ABSTRACTS OF PAPERS PUBLISHED
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Isoscalar Giant Resonances in ^{28}Si and the Mass Dependence of Nuclear Compressibility

D. H. Youngblood, Y. -W. Lui, and H. L. Clark
Phys. Rev. C **65**, 034302 (2002)

The giant resonance region from 8 MeV<E_x<55 MeV in ^{28}Si has been studied with inelastic scattering of 240 MeV α particles at small angles including 0°. Strength corresponding to 81±10%, 68±9%, and 15±4% of the isoscalar *E0, E2,* and *E1* sum rules, respectively, was identified with centroids of 21.25±0.38 MeV, 18.54±0.25 MeV, 19.15±0.60 MeV, and rms widths of 6.4±0.6 MeV, 4.7±0.6 MeV, and 6.9±0.7 MeV. The mass dependence of the compression modulus of finite nuclei is shown to be reasonably well reproduced from A = 24 to 208 in relativistic mean field calculations with the NLC interaction having K_{nm}= 225 MeV and in nonrelativistic calculations with the RATP interaction having K_{nm}=240 MeV.

Giant Resonances in ^{16}O

Y. - W. Lui, H. L. Clark, and D. H. Youngblood
Phys. Rev. C, **64**, 064308 (2001)

Giant resonances in ^{16}O have been studied with inelastic scattering of 240 MeV α particles at small angles. Isoscalar *E0, E1,* and *E2* strength corresponding to 48±10%, 32±7%, and 53±10%, of the respective energy-weighted sum rule was identified between E_x=11-40MeV with centroids of 21.13±0.49, 21.67±0.61, and 19.76±0.22 MeV and root-mean-square widths of 8.76±1.82, 7.10±0.52, and 5.11±0.17 MeV, respectively. Elastic scattering and inelastic scattering to states at 6.13, 6.92, and 11.52 MeV were measured from $\theta_{c.m.}$=2.5° to 11.5°.

Isoscalar *EO*, *E1*, and *E2* Strength in ^{40}Ca

D. H. Youngblood, Y. -W. Lui, and H. L. Clark
Phys. Rev. C, **63**, 067301 (2001)

The giant resonance region from *10<E_x<55* MeV in ^{40}Ca has been studied with inelastic scattering of 240-MeV α particles at small angles including 0°. Strength corresponding to 97±11%, 108±12%, and 62 + 10-20% of the isoscalar *E0, E2,* and *E1* sum rules, respectively, was identified with centroids of 19.18±0.37 MeV, 17.84±0.43 MeV, 23.36±0.70 MeV, and rms widths of 4.88±0.57 MeV, 2.89±0.60 MeV, and 5.34±0.90 MeV.

Refractive Elastic Scattering of ^{16}O by ^{12}C at 300 MeV

M. E. Brandan, A. Menchaca-Rocha, L. Trache,
H. L. Clark, A. Azhari, C. A. Gagliardi,
Y. -W. Lui, R. E. Tribble, R. L. Varner,
J. R. Beene, and G. R. Satchler
Nucl. Phys. **A688**, 659 (2001)

The ^{16}O+^{12}C elastic cross section at 300 MeV has been measured over a wide angular range, displaying the shoulder of a nuclear rainbow. The optical model analysis was done using microscopic as well as phenomenological real potentials. The results of this study confirm the potential characteristics found in previous studies at higher and lower energies.

Radius of ^{8}B Halo from the Asymptotic Normalization Coefficient

F. Carstoiu, L. Trache, C. A. Gagliardi
R. E. Tribble and A. M. Mukhamedzhanov
Phys. Rev C **63**, 054310 (2001)

The experimental asymptotic normalization coefficient determined from peripheral transfer reactions is used to obtain the root mean square radius of the wave function for the loosely bound proton in ^{8}B. It is shown that the asymptotic region contributes most and that matching of the interior wave function with the asymptotic part yields a nearly model-independent radius. We obtain $\langle r^2\rangle^{1/2}$=4.20± 0.22 fm for the root mean square radius of the last proton, much larger than the rms radius of the ^{7}Be core. This large value and the fact that the asymptotic part of the proton wave function contributes 85% to the rms radius are good signatures that ^{8}B is a halo nucleus.

