik D2, (1986), 91.

L.G. Moretto: Emission of Complex Fragments in Compound Nucleus Decay Nuclear. Fission and Heavy Ion Induced Reactions, Nuclear Science Research Conference Series, vol. 11, W. Schröder (ed.), Harwood Academic Publishers, p. 205 (1986).

D.G. Sarantities, D.R. Bowman, G.J. Wozniak, R.J. Charity, Z.H. Liu, R.J. McDonald, M.A. McMahan, and L.G. Moretto: Evidence for the Very Asymmetric "Fission" of 244 Cm, Complex Fragment Emission From Actinides. in preparation for Phys Rev C

Conference Proceedings

L. G. Moretto: The Role of Rotational Degrees of Freedom in Heavy Ion Collisions. Presented at the International Conference on Selected Aspects of Heavy Ion Reactions, Saclay, France, May 3-7, 1982; Nucl. Phys. 387, (1982), 331.

L.G. Moretto: Particle Angular Distributions and Gamma Ray Multiplicities as Experimental Probes for Angular Momentum Fluctuations. XX International Winter Meeting on Nuclear Physics, January 1982, University of Milan, Ed. p. 465.

L.G. Moretto and E.G. Lanza: A Feedback Process Controlling Energy Partition and Mass Exchange Between Heavy Ions. **Proceedings of the XXI International Winter Meeting of Nuclear Physics**, University of Milan ed. p. 396, January 1983.

L.G. Moretto: Statistical Properties of Deep Inelastic Reactions. **Proceedings of the International Conference on Nuclear Physics**, Florence, Italy, August 29 - September 3, 1983. P. Blasi and R.H. Ricci, Eds., Tiopgrafic Compositori, Bologna 1983, p 385.

L.G. Moretto: Statistics at Work in Heavy Ion Reactions. **Proceedings of the International School of Physics on Nuclear Structure and Heavy Ion Dynamics** Eds. L.G. Moretto and R.A. Ricci, North Holland, 1984, p 312.

Complete Mass Distributions in Compound Nucleus Decay and the Role of the Businaro-Gallone Point. **Proceedings of the XXII International Winter Meeting on Nuclear Physics**, Bormio, Italy, 1984, Ed. I. Iori, University of Milano, p.177.

Fission along the Mass Asymmetry Coordinate. An Experimental Evaluation of the Conditional Saddle Masses and of the Businero-Gallone Point. **Proceedings of the International Conference in Nuclear Physics**, Bombay, India, 1984, B.K. Jain and B.C. Sinhd, (eds.), World Scientific, p. 469, 1985.

L.G. Moretto, M.A. McMahan, L.G. Sobotka, and G.J. Wozniak: Compound Nucleus Emission of Complex Fragments at Low and Intermediate Energies. **Proceedings of the International Workshop on Gross Properties of Nuclei and Nuclear Excitations XIII**, H. Feldmeier, Ed., Darmstadt, 1985, ISSN 0720 8715, p. 104.

L.G. Moretto, G.J. Wozniak, and L.G. Sobotka: The Businaro-Gallone Transition as Observed in Complete Charge Distributions from Compound Nucleus Decay. **Proceedings of the 1984 INS-RIKEN International Symposium on Heavy Ion Physics**, Mount Fuji, Japan, E. Kubono, M. Ishihara, M. Ichimune, (eds., Supple.J. Phys. Soc. Japan 54, 366, 1985.

L.G. Moretto: Compound Nucleus Studies with Reverse Kinematics. Conference on Nuclear Structure with Heavy Ions, R.A. Ricci and C. Villi (eds.), Italian Physical Society, pp. 277, 1986.

R.J. Charity, M.A. McMahan, D.R. Bowman, Z.H. Liu, R.J. McDonald, G.J. Wozniak, L.G. Moretto, S. Bradley, W.L. Kehoe, A.C. Mignerey, D.G. Sarantities, L.G. Sobotka, G. Guarino, A. Pantaleo, L. Fiore, A. Gobbi, K. Hildenbrand, and M.N. Namboodiri: Intermediate Mass Fragment Emission from 8 to 40 MeV/. **Proceedings of the Fourth Winter Workshop on Nuclear Dynamics**, Copper Mountain, CO, February 23-28, 1986; CONF-860370,UC-34C,INC-40007-37, p. 116, 1986.

L.G. Moretto and D.R. Bowman: Particle Evaporation Spectra with Inclusion of Thermal Shape Fluctuations. XXV International Winter Meeting on Nuclear Physics, I. Iori (ed.) Ricezca Scientifica ed. Educazione Permanente, Milano, Suffl. N. 56, 1987, p. 711

L.G. Moretto: Complex Particle Emission in Heavy Ion Collisions. Physics at Tandem, Jiang Chenglie, Li Shennan, Sun Zuxun, Zang Huanqiao (eds.), World Scientific Publishing Co., p.276 (1987). (ISBN 9971-50-129-5.)

Rochester (Schröder and Huizenga) Group
Principal Investigators: Professors W.U. Schröder and J. Huizenga

BOOK:

W. U. Schröder and J. R. Huizenga, "Damped Nuclear Reactions", in Treatise on Heavy-Ion Science, Vol. 2, pages 113-726, Plenum Press (1984); D. A. Bromley, Editor.

EDITED BOOK:

Festschrift and Proceedings of the International Symposium on Nuclear Fission and Heavy-Ion-Induced Reactions, Rochester, April 20 - 22, 1986; Nuclear Science Research Conference Series 11, W. U. Schröder, Editor; Harwood Academic Publishers, New York, 1987.

PUBLICATIONS:

A. D. Hoover, J. R. Birkelund, D. Hilscher, W. U. Schröder, W. W. Wilcke, J. R. Huizenga, H. Breuer, A. C. Mignerey, V. E. Viola, and K. L. Wolf: The 165Ho + 56Fe Reaction at ELab = 462 MeV. Phys. Rev. C25, (1982), 256.

H. J. Wollersheim, W. W. Wilcke, J. R. Birkelund, and J. R. Huizenga: Influence of the Impact Parameter on Element Distributions in Dissipative Heavy-Ion Collisions. Phys. Rev. C25, (1982), 338.

J. R. Huizenga: Deep Inelastic Collisions. McGraw-Hill Encyclopedia of Science and Technology, 5th Edition, (1982), 63.

J. R. Huizenga, W. U. Schröder, J. R. Birkelund, and W. W. Wilcke: Distinctive Features of Heavy-Ion Dissipative Collisions. Nucl. Phys. A387, (1982), 257.

J. R. Birkelund, H. Freiesleben, J. R. Huizenga, W. U. Schröder, W. W. Wilcke, K. L. Wolf, J. P. Unik, and V. E. Viola: Mechanisms of Heavy Ion Dissipative Collisions: The 209Bi + 84Kr Reaction at ELab = 712 MeV. Phys. Rev. C26, (1982), 1984.

J. R. Birkelund, A. D. Hoover, J. R. Huizenga, W. U. Schröder, and W. W. Wilcke: Fusion Cross Sections for the 165Ho + 56Fe Reaction. Phys. Rev. C27, (1983), 882.

H. Rossner, D. Hilscher, E. Holub, G. Ingold, U. Jahnke, H. Orf, J. R. Huizenga, J. R. Birkelund, W. U. Schröder, and W. W. Wilcke: Angular Distributions of Fragments from Fission Induced by 20Ne on Targets of 165Ho, 197Au, and 209Bi. Phys. Rev. C27, (1983), 2666.

W. W. Wilcke, J. P. Kosky, J. R. Birkelund, M. A. Butler, A. D. Dougan, J. R. Huizenga, W. U. Schröder, H. J. Wollersheim, and D. Hilscher: New Mechanism of Alpha-Particle Production in Heavy-Ion-Induced Fission. Phys. Rev. Lett. 51, (1983), 99.

H. Breuer, A. C. Mignerey, V. E. Viola, K. L. Wolf, J. R. Birkelund, D. Hilscher, J. R. Huizenga, W. U. Schröder, and W. W. Wilcke: Charge and Mass Exchange in 56Fe-Induced Reactions at 8.3 MeV/Nucleon. Phys. Rev. C28, (1983), 1080.