Nuclear Physics with Radioactive Beams at Texas A&M University

L. Trache, A. Azhari, C. A. Gagliardi, A. M. Mukhamedzhanov, R. E. Tribble, and X. D. Tang

Acta Physica Polonica, **B32**, 1071 (2001)

A major contribution in nuclear astrophysics is expected now and in the near future from the use of radioactive beams. This paper presents an indirect method utilizing radioactive beams to determine the astrophysical S-factor at the very low energies relevant in stellar processes (tens and hundreds of keV) from measurements at energies more common to the nuclear physics laboratories (10 MeV/nucleon). The Asymptotic Normalization Coefficient method consists of the determination from peripheral transfer reactions of the single particle wave function of the outermost charged particle (proton or alpha particle) around a core in its asymptotic region only, as this is the part contributing to nuclear reactions at very low energies. It can be applied to the study of radiative proton or alpha capture reactions, a very important class of stellar reactions. The method is briefly presented along with our recent results in the determination of the astrophysical factor for the proton capture reactions ^{7}Be(p,γ)^{8}B and ^{11}C(p,γ)^{12}N. The first reaction is crucial for the understanding of the solar neutrino production, the second is a reaction that would bypass the mass A=8 gap in the hot pp chains. Our study was done at the K500 superconducting cyclotron of Texas A&M University. Proton transfer reactions with radioactive beams ^{7}Be and ^{11}C produced with MARS were measured, as well as proton transfer reactions involving stable partners. We present the experiments, then discuss the results and the uncertainties arising from the use of calculated optical potentials between loosely bound radioactive nuclei.

Astrophysical S-factors from Peripheral Transfer Reaction with Radioactive Beams

L. Trache, A. Azhari, C. A. Gagliardi, A. M. Mukhamedzhanov, X. D. Tang, R. E. Tribble, and F. Carstoiu

In *International Symposium on Nuclear Structure Physics*, University of Goettingen R. Casten *et al.*, Eds., World Scientific Publ. Co., Singapore, p. 411 (March 2001)

We have shown in the last years that one can determine astrophysical S-factors for proton radiative capture reactions using the precise knowledge of the tail of the wave function of the last proton in the final nucleus. We first show that from peripheral transfer reactions we can extract more precisely and parameter independent the Asymptotic Normalization Coefficients rather than the spectroscopic factors. Peter von Brentano made this observation in the early years of his stripping reaction studies. Using reactions induced by radioactive beams at Texas A&M University we extracted the S-factors for the ^{7}Be(p,γ)^{8}B reaction, crucial for the solar neutrino problem, for the ^{11}C(p,γ)^{12} N reaction (hot pp chain in novae) and a few other reactions.

Asymptotic Normalization Coefficient of ^{8}B from Breakup Reactions and the S_{17} Astrophysical Factor

L. Trache, F. Carstoiu, C. A. Gagliardi, and R. E. Tribble

Phys. Rev. Lett. **87**, 271102 (2001)

We show that asymptotic normalization coefficients (ANC) can be extracted from one-nucleon breakup reactions of loosely bound nuclei at 30-300 MeV/u. In particular, the breakup of ^{8}B is described in terms of an extended Glauber model. The parallel momentum distribution of core fragments is fully reproduced. The ^{8}B ANC extracted for the ground state of this nucleus from breakup data at several energies and on different targets, C^2_{tot}=0.450±.039 fm^{-1}, leads to the astrophysical factor S_{17}(0)=17.4±1.5 eVb for the key reaction for solar neutrino production ^{7}Be(p,γ)^{8}B. The procedure described here is more general, providing an indirect method to determine reaction rates of astrophysical interest with beams of loosely bound radioactive nuclei.

***TWIST* - The TRIUMF Weak Interaction Symmetry Test – the Michel Parameters from μ^{+} Decay**

N. L. Rodning, W. Andersson, Y. Davydov, P. Depommier, J. Doornbos, W. Faszer,

C. A. Gagliardi, A. Gaponenko, D. R. Gill, P. W. Green, P. Gumplinger, J. C. Hardy, M. Hasinoff, R. Helmer, R. Henderson, P. Kitching, D. D. Koetke, E. Korkmaz, A. Khruchinsky, D. Maas, J. A. Macdonald, R. MacDonald, R. Manweiler, G. Marshall, T. Mathie, J. R. Musser, P. Nord, A. Olin, R. Openshaw, D. Ottewell, T. Porcelli, J. -M. Poutissou, R. Poutissou, G. Price, M. Quraan, J. Schaapman, V. Selivanov, G. Sheffer, B. Shin, F. Sobratee, J. Soukup, T. Stanislaus, G. Stinson, R. Tacik, V. Torokhov, R. E. Tribble, M. A. Vasiliev, H. -C. Walter, S. -C. Wang, and D. Wright
Nucl. Phys. **B98**, 247 (2001)

We propose to make the first high precision measurements of nearly the entire differential spectrum (in energy and angle) of positrons from the decay of polarized muons. The main goal of the experiment is the precise testing of the (*V - A*) structure of electroweak interactions in the framework of the $SU(2)_L \times U(1)$ model.
Highly polarized "surface" μ^+ from the TRIUMF M13 beamline will enter a large volume, high field superconducting magnet on axis and will stop in a thin target at its center. The e^+ from the muon decay will be precisely tracked in the magnetic field using small-cell planar drift chambers. This spectrometer has been simulated with GEANT and EGS4 and has been demonstrated to meet the precision requirements.