J. R. Huizenga, J. R. Birkelund, L. E. Tubbs, D. Hilscher, U. Jahnke, H. Rossner, B. Gebauer, and H. Lettau: Limitation of Complete Linear Momentum Transfer in Heavy-Ion Reactions. Phys. Rev. C28, (1983), 1853.

J. P. Kosky, W. W. Wilcke, J. R. Birkelund, M. A. Butler, A. D. Dougan, J. R. Huizenga, W. U. Schröder, H. J. Wollersheim, and D. Hilscher: Alpha-Particle Emission in the Strongly Damped Reaction of 165Ho + 56Fe at 8.3 MeV/Nucleon. Phys. Lett. 133B, (1983), 153.

J. R. Birkelund and J. R. Huizenga: Fusion Reactions Between Heavy Nuclei. Ann. Rev. Nucl. and Part. Sci. 33, (1983), 265.

J. R. Huizenga: Deep Inelastic Reactions and Fusion. Nucl. Phys. A409, (1983), 181c.

A. C. Mignerey, K. L. Wolf, D. G. Raich, V. E. Viola, Jr., J. R. Birkelund, W. U. Schröder, and J. R. Huizenga. Bombarding Energy Dependence of the 144Sm + 84Kr Reaction. Phys. Rev. C29, (1984), 158.

J. R. Birkelund and J. R. Huizenga: Measurement of Nuclear Potentials from Fusion Excitation Functions. Phys. Rev. C30, (1984), 401.

H. H. Rossner, J. R. Huizenga, and W. U. Schröder: Statistical Model of Fission-Fragment Angular Distributions. Phys. Rev. Lett. 53, (1874), 38.

W. U. Schröder and J. R. Huizenga, Damped Nuclear Reactions, in "Treatise on Heavy-Ion Science", Vol. 2, pages 113-726, D. A. Bromley, Editor, Plenum Press, 1984.

L. E. Tubbs, J. R. Birkelund, J. R. Huizenga, D. Hilscher, U. Jahnke, H. Rossner, and B. Gebauer: Linear Momentum Transfer in 292-MeV 20Ne-Induced Fission of 165Ho, 181Ta, 197Au, 209Bi, and 238U. Phys. Rev. C32, (1985), 214.

E. Holub, D. Hilscher, G. Ingold, U. Jahnke, H. Orf, H. Rossner, W. P. Zank, W. U. Schröder, H. Gemmeke, K. Keller, L. Lassen, and W. Luecking: Preequilibrium Neutron Emission in Fusion of 165Ho + 12C at 25 MeV per Nucleon. Phys. Rev. C33, (1986), 143.

H. Rossner, J. R. Huizenga, and W. U. Schröder: Fission Fragment Angular Distributions. Phys. Rev. C33, (1986), 560.

M. A. Butler, S. S. Datta, R. T. de Souza, J. R. Huizenga, W. U. Schröder, J. Tõke, and J. L. Wile: Relaxation of the Mass Asymmetry Degree of Freedom in Heavy-Ion Reactions. Rapid Communication, Phys. Rev. C34, (1986), 2016.

J. L. Wile, W. U. Schröder, J. R. Huizenga, and D. Hilscher: Temperatures, Energies, and Degree of Thermal Equilibration of Fragments in Damped Nuclear Reactions. Phys. Rev. C35, (1987), 1608.

L. M. Schmieder, W. U. Schröder, and M. A. Butler: An Analysis of Damped and Fusion Processes in the 197Au + 51V Reaction at ELab = 447 MeV. Phys. Rev. C, in press.

I. M. Govil, J. R. Huizenga, W. U. Schröder, and J. Tõke: Shapes of Alpha-Particle Spectra from Energetic Heavy-Ion Fusion Reactions. Physics Letters, in press.

Conference Proceedings

J. R. Huizenga, J. R. Birkelund, W. U. Schröder, W. W. Wilcke, and H. J. Wollersheim: Experimental Characteristics of Damped Nuclear Reactions. **Proceedings Nuclear Physics Workshop**, Trieste, 1981, C. H. Dasso, R. A. Broglia, A. Winther, eds., North Holland (1982), 583.

H. Breuer, A. Gökman, C. J. Kulesza, G. Lavelle, A. C. Mignerey, K. Kwiatkowski, V. E. Viola, J. R. Birkelund, A. D. Hoover, J. R. Huizenga, W. U. Schröder, W. W. Wilcke, H. J. Wollersheim, R. R. Betts, B. G. Glagola, C. Davids, and K. L. Wolf: Nucleon and Energy Exchange in Low-Energy Heavy-Ion Reactions. **Proceedings of the Workshop on Nuclear Dynamics III**, Copper Mountain, Colorado, March 1984, Report INC-40007-24, (1984), 58.

D. Hilscher, E. Holub, G. Ingold, U. Jahnke, H. Orf, H. Rossner, W. U. Schröder, H. Gemmeke, K. Keller, L. Lassen, and W. Luecking: Preequilibrium Neutron Emission in Central and Peripheral Heavy-Ion Collisions. **Proceedings of the Workshop on Coincident Particle Emission from Continuum States**, Bad Honnef, June 1984.

J. R. Huizenga and W. U. Schröder: Fragment Angular Distributions from Heavy-Ion-Induced Fission. **Proceedings of the 1984 INS-RIKEN International Symposium Heavy Ion Physics**. J. Phys. Soc. Japan 54, Suppl. II, (1985), 257.

J. R. Huizenga and W. U. Schröder: Nuclear Transport Phenomena in Low-Energy Heavy-Ion Collisions. **Proceedings of the Niels Bohr Centennial Conference, Copenhagen**, 1985; North-Holland, Amsterdam (J. Bang and J. DeBoer, Editors), (1985), 255-280.

J. Tõke, J. R. Birkelund, M. A. Butler, J. R. Huizenga, J. P. Kosky, L. M. Schmieder, W. U. Schröder, and W. W. Wilcke: Signatures of Fast Alpha-Particle Emission in Damped Heavy-Ion Reactions. **Proceedings of the Workshop on Nuclear Dynamics IV**, Copper Mountain, Colorado, February 24 - 28, 1986, 66-69.

W. U. Schröder, R. T. de Souza, J. R. Huizenga, and L. M. Schmieder: Mass, Charge, and Energy Transfer in Damped Reactions. **Proceedings of the International Symposium Nuclear Fission and Heavy-Ion-Induced Reactions**, Rochester, New York, April 20 - 22, 1986, W. U. Schröder, Editor, Nucl. Sci. Res. Conf. Ser., Vol. 11, pp. 255-291, Harwood Academic Press, New York (1987).

H. Rossner, J. R. Huizenga, and W. U. Schröder: The Fission Channel in Heavy-Ion Reactions. **Proceedings of the International Symposium Nuclear Fission and Heavy-Ion-Induced Reactions**, Rochester, New York, April 20 - 22, 1986, W. U. Schröder, Editor, Nucl. Sci. Res. Conf. Ser., Vol. 11, pp. 127-142, Harwood Academic Press, New York (1987).

W. U. Schröder, J. R. Birkelund, J. R. Huizenga, L. E. Tubbs, W. W. Wilcke, W. Bohne, B. Gebauer, D. Hilscher, E. Holub, G. Ingold, U. Jahnke, H. Lettau, H. Morgenstern, H. Orf, H. Rossner, W. P. Zank, H. Gemmeke, K. Keller, L. Lassen, and W. Luecking: Dissipation of Linear Momentum and Energy in Fusion-Like Reactions. **Proceedings of the Berlin Symposium on Nuclear Physics with Heavy Ions at VICKSI**, February 1986. Report HMI-437, (1987), 45.

W. U. Schröder, S. S. Datta, J. L. Wile, Jan Tõke, R. T. de Souza, and J. R. Huizenga: Energy Dissipation and Particle Emission in Heavy-Ion Reactions. **Proceedings of the International Symposium on Collective Phenomena in Nuclear and Subnuclear Long Range Interactions in Nuclei**, Bad Honnef, West Germany, May 5 - 10, 1987, in press.

J. R. Huizenga, M. A. Butler, H. Rossner, J. L. Wile, S. S. Datta, R. T. de Souza, D. Hilscher, W. U. Schröder, and J. Tõke: Massive Heavy-Ion Reactions. **Proceedings of the All-Union Symposium on the Physics of Nuclear Fission**, Obninsk, U.S.S.R., June 2-5, 1987, in press.

Indiana / Maryland (Viola) Group
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* A.D. Hoover, J.R. Birkelund, W.U. Schröder, J.R. Huizenga, W.W. Wilcke, V.E. Viola, H. Breuer, A.C. Mignerey, and K.L. Wolf: The 165Ho + 56Fe Reaction at 462 MeV. Phys. Rev. C25, (1982), 256.

* J.R. Birkelund, H. Freiesleben, J.R. Huizenga, W.U. Schröder, W.W. Wilcke, K.L. Wolf, J.P. Unik, and V.E. Viola, Jr.: Mechanisms of Heavy-Ion Dissipative Collisions: The 209Bi + 84Kr Reaction at 712 MeV. Phys. Rev. C26, (1982), 1984.

H. Breuer, N.R. Yoder, A.C. Mignerey, V.E. Viola, K. Kwiatkowski, and K.L. Wolf: The Analysis of Simultaneous Mass and Charge Data From Damped Heavy-Ion Reactions. Nucl. Instr. Meth. 204, (1983), 419.

* H. Breuer, A.C. Mignerey, V.E. Viola, Jr., K.L. Wolf, J.R. Birkelund, D. Hilscher, J.R. Huizenga, W.U. Schröder, and W.W. Wilcke: Charge and Mass Exchange in 56Fe-Induced Reactions at 8.3 MeV/u. Phys. Rev. C28, (1983), 1080.

* A.C. Mignerey, K.L. Wolf, V.E. Viola, Jr., J.R. Birkelund, W.U. Schröder, and J.R. Huizenga: The Dependence of Nuclear Orbiting and Charge Exchange on Bombarding Energy in the 144Sm + 84Kr Reaction. Phys. Rev. C29, (1984), 158.

K. Kwiatkowski, S.H. Zhou, W. Wilson, V.E. Viola, Jr., and H. Breuer: A Detector System for Discrete Nuclide Identification of Ions with A ≤ 60. Nucl. Instr. Meth. 225, (1984), 65.

D.R. Benton, H. Breuer, F. Khazaie, K. Kwiatkowski, V.E. Viola, S. Bradley, A.C. Mignerey, A.P. Weston-Dawkes, and R.J. McDonald: Excitation Energy Division in the 9 MeV/Nucleon 56Fe + 165Ho Reaction. Phys. Lett. B185, (1987), 326.

V.E. Viola, Jr.: Nucleus-Nucleus Collisions: A Laboratory for Studying Equilibration Phenomena. Accounts of Chemical, 20, (1987), 32.

D.R. Benton, H. Breuer, F. Khazaie, K. Kwiatkowski, V.E. Viola, Jr., S. Bradley, A.C. Mignerey, A.P. Weston-Dawkes, and R.J. McDonald: Excitation Energy Division in the 56Fe + 165Ho Reaction. In preparation for Phys. Rev. C.

R.T. de Souza, W.U. Schröder, J.R. Huizenga, R. Planeta, K. Kwiatkowski, V.E. Viola, Jr., and H. Breuer: The Effect of Static and Dynamical Driving Forces on the Evolution of Mass and Charge Asymmetry in Damped Heavy-Ion Reactions. In preparation for Phys. Rev. Lett.

Conference Proceedings:

V.E. Viola, Jr.: Energy Dissipation in Nucleus-Nucleus Collisions: Damped Collisions. in Collective Motion and Giant Resonances. **Proceedings of the 15th Mikolajki Summer School of Nuclear Physics**, Poland, Sept. 5-17, 1983 (Harwood Academic Publishers, Ed. Z. Wilhelmi and Mikicinska-Habior), (1986), 365.

H. Breuer, A. Gokmen, A.C. Mignerey, K. Kwiatkowski, V.E. Viola, J.R. Birkelund, J.R. Huizenga, W.U. Schröder, W. Wilcke, H.J. Wollersheim, B.G. Glagola, and K.L. Wolf: Nucleon and Energy Exchange in Low-Energy Heavy-Ion Reactions. **Proceedings of the Winter Workshop on Nuclear Dynamics III**, Copper Mountain, CO, (March 1984), USDOE TIS CONF-8403101, p. 58.

D.R. Benton, H. Breuer, F. Khazaie, K. Kwiatkowski, V.E. Viola, S. Bradley, A.C. Mignerey, A.P. Weston-Dawkes, and R.J. McDonald: Excitation Energy Division in the 9 MeV/Nucleon 56Fe + 165Ho. **Proceedings of the Winter Workshop on Nuclear Dynamics IV**, Copper Mountain, CO, (Feb. 1986), CONF-860270, UC-34C, 36.

V.E. Viola and K. Kwiatkowski: Linear Momentum Transfer in Projectile-Nucleus Collisions. **Proceedings of the Symposium on the Many Facets of Heavy-Ion Fusion Reactions**, Argonne, Il, (March 1986), Argonne National Laboratory Report ANL-PHY-86-1, (1986), 237.

V.E. Viola: Linear Momentum and Energy Transfer in Nucleus-Nucleus Collisions. Nuclear Fission and Heavy-Ion-Induced Reactions, (Harwood Academic Publishers, Eds. W.U. Schröder). **Proceedings of the International Symposium on Nuclear Fission and Heavy-Ion-Induced Reactions**, Rochester, New York, (April, 1986), 337.

Rochester (Cline) Group
Principal Investigator: Prof. D. Cline

T. Czosnyka, D. Cline, L. Hasselgren, C.Y. Wu, R. M. Diamond, H. Kluge, C. Roulet, E.K. Hulet, R.W. Lougheed, and C. Baktash: E2 Properties of the Ground State Band in 248Cm. Nucl. Phys. A458, (1986), 123. UR-NSRL-263.

D. Cline: Heavy Ion Coulomb Excitation and Nuclear Structure. Annual Review of Nuclear and Particle Science, vol. 36, (1986), 681-714.

M.W. Guidry, S. Juutinen, X.T. Liu, C.R. Bingham, A. Larabee, L.L. Riedinger, C. Baktash, I.Y. Lee, M.L. Halbert, D. Cline, B. Kotlinski, W.J. Kernan, D. Sarantities, T.M. Semkow, K. Honkanen, and M. Rajagopalen: Population of High Spin States in Transfer Reactions. Phys. Lett. 163B, (1985), 79. NSRL-290.

C.Y. Wu, X.T. Liu, S.P. Sorensen, R.W. Kincaid, M.W. Guidry, D. Cline, W.J. Kernan, E. Vogt, T. Czosnyka, A.E. Kavka, M.A. Stoyer, J.O. Rasmussen, and M.L. Halbert: Population of High Spin States in the Actinide Region by Heavy Ion Transfer Reactions. Phys. Lett. B188, (1987), 25.

S. Juutinen, X.Y.Liu, S. Sorensen, B. Cox, R.W. Kincaid, C.R. Bingham, M.W. Guidry, W.J. Kernan, C.Y. Wu, E. Vogt, D. Cline, M.L. Halbert, I.Y. Lee, and C. Baktash: Anomalous Two-Neutron Transfer Cross Sections at Large Separation in Heavy Ion Reactions. Phys. Lett. B192, (1987), 307.

C. Fahlander, A. Backlin, L. Hasselgren, A. Kavka, V. Mittal, D. Cline, B. Kotlinski, H. Grein, E. Grosse, R. Kulessa, C. Michael, W. Spreng, H.J. Wollersheim, and J. Stachel: Quadrupole Collective Properties of 114Cd. Nucl. Phys., submitted 1987.