Asymptotic Normalization Coefficients and the ^{7}Be(ρ,γ) ^{8}B Astrophysical *S* Factor

A. Azhari, V. Burjan, F. Carstoiu, C. A. Gagliardi, V. Kroha, A. M. Mukhamedzhanov, F. M. Nunes, X, Tang, L. Trache, and R. E. Tribble
Phys. Rev. C **63**, 055803 (2001)

We consider the results of two proton transfer reactions, ^{10}B(^{7}Be, ^{8}B) ^{9}Be and ^{14}N(^{7}Be, ^{8}B) ^{13}C, to obtain a weighted average of the measured asymptotic normalization coefficients for the virtual transition ^{7}Be + $p \leftrightarrow ^8$B. These coefficients specify the amplitude of the tail of the ^{8}B overlap function in the ^{7}Be + *p* channel, and are used to calculate the astrophysical *S* factor for the direct capture reaction ^{7}Be (ρ,γ) ^{8}B at solar energies, $S_{17}(0)$. In light of recent improvements in the determination of optical-model potentials, including detailed understanding of the correlations between the DWBA analyses of the two experiments, and a new experimental measurement of the asymptotic normalization coefficients for the virtual transition ^{13}C + $p \leftrightarrow ^{14}$N, we report a weighted average asymptotic normalization coefficient of $C^2_{p_{3/2}} = 0.388 \pm 0.039$ fm^{-1} for ^{8}B $\leftrightarrow$ ^{7}Be + *p,* which implies $S_{17}(0) = 17.3 \pm 1.8$ eV b.

A Precision Measurement of Muon Decay

M. Quraan, A. Gaponenko, P. Green, P. Kitching, R. MacDonald, G. Price, N. Rodning, J. Schaapman, F. Sobratee, J. Soukup, G. Stinson, A. Khruchinsky, V. Selivanov, Torokhov, C. A. Gagliardi, J. C. Hardy, J. R. Musser, R. E. Tribble, M. A. Vasiliev, W. Andersson, M. Comyn, Y. Davydov, J. Doornbos, W. Faszer, D. Gill, P. Gumplinger, R. Henderson, J. Macdonald, G. Marshall, A. Olin, D. Ottewell, R. Openshaw, J. Poutissou, R. Poutissou, G. Sheffer, H. Walter, D. Wright, M. Hasinoff, D. Mass, P. Depommier, E. Korkmaz, T. Porcelli, T. Mathie, R. Tacik, Y. Shin, D. Koetke, R. Manweiler, P. Nord, and T. Stanislaus
Int. J. Mod. Phys. **A 16**, 296 A, (2001)

The (V - A) structure of the weak interaction was put into the standard model by hand in order to obtain agreement with experiments. These experiments, however, do not rule out relatively large deviations from this structure. Muon decay provides an ideal laboratory to test this structure, being a purely leptonic process. The TRIUMF Weak Interaction Symmetry Test (TWIST) will measure both the energy and emission-angle distribution of positrons from the decay of polarized muons. This will provide a simultaneous determination of the Michel parameters $P\mu\xi, \rho\delta$ describing muon decay with a precision of a few parts in 10^4. Stringent limits may then be placed on the coupling constants, as well as the mass and mixing angle of a possible right-handed W boson (W_R). In this paper the formalism for muon decay is

presented, TWIST is described, and the expected results are discussed.

Asymptotic Normalization Constants in Nuclear Astrophysics

V. Kroha, P. Bem, V. Burjan, J. Novak, S. Piskor, E. Simeckove, J. Vincour, C. A. Gagliardi, A. Mukhamedzhanov, X. Tang, L. Trache, R. Tribble, F. Carstoiu
Czech. J. Phys. **51** (5), 471 (2001)

The indirect method of determining astrophysical nuclear reaction rates is discussed. The overall normalization of the astrophysical S-factor for such reactions may be determined from one quantity, the asymptotic normalization coefficient of the overlap function of the bound state wave functions for the initial and final channels. These coefficients can be found also from peripheral transfer reactions whose amplitudes are determined by the same overlap function as the amplitudes of the corresponding astrophysical radiative capture processes. The experimental test of this approach and the last results of S_{17} measurements are presented.