P.A. Butler, S. Juutinen, S.P. Sorensen, X.T. Liu, R.W. Kincaid, C.Y. Wu, W.J. Kernan, A. Kavka, E. Vogt, D. Cline, C. Baktash, I.Y. Lee: Observation of Intrinsic Excitation in 160Dy Following Heavy-Ion Transfer Reactions. Phys. Lett. 191, (1987), 333.

C.Y. Wu, X.T. Liu, S.P. Sorensen, R.W. Kincaid, M.W. Guidry, D. Cline, W.J. Kernan, E. Vogt, T. Czosnyka, A.E. Kavka, and B. Kotlinski: Oscillating Two-Neutron Transfer Probabilities at Large Radial Separation in Heavy-Ion Reactions. Phys. Lett., submitted 1987.

X.T. Liu, C.Y. Wu, S.P. Sorensen, R.W. Kincaid, X.L. Han, M.W. Guidry, D. Cline, W.J. Kernan, E. Vogt, T. Czosnyka, and A.E. Kavka: Two-Neutron Pairing Enhancement Factors. Phys. Lett., submitted 1987.

Conference Proceedings

C. Fahlander, A. Backlin, L. Hasselgren, A. Kavka, V. Mittal, L.E. Svensson, B. Varnestig, D. Cline, B. Kotlinski, F. Azgui, H. Grein, E. Grosse, R. Kulessa, C. Michel, W. Spreng, J. Stachel, and H.J. Wollersheim: The Quadrupole Properties of the Five-State Multiplet in 114Cd. Niels Bohr Centennial Symposium on Nuclear Structure, Copenhagen, Denmark, 1985, Ed. R.A. Broglia, G.B. Hagemann, and B. Herskind, (North Holland), (1985), 45.

B. Kotlinski, A. Backlin, D. Cline, C.Y. Wu, R.M. Diamond, A. Macchiavelli, and M.A. Stephens: Coulomb Excitation of 168Er. **Proceedings of the 16th Mikolajhi Summer School entitled Heavy-Ions in Nuclear Physics**. Ed. Z. Wilhelmi, M. Kicinska-Habior, (1985), 92.

D. Cline: Nuclear Shapes Studied by Coulomb Excitation. **Proceedings of the Niels Bohr Centennial Conference on NUCLEAR STRUCTURE 1985**, Copenhagen, Denmark, May 20-25, edited by R.A. Broglia, G.B. Hagemann, and B. Herskind, (Elsevier), NSRL-292, (1985), 313.

D. Cline: Quadrupole Collectivity in Nuclei. **Proceedings of the Symposium on Electromagnetic Properties of High Spin States**, Ed. Bergström, A. Kerek, 1985.

L. Hasselgren, J. Srebrny, C.Y. Wu, D. Cline, D. Clark, T. Czosnyka, B. Kotlinski, L. E. Svensson, A. Backlin, C. Fahlander, L. Westerberg, R.M. Diamond, D. Habs, H. Korner, F.S. Stephens, C. Baktash, G.R. Young, and W. Karczmarczyk: Quadrupole Collective Degrees of Freedom in 110Pd. **Proceedings of the 17th Mikolajki Summer School on Nuclear Physics 1985**.

D. Cline: Nuclear Shapes Studied by Coulomb Excitation. **Proceedings of the Int. Conf. on Nuclear Shapes**, June 28 - July 4, 1987. Ed. J.D. Garrett, World Scientific Publishers, (1987).

D. Cline: Heavy-Ion Induced One and Two Neutron Transfer Reactions as a Probe of High-Spin Collective States. **Proceedings of the Workshop on Nuclear Structure at Moderate and High Spin, Berkeley, October, 1986**. Ed. M.A. Deleplanque, R.M. Diamond, F.S. Stephens, (1986), 117;.LBL-22379.

J.O. Rasmussen, M.W. Guidry, and L.F. Canto: Transfer Involving Deformed Nuclei. Niels Bohr Centennial Symposium on Semiclassical Descriptions of Atomic and Nuclear Collisions, Ed. J. de Boer and J. Bang, (North Holland), 1985.

M.W. Guidry: A Q-Window with a View, Nuclear Structure from Heavy-ion Transfer Reactions. **Proceedings of the Workshop on Relations Between Structure and Reactions in Nuclear Physics**, Drexel, (1986).

Diamond & Stephens Group, LBL
Principal Investigators: Drs. R.M. Diamond and F.S. Stephens

* J.E. Draper, J.O. Newton, L.G. Sobotka, H. Lindenberger, G.J. Wozniak, L.G. Moretto, F.S. Stephens, R.M. Diamond, and R. J. McDonald: Dependence of the Giant Dipole Strength Function on Excitation Energy. Phys. Rev. Lett. 49, (1982), 434.

J.H. Hamilton, A.V. Ramayya, R.M. Ronningen, R.O. Sayer, H. Yamada, C.F. McGuire, P. Colombani, D. Ward, R.M. Diamond, F.S. Stephens, I.Y. Lee, P.A. Butler, and D. Habs: Isomeric Trapping Following Coulomb Excitation of High-Spin States in 178H. Phys. Lett. 112B, (1982), 327.

H. Hubel, R.M. Diamond, P. Agner, C. Ellegaard, D. B. Fossan, H. Kluge, C. Schuck, S. Shih, F.S. Stephens, and U. Smilanski: Lifetimes of Unresolved Transitions from very High-Spin States in Nuclei near N=82. Z. Phys. A304, (1982), 225.

* A.J. Pacheco, G.J. Wozniak, R.J. McDonald, R.M. Diamond, C.C. Hsu, L.G. Moretto, D.J. Morrissey, L.G. Sobotka, and F. S. Stephens: Angular Momentum Transfer and Alignment in Deep-Inelastic Reactions for Nearly Symmetric Heavy-Ion Systems. Nucl. Phys. A397, (1983), 313.

* G.J. Wozniak, G.J. Mathews, R.P. Schmitt, R. Regimbart, H. Hubel, R.M. Diamond, and L. G. Moretto: A Study of Charge, Energy, and Angular Momentum Transfer in the 56Fe + 197Au and 56Fe + 107,109Ag Reactions at 7.2 and 8.3 MeV/Nucleon. Nucl. Phys. A402, (1983), 322.

O. Hausser, H.R. Andrews, P. Horn, M.A. Lone, P. Taras, P. Skensved, R.M. Diamond, M.A. Deleplanque, E.L. Dines, A.O. Macchiavelli, and F.S. Stephens: Transient Magnetic Fields for Large-Z Atoms Recoiling through Gadolinium. Nucl. Phys. A412, (1984), 141.

O. Hausser, D. Ward, H.R. Andrews, P. Taras, B. Haas, M.A. Deleplanque, R.M. Diamond, E.L. Dines, A.O. Macchiavelli, R.J. McDonald, F.S. Stephens, and C.V. Stager: Spin Precession of Unresolved High-Spin States in 153-156Dy. Phys. Lett. 144B, (1984), 341.

* T. Czosnyka, D. Cline, L. Hasselgren, C.Y. Wu, R.M. Diamond, H. Kluge, C. Roulet, E.K. Hulet, R.M. Lougheed, and C. Baktash: E2 Properties of the Ground-State Band in 248Cm. Nucl. Phys. A458, (1986), 123.

P. Taras, O. Hausser, H.R. Andrews, D. Ward, M.A. Deleplanque, R.M. Diamond, A.O. Macchiavelli, and F.S. Stephens: Neutron Alignment of High Spin in 156Dy. Nucl. Phys. A435, (1985), 294.

F.K. McGowan, N.R.Johnson, I.Y. Lee, W.T. Milner, C. Roulet, J. Hattula, M.P. Fewell, Y.A. Ellis-Akovali, R.M. Diamond, F.S. Stephens, and M.W. Guidry: Test of the Triaxial Rotor Model and the Interacting Boson Fermion Approximation Model Description of Collective States in 191Ir. Phys . Rev. C33, (1986), 855.

* L.G. Sobotka, G.J. Wozniak, R.J. McDonald, M.A. McMahan, R.J. Charity, L.G. Moretto, Z.H. Liu, F.S. Stephens, R.M. Diamond, M.A. Deleplanque, and A.J. Pacheco: Excitation Energy Division in the First 160 MeV of Total Kinetic Energy Loss for the Reactions: 684 MeV 80Kr + 174Yb. Phys. Lett. B175, (1986), 27.