Measurement of Polarization Observables in Y and Ψ Production with 800 GeV *p* + *Cu* Collisions

P. Reimer, T. Awes, M. Beddo, M. Brooks, C. Brown, J. Bush, T. Carey, T. Chang, W. Cooper, C. A. Gagliardi, G. Garvey, D. Geesaman, E. Hawker, X. He, L. Isenhower, *et al*.
in *Nuclear Physics in the 21st Century*, eds. E. Norman, L. Schroeder, and G. Wozniak, American Institute of Physics Conference Proceedings, **610** 420 (2001)

Despite QCD's success in describing many aspects of the strong interaction, an adequate description of quarkonia production is still missing. While the production of the heavy $Q\overline{Q}$ pair from gluon-gluon fusion or quark-antiquark annihilation can be perturbatively calculated, the long-distance process involving the formation of the bound states is presently not amenable to calculation. Various models of quarkonia production have been proposed, including color singlet and octet components, and these models make predictions for polarization of the quarkonia. FNAL E866 has measured the polarization of quarkonia production in the Ψ and Y families. The data show that the Y (1S) is produced with only slight polarization, and only at large fractional longitudinal momentum (x_F) or large transverse momenta (p_T), while the Y (2S) and (3S) states are completely polarized. In the Ψ family, the J/Ψ is produced with only slight polarization, which changes from transverse to longitudinal as a function of increasing x_F. These results are particularly important to both RHIC and CERN, where charmonium formation plays a critical role in the search for a quark-gluon plasma.

Search for the Lepton-Family-Number Nonconserving Decay $\mu^+ \rightarrow e^+\gamma$

M. Ahmed, J. F. Amann, D. Barlow, K. Black, R. D. Bolton, M. L. Brooks, S. Carius, Y. K. Chen, A. Chernyshev, H. M. Concannon, M. D. Cooper, P. S. Cooper, J. Crocker, J. R. Dittmann, M. Dzemidzic, A. Empl, R. J. Fisk, E. Fleet, W. Foreman, C. A. Gagliardi, D. Haim, A. Hallin, C. M. Hoffman, G. E. Hogan, E. B. Hughes, E. V. Hungerford III, C. C. H. Jui, G. J. Kim, J. E. Knott, D. D. Koetke, T. Kozlowski, M. A. Kroupa, A. R. Kunselman, K. A. Lan, V. Laptev, D. Lee, F. Liu, R. W. Manweiler, R. Marshall, B. W. Mayes II, R. E. Mischke, B. M. K. Nefkens, L. M. Nickerson, P. M. Nord, M. A. Oothoudt, J. N. Otis, R. Phelps, L. E. Piilonen, C. Pillai, L. Pinsky, M. W. Ritter, C. Smith, T. D. S. Stanislaus, K. M. Stantz, J. J. Szymanski, L. Tang, W. B. Tippens, R. E. Tribble, X. L. Tu, L. A. Van Ausdeln, W. H. von Witch, D. Whitehouse, C. Wilkinson, B. Wright, S. C. Wright, Y. Zhang, and K. O. H. Ziock
Phys. Rev. D **65**, 112002 (2002)

The MEGA experiment, which searched for the muon- and electron-number violating decay μ^+-->e^+gamma, is described. The spectrometer system, the calibrations, the data taking procedures, the data analysis, and the sensitivity of the experiment are discussed. The most stringent upper limit on the branching ratio, [script B](μ^+-->e^+gamma)<1.2×10^{-11} with 90% confidence, is derived from a likelihood analysis.

Measurement of Inclusive Antiprotons from Au + Au Collisions at $\sqrt{S_{NN}}$ =130 GeV

STAR Collaboration
Phys. Rev. Lett. **87**, 262302 (2001)

We report the first measurement of inclusive antiproton production at midrapidity in Au + Au collisions at $\sqrt{S_{NN}}$ = 130 GeV by the STAR experiment at RHIC. The antiproton transverse mass distributions in the measured transverse momentum range of $0.25 < p_{\perp} < 0.95$ GeV/c are found to fall less steeply for more central collisions. The extrapolated antiproton rapidity density is found to scale approximately with the negative hadron multiplicity density.

Improved Measurement of the $\bar{d}/\bar{u}$ Asymmetry in the Nucleon Sea

R. S. Towell, P. L. McGaughey, T. C. Awes, M. E. Beddo, M. L. Brooks, C. N. Brown, J. D. Bush, T. A. Carey, T. H. Chang, W. E. Cooper, C. A. Gagliardi, G. T. Garvey, D. F. Geesaman, E. A. Hawker, X. C. He, L. D. Isenhower, D. M. Kaplan, S. B. Kaufman, P. N. Kirk, D. D. Koetke, G. Kyle, D. M. Lee, W. M. Lee, M. J. Leitch, N. Makins, J. M. Moss, B. A. Mueller, P. M. Nord, V. Papavassiliou, B. K. Park, J. C. Peng, G. Petitt, P. E. Reimer, M. E. Sadler, W. E. Sondheim, P. W. Stankus, T. N. Thompson, R. E. Tribble, M. A. Vasiliev, Y. C. Wang, Z. F. Wang, J. C. Webb, J. L. Willis, D. K. Wise, and G. R. Young
Phys. Rev. D **64**, 052002 (2001)

Measurements of the ratio of Drell-Yan yields from an 800 Ge V/c proton beam incident on liquid hydrogen and deuterium targets are reported. Approximately 360 000 Drell-Yan muon pairs remained after all cuts on the data. From these data, the ratio of down antiquark $(\bar{d})$ to up $(\bar{u})$ antiquark distributions in the proton sea is determined over a wide range in Bjorken-*x*. These results confirm previous measurements by E866 and extend them to lower *x*. From these data, $(\bar{d}-\bar{u})$ and $\int(\bar{d}-\bar{u})dx$ are evaluated for $0.015 < x < 0.35$. These results are compared with parametrizations of various parton distribution functions, models and experimental results from NA51, NMC and HERMES.

Asymptotic Normalization Coefficients and Astrophysical Direct Capture Rates

C. A. Gagliardi, A. Azhari, V. Burjan, F. Carstoiu, V. Kroha, A. M. Mukhamedzhanov, A. Sattarov, X. Tang, and R. E. Tribble
Eur. Phys. J. A, **13**, 227 (2002)

Peripheral transfer reactions can be used to determine asymptotic normalization coefficients (ANCs). These coefficients, which specify the normalization of the tail of the nuclear overlap function, determine *S*-factors for direct capture reactions at astrophysical energies. A variety of proton transfer reactions involving both stable and radioactive beams have been used to measure ANCs. Tests have demonstrated that ANCs determined from proton transfer reactions can be used to calculate astrophysical direct capture rates to within 9%. The ^{10}B(^{7}Be, ^{8}B) ^{9}Be and ^{14}N(^{7}Be, ^{8}B) ^{13}C reactions have been used to measure the ANC appropriate for determining the ^{7}Be(p,γ)^{8}B rate, and the ^{14}N(^{11}C, ^{12}N) ^{13}C reaction has been used to measure the ANC required to calculate the ^{11}C(p,γ) ^{12}N rate.

Drift Chambers for a Precision Measurement of the Michel Parameters in Muon Decay

Yu. Davydov, W. Andersson, M. Comyn, P. Depommier, J. Doornbos, W. Faszer, C. A. Gagliardi, D. R. Gill, P. Green, P. Gumplinger, J .C. Hardy, M. Hasinoff , R. Helmer, R. Henderson, A. Khruchinsky, P. Kitching, D. D. Koetke, E. Korkmaz, Yu. Lachin, D. Maas, J. A. Macdonald, R. MacDonald, R. Manweiler, G. Marshall, E. L. Mathie, L. Miassoedov, J. R. Musser, P. Nord, A. 01in, R. Openshaw, D. Ottewell, T. Porcelli, J-M. Poutissou, R. Poutissou, G. Price, M. A. Quraan, N. L. Rodning, J. Schaapman, V. Selivanov, G. Sheffer, B. Shin, F. Sobratee, J. Soukup, T.D.S. Stanislaus, G. Stinson, R. Tacik, V. Torokhov, R. E. Tribble, M. A. Vasiliev, H. C. Walter, and D. Wright
Nucl. Instrum. and Meth. Phys. Res. A **461**, 68 (2001)

Planar drift chambers will be used in a solenoidal magnetic field to measure the Michel parameters in muon decay. The chamber manufacture procedure uses flat glass tables and precise ceramic glass spacers to provide precise anode-cathode spacing. Results of bench and beam tests of the prototype chambers are discussed.

Characteristics of a Delay-line readout in a C**ylindrical Drift Chamber System**

R. Barber, M. W. Ahmed, M. Dzemidzic, A. Empl, E. V. Hungerford, K. J. Lan, J. Wilson, M.D. Cooper, C. A. Gagliardi, D. Haim, G. J. Kim, D. D. Koetke, R. E. Tribble, L. A. Van Ausdeln

Nucl. Instrum. and Meth. Phys. Res. A **479**, 591-598 (2002)

This paper reports on the design, construction, and operational characteristics of a delay-line readout implemented on the cathode foils of a cylindrical drift chamber system. The readout was used to determine the position of an event along the length of the 1.74 m drift wires in the MEGA detectors used at the Los Alamos Meson Physics Facility. The performance of the system is interpreted by comparison to a PSPICE simulation, and to simple analytical models.