W.E. Meyerhof, J.P. Molitoris, K. Danzmann, D.W. Spooner, F.S. Stephens, R.M. Diamond, E.M. Beck, A. Schafer, and B. Muller: Search for correlated Narrow-Peak Structure in the Two-Photon Spectrum from 6-MeV/Nucleon U+Th Collisions. Phys. Rev. Lett. 57, (1986), 2139.

K. Danzmann, W.E. Meyerhof, E.C. Montenegro, Xiang-Yuan Xu, E. Dillard, H.P. Hülskotter, F.S. Stephens, R.M. Diamond, M.A. Deleplanque, A.O. Macchiavelli, J. Schweppe, R.J. McDonald, B.S. Rude, and J.D. Molitoris: 180°-Correlated Equal-Energy Photons from 5.9 MeV/N U + Th Collisions. Phys. Rev. Lett.,59(1987)1885.

Western Michigan University Group
Principal Investigators: Professors E.M. Bernstein and J.A. Tanis

E.M. Bernstein, M.W. Clark, J.A. Tanis, K.H. Berkner, R.J. McDonald, A.S. Schlachter, J.W. Stearns, W.G. Graham, R.H. McFarland, T.J. Morgan, J.R. Mowat, D.W. Mueller, and M.P. Stockli: Resonant Electron Transfer and L-shell Excitation for Nb31+ and 57La40+ Ions. J. Phys. B20, L505, (1987).

W.G. Graham, E.M. Bernstein, M.W. Clark, J.A. Tanis, K.H. Berkner, P. Gohil, R.J. McDonald, A.S. Schlachter, J.W. Stearns, R.H. McFarland, T.J. Morgan, and A. Muller: Structure in the Energy Dependence of High-Energy Electron-Capture Cross Sections. Phy. Rev. A33, (1986), 3591.

J.A. Tanis, E.M. Bernstein, M.W. Clark, W.G. Graham, R.H. McFarland, T.J. Morgan, J.R. Mowat, D.W. Mueller, A. Muller, M.P. Stockli, K.H. Berkner, P. Gohil, R.J. McDonald, A.S. Schlachter, and J.W. Stearns: Resonant Transfer and Excitation: Dependence on Projectile Charge State and Target-Electron Momentum Distribution. Phys. Rev. A34, (1986), 2543.

W.G. Graham, K.H. Berkner, E.M. Bernstein, M. Clark, R.H. McFarland, T.J. Morgan, A.S. Schlachter, J.W. Stearns, M.P. Stockli, and J.A. Tanis: Charge-State Dependence of Single-Electron-Capture-and-Loss Cross Sections for Highly Stripped V Ions in He at 8.55 MeV/u. J. Phys. B18, (1985), 2503.

J.A. Tanis, E.M. Bernstein, W.G. Graham, M.P. Stockli, M. Clark, R.H. McFarland, T.J. Morgan, K.H. Berkner, A.S. Schlachter, and J.W. Stearns: Resonant Electron Transfer and Excitation in Two-, Three-, and Four-Electron 20Caq+ and 23Vq+ Ions Colliding with Helium. Phys. Rev. Lett. 53, (1984), 2551.

J.A. Tanis, E.M. Bernstein, M.P. Stockli, W.G. Graham, K.H. Berkner, D.J. Markevich, R.H. McFarland, R.V. Pyle, J.W. Stearns, and J.E. Willis: Correlations Between Charge-Changing Interactions and Projectile K X-Ray Emission in Ar + Xe Collisions. Phys. Rev. A29, (1984), 2232.

Conference Proceedings

E.M. Bernstein, M.W. Clark, J.A. Tanis, W.G. Graham, R.H. McFarland, J.R. Mowat, D.W. Mueller, M.P. Stockli, K.H. Berkner, R.J. McDonald, A.S. Schlachter, and J.W. Stearns: L-Shell Resonant Transfer and Excitation for Ne-like Niobium Ions. Conference on the Physics of Multiply Charged Ions, Groningen, The Netherlands, 1986; Nucl. Instr. Meth. in Phys. Res. B23, (1987), 154.

W.G. Graham, E.M. Bernstein, M.W. Clark, J.A. Tanis, K.H. Berkner, R.J. Mc Donald, A.S. Schlachter, J.W. Stearns, R.H. McFarland, T.J. Morgan, A. Muller, and M.P. Stockli: Electron Loss and Excitation in Collisions of Highly Charged Calcium Ions with H2 and He. Conference on the Physics of Multiply Charge Ions, Groningen, the Netherlands, 1986; Nucl. Instr. Meth.. in Phys. Res B23, (1987).

A.S. Schlachter, K.H. Berkner, R.J. McDonald, J.W. Stearns, E.M. Bernstein, M.W. Clark, J.A. Tanis, W.G. Graham, R.H. McFarland, M.P. Stockli, J.R. Mowat, and D.W. Mueller: Charge Transfer and Excitation in High Energy Ion-Atom Collisions. Third International Workshop on Cross Sections for Fusion and Other Applications, College Station, Texas, 1986; to be published in Nucl. Inst. Methods (1987).

E.M. Bernstein, M.W. Clark, J.A. Tanis, W.G. Graham, R.H. McFarland, T.J. Morgan, J.R. Mowat, D.W. Mueller, M.P. Stockli, K.H. Berkner, R.J. McDonald, A.S. Schlachter, and J.W. Stearns: K and L-Shell Resonant Transfer and Excitation in Ion-Atom Collisions. Ninth Conference on the Applications of Accelerators in Research and Industry, Denton, Texas, 1986; Nucl. Instr. Meth. in Phys Res. B24/B25, (1987), 232.

W.G. Graham, E.M. Bernstein, M.W. Clark, J.A. Tanis, K.H. Berkner, A.S. Schlachter, J.W. Stearns, B.M. Johnson, K.W. Jones, M. Meron, R.H. McFarland, T.J. Morgan, and M.P. Stockli: Ion-X-Ray Coincidence Measurements in Heavy Ion Collisions. Ninth Conference on the Applications of Accelerators in Research and Industry, Denton, Texas, 1986; Nucl. Instr. Meth. in Phy. Res. B24/B25, (1987), 69.

A.S. Schlachter, K.H. Berkner, J.W. Stearns, H. Schmidt-Böcking, S. Kelbch, J. Ullrich, S. Hagmann, R. Richard, M.P. Stockli, W.G. Graham, E.M. Bernstein, M.W. Clark, J.A. Tanis, and A. Muller: Ionization and Charge Transfer in High-Energy Ion-Atom Collisions. 9th Conference on the Applications of Accelerators in Research and Industry, Denton, Texas, 1986; Nucl. Instr. Methods in Phys. Res. B24/B25, (1987), 219.

J.A. Tanis, E.M. Bernstein, M.W. Clark, W.G. Graham, R.H. McFarland, T.J. Morgan, A. Muller, M.P. Stockli, K.H. Berkner, P. Gohil, A.S. Schlachter, J.W. Stearns, B.M. Johnson, K.W. Jones, M. Meron, and J. Nason: Correlated Electron Capture and Inner-Shell Excitation Measurements in Ion-Atom Collisions. 14th International Conference on the Physics of Electronic and Atomic Collisions, Palo Alto, CA, 1985; published in Electronic and Atomic Collisions (Invited Paper), D.C. Lorents, W.E. Meyerhof, and J.R. Peterson eds., (North-Holland, Amsterdam, 1986), 425-430.

J.A. Tanis, E.M. Bernstein, M.W. Clark, W.G. Graham, R.H. McFarland, T.J. Morgan, A. Muller, M.P. Stockli, K.H. Berkner, P. Gohil, A.S. Schlachter, J.W. Stearns, B.M. Johnson, K.W. Jones, M. Meron, and J. Nason: Two-Electron Capture and Loss in Fast Highly Charged Ion-Atom Collisions. Second U.S.-Mexico Symposium on Atomic and Molecular Physics: Two Electron Phenomena, Cocoyoc, Mexico, 1986; to be published.