^{8}B Astrophysical Factor

A. M. Mukhamedzhanov, C. A. Gagliardi, and R. E Tribble

Nucl. Phys. **A688**, 277c-280c (2001)

We summarize the results for $S_{17}(0)$ derived by different experimental methods and note areas where additional work is required.

Astrophysical *S* Factors Determined from Asymptotic Normalization Coefficients Measured in Peripheral Transfer Reactions

C. A. Gagliardi, A. Azhari, V. Burjan, F. Carstoiu, V. Kroha, A. M. Mukhamedzhanov, X. Tang, L. Trache, and R. E. Tribble

Nucl. Phys **A688**, 536c-538c (2001)

Peripheral transfer reactions can be used to determine asymptotic normalization coefficients (ANC). These coefficients, which specify the normalization of the tail of the overlap function, determine astrophysical *S* factors for direct capture reactions at stellar energies. This technique is particularly suited for use with radioactive beams. The ^{10}B(^{7}Be, ^{8}B) ^{9}Be and ^{14}N(^{7}Be, ^{8}B) ^{13}C reactions have been used to measure the ANC appropriate for determining the ^{7}Be(p, γ) ^{8}B rate, and the ^{14}N(^{11}C, ^{12}N) ^{13}C reaction has been used to measure the ANC required to calculate the ^{11}C(p, γ) ^{12}N rate.

Superallowed Beta Decay: Probing the Standard Model with Nuclei Near N=Z

J. C. Hardy and I. S. Towner

Selected Topics on N = Z Nuclei, Lund University (2000), p. 90

The decay of nuclei near N=Z provides a sensitive method for probing the limitations of the Electroweak Standard Model. To date, the strengths of superallowed 0^{+}-to-0^{+} beta-decay transitions have been determined with high precision from nine different short-lived nuclei, ranging from ^{10}C to ^{54}Co. Each result leads to an independent measure for the vector coupling constant, G_V, and collectively the nine values can be used to test the conservation of the weak vector current (CVC). The results support CVC to better than a few parts in 10,000--a clear success for the Standard Model! However, when the average value of G_V as determined in this way, is combined with data from decays of the muon and kaon to test another prediction of the Standard Model, the result is much more provocative. A test of the unitarity of the Cabibbo-Kobayashi-Maskawa matrix fails by more than two standard deviations. This result, if confirmed by even more precise measurements in the future, could have far-reaching consequences. We describe the current status of the nuclear measurements and compares the results with neutron-decay measurements, which are less precise but consistent with the nuclear results. New nuclear measurements aimed at achieving a definitive result will focus on even-even N = (Z_2) nuclei lighter than A = 40, and on odd-odd N = Z nuclei heavier than A = 60.

Precise Relative and Absolute Germanium Detector Efficiencies for Gamma Rays

R. G. Helmer, J. C. Hardy, and M. A. Ludington
Trans. Am. Nucl. Soc. **84**, 328 (2001)

Gamma-ray spectroscopy is a mature tool for basic laboratory research and for many laboratory and field applications, and its use depends on a knowledge of the detector efficiency. For most of these uses, an efficiency with an accuracy of a few percent is quite adequate. In the last few years, a major emphasis of this field has been to develop techniques for generating efficiencies for volume sources for field applications. These techniques often depend on the earlier validation of laboratory methods. The current work is aimed at establishing a methodology for laboratories to improve the precision of their detector efficiencies from ~0.5 to near 0.1% for both relative efficiencies and absolute efficiencies.

Standard-Model Tests with Superallowed Beta-Decay: An Important Application of Very Precise Mass Measurements

J. C. Hardy and I. S. Towner
Hyperfine Interactions **132**, 115 (2001)

Superallowed beta decay provides a sensitive means for probing the limitations of the Electroweak Standard Model. To date, the strengths (*ft*-values) of superallowed $0^+ \rightarrow 0^+$ beta decay transitions have been determined with high precision from nine different short-lived nuclei, ranging from ^{10}C to ^{54}Co. Each result leads to an independent measure for the vector coupling constant, G_V, and collectively the nine values can be used to test the conservation of the weak vector current (CVC). Within current uncertainties, the results support CVC to better than a few parts in 10,000--a clear success for the Standard Model! However, when the average value of G_V, as determined in this way, is combined with data from decays of the muon and kaon to test another prediction of the Standard Model, the result is much more provocative. A test of the unitarity of the Cabibbo-Kobayashi-Maskawa matrix fails by more than two standard deviations. This result can be made more definitive by experiments that require extremely precise mass measurements, in some cases on very short-lived (<100 ms) nuclei. Here we present the current status and future prospects for these Standard-Model tests, emphasizing the role of precise mass, or mass-difference measurements. There remains a real challenge to mass-measurement technique with the opportunity for significant new results.

Precise Efficiency Calibration of an HPGE Detector Using the Decay of ^{180m}HF

M. Sanchez-Vega, J. C. Hardy, and V. E. Iacob
Romanian Journal of Physics **46**, 53 (2001)

We have used the decay of ^{180m}Hf ($t_{1/2}$ = 5.5 h) to obtain a very precise gamma-ray calibration source in the 90 to 330 keV energy range. The decay of ^{180m}Hf to the ^{180}Hf ground state includes a cascade of three consecutive E2 gamma-ray transitions of energies 332.3, 215.4 and 93.3 keV with no other feeding of the intermediate states. Since the total transition intensities must be the same, the relative gamma-ray intensities emitted by the source are thus dependent only on the calculated E2 conversion coefficients. This provides a rather precise calibration standard.

Superallowed 0^+-to-0^+ Beta Decay: Probing the Weak Force

J. C. Hardy
Trans. Am. Nucl. Soc. **85**, 231 (2001)

The *ft*-values for superallowed 0^+-to-0^+ nuclear beta transitions are key elements in an important test of the electroweak Standard Model: the unitarity of the Cabibbo-Kobayashi-Maskawa (CKM) matrix. Precise measurements of the *ft*-values are used to determine G_V, the vector coupling constant; this, in turn, yields V_{ud}, the up-down element of the CKM matrix. To date, the *ft*-values for nine 0^+-to-0^+ transitions have been determined to a precision of ~0.1% or better; this spans a wide range of nuclear masses from ^{10}C, the lightest parent, to ^{54}Co, the heaviest. As anticipated by the Conserved Vector Current hypothesis, all nine yield consistent values for G_V, but the value of V_{ud} derived from their average yields a more provocative result. The unitarity test fails by more than two standard deviations. This result

would have far-reaching consequences if it were to be confirmed with improved statistical definition.

Production of ^{60}Co Sources for High-Accuracy Efficiency Calibrations of Gamma-Ray Spectrometers

E. Schoenfeld, H. Janssen, R. Klein, J. C. Hardy, V. Iacob, M. Sanchez-Vega, H. C. Griffin, and M. A. Ludington
Radiation Applications and Isotopes, **56**, 215 (2002)

A set of ^{60}Co gamma-ray spectrometer sources has been produced at the PTB. The activity values (10 kBq to 45 kBq) have been measured by the 4B∃-(-coincidence technique with a standard uncertainty of less than 0.1%. Special care was taken to include all contributions to the standard uncertainty of the activity value when establishing the uncertainty budget for the activity of each of these sources. The activity ratio of two of these sources, as obtained by the absolute measurements, was checked by independent gamma-ray counting in two other laboratories, where precision of less than 0.2% was achieved. The described procedure is considered to be a step towards more accurately determined efficiency functions in gamma-ray spectroscopy.

Precise Efficiency Calibration of an HPGE Detector: Source Measurements and Monte Carlo Calculations with Sub-Percent Precision

J. C. Hardy, V. E. Iacob, M. Sanchez-Vega, R. T. Effinger, P. Lipnik, V. E. Mayes, D. K. Willis, and R.G. Helmer
Radiation Applications and Isotopes, **56**, 65 (2002)

With the goal of measuring precise gamma-ray intensities for short-lived (< 5 s) accelerator-produced activities, we have calibrated the efficiency of an HPGe detector between 53 and 1836 keV to sub-percent precision with a combination of source measurements and Monte Carlo calculations. Using known or independently measured detector dimensions, we have achieved both relative and absolute agreement (the latter, to 0.1%) between the calculated and measured efficiencies with only two adjustable detector parameters, the thicknesses of the contact dead layers.

Radioactive Beams at Texas A&M University

R. E. Tribble, A. Azhari, C. A. Gagliardi, J. C. Hardy, A. Mukhamedzhanov, X. Tang, L. Trache, and S. J. Yennello
Nucl. Phys. A **701**, 278 (2002)

The combination of the K500 superconducting cyclotron and the recoil spectrometer MARS has been used to generate secondary radioactive ion beams ranging from ^{7}Be at 12 MeV/u to ^{62}Ga at 37 MeV/u. Secondary beams are produced via transfer reactions in inverse kinematics using stable beams from the cyclotron on gas targets. The radioactive beams have been used for reaction measurements and beta-decay studies.