W.G. Graham, E.M. Bernstein, M.W. Clark, C.S. Oglesby, J.A. Tanis, K.H. Berkner, P. Gohil, A.S. Schlachter, J.W. Stearns, B.M. Johnson, K.W. Jones, M. Meron, R.H. McFarland, T.J. Morgan, A. Muller, and M.P. Stockli: Loss and Excitation in Single Collisions of Highly-Stripped Heavy Ions with Atoms. Second U.S.-Mexico Symposium on Atomic and Molecular Physics: Two Electron Phenomena, Cocoyoc, Mexico, 1986; to be published.

J.A. Tanis, E.M. Bernstein, C.S. Oglesby, W.G. Graham, M. Clark, R.H. McFarland, T.J. Morgan, M.P. Stockli, K.H. Berkner, A.S. Schlachter, J.W. Stearns, B.M. Johnson, K.W. Jones, and M. Meron: Resonant Transfer and Excitation for Highly Charged Ions ($16 \leq Z \leq 23$) in Collisions with Helium. Workshop on Atomic Spectra and Collisions in External Fields, Gaithersburg, Maryland, 1984; published in Atomic Excitation and Recombination in External Fields, M.H. Nayfeh and C.W. Clark eds., (Gordon and Breach, New York, 1985), 453-466.

J.A. Tanis, E.M. Bernstein, C.S. Oglesby, W.G. Graham, M. Clark, R.H. McFarland, T.J. Morgan, M.P. Stockli, K.H. Berkner, A.S. Schlachter, J.W. Stearns, B.M. Johnson, K.W. Jones, and M. Meron: New Evidence for Resonant Transfer and Excitation for 16S, 20Ca, and 23V Ions Colliding with Helium. X-84 International Conference on X-Ray and Inner-Shell Processes in Atoms, Molecules, and Solids, Leipzig, East Germany, 1984; published in X-Ray and Inner-Shell Processes in Atoms, Molecules, and Solids, A. Meisel and J. Finster eds., (Karl-Marx-Unviersitat, Leipzig, 1985), 125-134.

J.A. Tanis, E.M. Bernstein, C.S. Oglesby, W.G. Graham, M. Clark, R.H. McFarland, T.J. Morgan, M.P. Stockli, K.H. Berkner, A.S. Schlachter, J.W. Stearns, B.M. Johnson, K.W. Jones, and M. Meron: Resonant-Transfer-and-Excitation for Highly Charged Ions (16≤Z≤23) in Collisions with Helium. Nucl. Instr. and Meth. B10/11, (1985), 128.

W.G. Graham, J.A. Tanis, E.M. Bernstein, M. Clark, R.H. McFarland, T.J. Morgan, M.P. Stockli, K.H. Berkner, R.V. Pyle, A.S. Schlachter, J.W. Stearns, B.M. Johnson, K.W. Johnson, K.W. Jones, and M. Meron: Charge Changing Collisions of Heavy Ions in Gases at MeV Energies. **Proceedings of the International Workshop on Atomic Physics for Heavy Ion Fusion 1984**, Rutherford Appleton Laboratory, United Kingdom, (1984), 231-240.

LLNL / Oxford University Group
Principal Investigators: Dr. D.D. Dietrich and Professor J.D. Silver

J. D. Silver, A. F. McClelland, J. M. Laming, S. D. Rosner, G. A. Chandler, D. D. Dietrich, and P.O. Egan: Simultaneous Observation of Lyman Alpha and Balmer Beta Transitions in Hydrogenic iron Fe25+ : A novel technique for 1s Lamb shift Measurements. Phys. Rev A36, (1987), 1515.

D. D. Dietrich, G. A. Chandler, R. J. Fortner, C. J. Hailey, and R. E. Stewart: Observation of Electric Quadrupole Decay in Xe45+ and Xe44+. Phys. Rev. Lett 54, (1985), 1008.

D. D. Dietrich, G. A. Chandler, R. J. Fortner, C. J. Hailey, and R. E. Stewart: Precision X-Ray Spectroscopy on 8.5 MeV/amu Heavy Ions. NIM B9, (1985), 686.

C. J. Hailey, R. E. Stewart, G. A. Chandler, D. D. Dietrich, R. J. Fortner: A Precision Measurement of the 2P3/2 - 2P1/2 Fine Structure Splitting in Hydrogenic Iron and Zinc Using Beam Foil Spectroscopy. J. Phys. B18, (1985), 1443.

Gould Group
Principal Investigator: Dr. H. Gould

J. Alonso and H. Gould: Charge Changing Cross-sections for Pb and Xe Ions at Velocities up to 4 x 10^9 cm/sec. Phys. Rev. A26, (1982), 1134-1137.

Stanford (Meyerhof) Group
Principal Investigator: Professor W.E. Meyerhof

R. Anholt, W.E. Meyerhof, J.D. Molitoris, and Xu Jun-Shau: Pb K-Shell Ionization Probability in High-Energy Xe + Pb Collisions. Z. Phys. A386, (1982), 189.

J.D. Molitoris, R. Anholt, W.E. Meyerhof, O.K. Baker, S.Andriamonje, and E. Morenzoni: K-Vacancy Production in High-Energy U + U and U + Pb Collisions at Small Impact Parameters. Z. Phys. A323, (1986), 127.

R. Anholt, D.W. Spooner, J.D. Molitoris, and Ch. Stoller: Small-Impact Parameter Studies of 2pσ-Vacancy Production in High-Z, Heavy-Ion Atom Collisions. J. Phys. B19, L245, (1986).

* J.D. Molitoris, Ch. Stoller, R. Anholt, W.E. Meyerhof, D.W. Spooner, R.J. McDonald, L.G. Sobotka, G.J. Wozniak, M.A. McMahan, E. Morenzoni, M. Nessi, and W. Wölfli: K-Shell Ionization in 7.5- and 8.6-MeV/amu U + U Collisions at Very Small Impact Parameters. Z. Phys. D2, (1986), 91.

* W.E. Meyerhof, J.D. Molitoris, K. Danzmann, D.W. Spooner, F.S. Stephens, R.M. Diamond, E.M. Beck, A. Schäfer, and B. Müller: Search for Correlated Narrow-Peak Structure in the Two-Photon Spectrum from 6 MeV/N U + Th Collisions. Phys. Rev. Lett. 57, (1986), 2139.

* K. Danzmann, W.E. Meyerhof, E.C. Montenegro, Xiang-Yuan Xu, E. Dillard, H.P. Hülskotter, F.S. Stephens, R.M. Diamond, M.A. Deleplanque, A.O. Macchiavelli, J. Schweppe, R.J. McDonald, B.S. Rude, and J.D. Molitoris: 180°-Correlated Equal-Energy Photons from 5.9 MeV/N U + Th Collisions. Phys. Rev. Lett.,59(1987)1885.

Xiang-Yuan Xu, E.C. Montenegro, R. Anholt, K. Danzmann, W.E. Meyerhof, A.S. Schlachter, B. Rude, and R.J. McDonald: Projectile K-Shell Ionization and Excitation in Intermediate-Velocity Atomic Collisions. To be submitted to Phys. Rev. A.

E.C. Montenegro, Xuang-Yuan Xu, R. Anholt, K. Danzmann, W.E. Meyerhof, A.S. Schlachter, B. Rude, and R.J. McDonald: Electron Capture by 861 MeV/amu Highly Ionized Ca Beams in Gas Targets. To be submitted to Phys. Rev. A.

SASSY II Group
Principal Investigator: A. Ghiorso

L.P. Somerville, M.J. Nurmia, J.M. Nitschke, and A. Ghiorso: Spontaneous Fission of Rutherfordium Isotopes. Phys. Rev. C31, (1985), 1801.

P. Armbruster, Y.K. Agarwal, W. Brüchle, M. Brügger, J.P. Dufour, H. Gäggeler, F.P. Hessberger, S. Hofmann, P. Lemmertz, G. Munzenberg, K. Poppensieker, W. Reisdorf, M. Schädel, K.-H. Schmidt, J.H.R. Schneider, W.F.W. Schneider, K. Sümmerer, D. Vermeuklen, G. Wirth, A. Ghiorso, K. E. Gregorich, D. Lee, M. Leino, K.J. Moody, G.T. Seaborg, R.B. Welch, P. Wilmarth, S. Yashita, C. Frink, N. Greulich, G. Herrmann, U. Hickmann, N. Hildebrand, J.V. Kratz, N. Trautmann, M.M. Fowler, D.C. Hoffman, W.R. Daniels, H.R. von Gunten, and H. Dornhöfer: Attempts to Produce Superheavy Elements by Fusion of 48Ca with 248Cm in the Bombarding Energy Range of 4.5-5.2 MeV/u. Phys. Rev. Lett. 54, (1985), 406.

W. Brüchle, Y.K. Agarwal, P. Armbruster, M. Brügger, J.P. Dufour, H. Gäggeler, F.P. Hessberger, S. Hofmann, P. Lemmertz, G. Munzenberg, K. Poppensieker, W. Reisdorf, M. Schädel, K.H. Schmidt, J.H.R. Schneider, W.F.W. Schneider, K. Sümmerer, D. Vermeulen, G. Wirth, A. Ghiorso, K.E. Gregorich, D. Lee, M. Leino, K.J. Moody, G.T. Seaborg, R.B. Welch, P. Wilmarth, S. Yashita, C. Frink, N. Greulich, G. Herrmann, U. Hickmann, N. Hildebrand, J.V. Kratz, N. Trautmann, W.R. Daniels, M.M. Fowler, D.C. Hoffman, H.R. von Gunten, and H. Dornhofer: Attempts to Produce Superheavy Elements by Fusion of 48Ca with 248Cm in the Bombarding Energy Range of 4.5 - 5.2 MeV/u. Journal of the Less-Common Metals, 122, (1986), 425-432.

Heavy Element Chemistry Group, U.C. Berkeley and LBL
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* P. Armbruster, Y.K. Agarwal, W. Brüchle, M. Brügger, J.P. Dufour, H. Gäggeler, F.P. Hessberger, S. Hofmann, P. Lemmertz, G. Munzenberg, K. Poppensieker, W. Reisdorf, M. Schädel, K.-H. Schmidt, J.H.R. Schneider, W.F.W. Schneider, K. Sümmerer, D. Vermeuklen, G. Wirth, A. Ghiorso, K. E. Gregorich, D. Lee, M. Leino, K.J. Moody, G.T. Seaborg, R.B. Welch, P. Wilmarth, S. Yashita, C. Frink, N. Greulich, G. Herrmann, U. Hickmann, N. Hildebrand, J.V. Kratz, N. Trautmann, M.M. Fowler, D. C. Hoffman, W.R. Daniels, H.R. von Gunten, and H. Dornhöfer: Attempts to Produce Superheavy Elements by Fusion of 48Ca with 248Cm in the Bombarding Energy Range of 4.5-5.2 MeV/u. Phys. Rev. Lett. 54, (1985), 406.

D.C. Hoffman, M.M. Fowler, W.R. Daniels, H.R. von Gunten, D. Lee, K.J. Moody, K. Gregorich, R. Welch, G.T. Seaborg, W. Brüchle, M. Brügger, H. Gäggeler, M. Schädel, K. Sümmerer, G. Wirth, Th. Blaich, G. Herrmann, N. Hildebrand, J.V. Kratz, M. Lerch, and N. Trautmann: Excitation Functions for Production of Heavy Actinides from Interactions of 40Ca and 48Ca Ions with 248Cm. Phys. Rev. C31, (1985), 1763.

D.C. Hoffman: Heavy Ion Reactions on Curium Targets. Int. Chem. Congress of Pacific Basic Societies, Honolulu, Hawaii, N. M. Edelstein, et al. (eds.), Americium and Curium Chemistry and Technology, 241-250, D. Reidel Publishing Co. (1985).

H. Gäggeler, W. Brüchle, M. Brügger, M. Schädel, K. Sümmerer, G. Wirth, J.V. Kratz, M. Lerch, Th. Blaich, G. Herrmann, N. Hildebrand, N. Trautmann, D. Lee, K.J. Moody, K.E. Gregorich, R.B. Welch, G.T. Seaborg, D.C. Hoffman, W.R. Daniels, M.M. Fowler, and H.R. von Gunten: Production of Cold Target-Like Fragments in the Reaction of 48Ca + 248Cm. Phys. Rev. C33, (1986), 1983-7.

H. Gäggeler, W. Brüchle, M. Brügger, K.J. Moody, M. Schädel, K. Sümmerer, G. Wirth, Th. Blaich, G. Herrmann, N. Hildebrand, J.V. Kratz, M. Lerch, N. Trautmann, W.R. Daniels, M.M. Fowler, D.C. Hoffman, K. Gregorich, D. Lee, G.T. Seaborg, R. Welch, and H.R. von Gunten: Actinide Yields from the Reactions of 40Ca and 48Ca with 248Cm. Journal of the Less-Common Metals, 122, (1986), 433-439.

* W. Brüchle, Y.K. Agarwal, P. Armbruster, M. Brügger, J.P. Dufour, H. Gäggeler, F.P. Hessberger, S. Hofmann, P. Lemmertz, G. Munzenberg, K. Poppensieker, W. Reisdorf, M. Schädel, K.H. Schmidt, J.H.R. Schneider, W.F.W. Schneider, K. Sümmerer, D. Vermeulen, G. Wirth, A. Ghiorso, K.E. Gregorich, D. Lee, M. Leino, K.J. Moody, G.T. Seaborg, R.B. Welch, P. Wilmarth, S. Yashita, C. Frink, N. Greulich, G. Herrmann, U. Hickmann, N. Hildebrand, J.V. Kratz, N. Trautmann, W.R. Daniels, M.M. Fowler, D.C. Hoffman, H.R. von Gunten, and H. Dornhofer: Attempts to Produce Superheavy Elements by Fusion of 48Ca with 248Cm in the Bombarding Energy Range of 4.5 - 5.2 MeV/u. Journal of the Less-Common Metals, 122, (1986), 425-432.

M.M. Fowler, W.R. Daniels, H.R. von Gunten, H. Gäggeler, D.C. Hoffman, K.J. Moody, M. Lerch, G. Herrmann and N. Trautmann: Radiochemical Separation of Actinides from Copper and Gold Catcher Foils from Heavy Ion Reactions with Actinide Targets. Radiochimica Acta 40, (1986), 75-79.

OASIS (Nitschke) Group
Principal Investigator: Dr. J.M. Nitschke

R.W. Lougheed, E.K. Hulet, R.L. Landingham, J.M. Nitschke, H. Folger, J.V. Kratz, W. Brüchle, and H. Gäggeler: The Preparation of Curium Metal Targets for the Synthesis of Superheavy Elements. Nucl. Instr. and Meth. 200, (1982), 71.

J.M. Nitschke: A Digital Calorimeter. Nucl. Instr. and Meth. 206, (1983), 355.

J.M. Nitschke, M.D. Cable, and W.-D. Zeitz: New Beta-Delayed Proton Emitters in the Lanthanide Region. Z. Physik 312, (1983), 265.

J.M. Nitschke: OASIS: The SuperHILAC On-line Isotope Separator. Nucl. Instr. and Meth. 206, (1983), 341.

J.M. Nitschke: The Application of Alpha Spectroscopy to the Discovery of New Elements. Nucl. Instr. and Meth. Phys. Res. 223, (1984), 303.

J.M. Nitschke, P.A. Wilmarth, P.K. Lemmertz, W.-D. Zeitz, and J.A. Honkanen: Beta-Delayed Proton Emission Observed in New Lanthanide Isotopes. Z. Physik A316, (1984), 249.

J.M. Nitschke: An Electron-Beam-Generated-Plasma Ion Source for On-line Isotope Separation. Nucl. Instr. and Meth. Phys. Res. A236, (1985), 1.

* L.P. Somerville, M.J. Nurmia, J.M. Nitschke, and A. Ghiorso: Spontaneous Fission of Rutherfordium Isotopes. Phys. Rev. C31, (1985), 1801.

K.S. Toth, Y.A. Ellis-Akovali, F.T. Avignone III, R.S. Moore, D.M. Moltz, J.M. Nitschke, P.A. Wilmarth, P.K. Lemmertz, D.C. Sousa, and A.L. Goodman: Single Particle States in 149Er and 149Ho, and the Effect of the Z=64 Closure. Phys. Rev. C32, (1985), 342.

K.S. Toth, Y.A. Ellis-Akovali, F.T. Avignone, J.M. Nitschke, P.A. Wilmarth, P.K. Lemmertz, and D.M.Moltz: Identification of 151Yb via its ß-Delayed-Proton Decay. Submitted to Phys. Rev. C.

P.A. Wilmarth, J.M. Nitschke, R.B. Firestone, and J. Gilat: Beta-Delayed Proton Emission in the Lanthanide Region. Z. Phys. A325, (1986), 485.

K.S. Toth, Y.A. Ellis-Akovali, J.M. Nitschke, P.A.Wilmarth, P.K.Lemmertz, D.M. Moltz, and F.T.Avignone, III: Structure in ß-Delayed Proton Spectra of N=81 Precursors. Phys. Lett. B178, (1986), 150.

K.S. Toth, J. Gilat, J.M. Nitschke, P.A. Wilmarth, K. Vierinen, and F.T. Avignone III: Observation of 149Tm Decay to 149Er Levels and ß-Delayed Proton Emission. Phys. Rev. C36, (1987), 826.

J. Gilat, J.M. Nitschke, P.A. Wilmarth, and R.B. Firestone: Decay Studies of Neutron-Deficient Nuclei Near Z=64: 141Dy, 141Tb, 141Gd, 141Eu. LBL-23407; submitted to Phys. Rev. C.

J.M. Nitschke, P.A. Wilmarth, J. Gilat, and K.S. Toth: Delay Proton Emission of N=81 Precursors: 148Ho, 150Tm, and 152Lu. LBL-23408; submitted to Phys. Rev. C.

K.S. Toth, D.C. Sousa, J.M. Nitschke, and P.A. Wilmarth: Beta Decay Properties of 148Er and 148Ho. Submitted to Phys. Rev. C.

K.S. Toth, D.C. Sousa, J.M. Nitschke, and P.A. Wilmarth: Decay Properties of 150Tm and 150Er. Phys. Rev. C35, (1987), 620.

K.S. Toth, D.C. Sousa, J.M. Nitschke, and P.A. Wilmarth: Investigation of A=152 Radioactivities with Mass-Separated Sources - Identification of Lu-152. Phys. Rev. C35, (1987), 310.

K. Vierinen, J.M. Nitschke, P.A. Wilmarth, J. Gilat, and R.B.Firestone: New Europium Isotopes Near the Proton Drip Line: 134Eu, 135Eu, and 136Eu. LBL-23221 (1987); to be submitted to Nucl. Phys. A.

Conference Proceedings

J.M. Nitschke: Experiments at the Proton Drip Line. Invited talk at the **International Chemical Congress of the Pacific Basin Societies Symposium on the 40th Anniversary of the Discovery of Americium and Curium**, Honolulu, Hawaii, December 16-21, 1984 (D. Reidell Publishing Co., Dordrecht, Holland, 1984).

J.M. Nitschke: Prospects for the Production of Radioactive Beams at the Berkeley SuperHILAC/Bevalac. **Proceedings of the Workshop on Prospects for Research with Radioactive Beams from Heavy Ion Accelerators**, Washington, D.C., (1984), 48; UC-34A, CONF-8404154; LBL-18187.

J.M. Nitschke: Propriétés des emetteurs de protons différé dans la region des lanthanides (invited). 3ème COLLOQUE GANIL, Giens (France), May 1986.

J.M. Nitschke, P.A. Wilmarth, J. Gilat, P. Möller, and K.S. Toth: Beta-Delayed Proton Decay in the Lanthanide Region (invited paper). **Proceedings of the 5th International Conference on Nuclei Far from Stability**, September 1987, Rosseau Lake, Canada (to be published).

J. Gilat, J.M. Nitschke, P.A. Wilmarth, K. Vierinen, and R.B. Firestone: Decay Studies of Neutron Deficient Rare Earth Isotopes with OASIS (invited paper). **Proceedings of the 5th International Conference on Nuclei Far from Stability**, September 1987, Rosseau Lake, Ontario, Canada (to be published).

K.S. Toth, J.M. Nitschke, P.A. Wilmarth, Y.A. Ellis-Akovali, J. Gilat, D.M. Moltz, M.N. Rao, P.C. Sousa, and K. Vierinen: Radioactivities with $146 \leq A \leq 152$ Investigated with the OASIS Facility. **Proceedings of the 5th International Conference on Nuclei Far from Stability**, September 1987, Rosseau Lake, Ontario, Canada (to be published).

K.S. Toth, J.M. Nitschke, P.A. Wilmarth, Y.A. Ellis-Akovali, and K. Vierinen: Decomposition of the 147Dy ß-Delayed-Proton Spectrum. **Proceedings of the 5th International Conference on Nuclei Far from Stability**, September 1987, Rosseau Lake, Ontario, Canada (to be published).

Additional Programs and Publications

During the last 5 years, several principal investigators have effectively terminated their programs because of other commitments. These persons have made substantial contributions but were not included in the body of this program because they do not have ongoing programs at the SuperHILAC.

Prof. R. Vandenbosch, University of Washington

D.-K. Lock, R. Vandenbosch,K.Lesko,S. Gil,A. Seamster,D. Leach, andA. Lazzarini: Nuclide Distributions for Fe-like Fragments in the ^{136}Xe+ ^{56}Fereaction Nucl. Phys. A442 (1985) 142

D.-K.Lock, R. Vandenbosch J. Randrup: Transport and Evaporation Model Calculation of N and Z Distributions for Damped Nuclear Reactions Phys. Rev. C31(1985)1268

R. Vandenbosch, A. Lazzarini, D. Leach, D. Lock, A. Ray, and A. Seamster: Nonequilibrium Excitation-energy Divisiojn in deeply inelastic Collisions. Phys. Rev. Lett. 52 (1984) 1964

K.T. Lesko, S. Gil, A. Lazzarini, V. Metag, A.G. Seamster, and R. Vandenbosch: Properties of Fission Induced by the Complete Capture of ^{40}Ar by ^{238}U at $E_{c.m}$ =291 Mev. Phys. Rev. C27(1983) 2999

Prof R. Marrus, Univ. of California, Berkeley

J.P. Briand, M. Tavernier, R. Marrus, and J.P. Desclaux: High-precision Spectroscopic Study of Heliumlike Iron. Phys. Rev. A29(1984)3143

H. Gould and R. Marrus: Lamb Shift and the Lifetime of the 2S $^2S_{1/2}$ State of Hydrogenlike Argon. Phys. Rev. A28(1983)2001

M.H. Prior, R. Marrus, C.R. Vane: Electron Capture by Trapped Ne^{Q+} Ions at Very Low Energies. Phys. Rev. A28(1983)141

J.P. Briand, M. Tavernier, P. Indelicato, R. Marrus, and H. Gould: High-Precision Spectroscopic Studies of Lyman Alpha Lines of Hydrogenlike Iron: A Measurement of the 1S Lamb Shift. Phys. Rev. Lett. 50(1983)832

R. Mann, C.L. Cocke, A.S. Schlachter, M. Prior, and R. Marrus: Selective Final-state Population in Electron Capture by Low-Energy Highly-charged Projectiles by Energy-Gain Spectroscopy. Phys. Rev. Lett.49(1982)1329

Professor A. Mignerey, Univ. of Maryland: Professor Mignery's publications are listed along with those of Professor Viola with whom she worked as a collaborator.

Drs. David Ward and H.R. Andrews and group, Chalk River: This group worked in close collaboration with the Diamond and Stephens group, and their publications are included there.

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