Cluster Emission and Phase Transition Behaviours in Nuclear Disassembly

Y. G. Ma
J. Phys. G. **27,** 2455 (2001)

The features of the emissions of light particles (LP), charged particles (CP), intermediate mass fragments (IMF) and the largest fragment (MAX) are investigated for ^{129}Xe as functions of temperature and 'freeze-out' density in the frameworks of the isospin-dependent lattice gas model and the classical molecular dynamics model. Definite turning points for the slopes of average multiplicity of LP, CP and IMF, and of the mean mass of the largest fragment (A_{max}) are shown around a liquid-gas phase transition temperature and while the largest variances of the distributions of LP, CP, IMF and MAX appear there. It indicates that the cluster emission rate can be taken as a probe of nuclear liquid--gas phase transition. Furthermore, the largest fluctuation is simultaneously accompanied at the point of the phase transition as can be noted by investigating both the variances of their cluster multiplicity or mass distributions and the Campi scatter plots within the lattice gas model and the molecular dynamics model, which is consistent with the result of the traditional thermodynamical theory when a phase transition occurs.

Target-Atom K-Shell Ionization by Binary Encounter Electrons

V. Horvat and R. L. Watson

J. Phys. B **34**, 777 (2001)

Spectra of K-alpha x rays emitted from Cu atoms bombarded with 10 MeV/u beams of Kr, Xe, and Bi ions were measured with a curved crystal spectrometer. Large enhancements of the K-alpha diagram lines were observed and attributed to secondary ionization by photons and electrons. To explain these results quantitatively, contributions from binary encounter electrons have been calculated by considering their production and transport as well as the effective cross section for target K-shell ionization by electron impact. The results are in good agreement with the measurements.

Projectile and Target Z-Scaling of Target K-Vacancy Production Cross Sections at 10 MeV/amu

R. L. Watson, V. Horvat, and K. E. Zaharakis

In *Application of Accelerators in Research and Industry*, *AIP Conference Proceedings*, Eds. J. L. Duggan and I. L. Morgan, **576**, 93 (2001)

Beams of 10 MeV/u, Ne, Ar, Cr, Kr, Xe and Bi ions have been employed to examine the dependence of target atom K-vacancy production cross sections on projectile and target atomic number. The collision systems studied range in Z1/Z2 from 0.14 to 6.4 and in relative velocity (v1/v2K) from 0.31 to 1.87. Photoionization and ionization by electrons were found to contribute significantly to K-vacancy production in collision systems for which Z1/Z2 > 1. The cross sections for projectiles with Z1 > 18 are greatly overestimated by theoretical (PWBA/ECPSSR) calculations. Empirical scaling laws have been deduced to facilitate the prediction of K-vacancy production cross sections for other collision systems.

Multiple Electron Stripping of 3.4 MeV/u Kr^{7+} and Xe^{11+} in Nitrogen

D. Mueller, L. Grisham, I. Kaganovich,

R. L. Watson, V. Horvat, and K. E. Zaharakis

Phys. Plasmas **8**, 1753 (2001)

Uses of heavy ion beams with ~ 10 MeV/u, mass 200 u and average charge state of 1^+ has been proposed as a driver for heavy-ion-driven, inertial-confinement fusion. Stripping of the ion beam by background gas results in an increase in the space charge density of the beam. This will make focusing the intense ion beam onto small targets problematic. Knowledge of the electron loss cross sections is essential to understand and address the problem. Currently, there are no 10 MeV/u, mass 200 u, charge state 1^+ beams available, and the theories that calculate electron loss cross sections can be experimentally tested only by using available beams of somewhat lower energy and higher initial charge state. The charge state distribution of ions produced in single collisions of 3.4 MeV/u Kr 7^+ and 3.4 MeV/u Xe 11^+ in N2 have been measured using a windowless gas cell. The charge states of the outgoing ions were determined by magnetic analysis using a position-sensitive microchannel-plate detector. The cross sections for single and multiple electron loss were determined. The results indicate that substantial multiple-electron loss occurs. The relative cross section for loss of i + 1 electrons in 0.3 to 0.7 times that for i electron loss. The sum of the electron-weighted cross sections normalized to the total cross section is 1.85 for Kr and 1.97 for Xe.

Kinetic Equation with Exact Charge Conservation

C. M. Ko, V. Koch, Z. W. Lin, K. Redlich,

M. Stephanov, and X. N. Wang

Phys. Rev. Lett. **86**, 5438 (2001)

A kinetic master equation for multiplicity distributions is formulated for charged particles which are created or destroyed only in pairs due to the conservation of their Abelian charge. It allows one to study time evolution of the multiplicity distributions in a relativistic many-body system with arbitrary average particle multiplicities. It is shown to reproduce the equilibrium results for both canonical (rare particles) and grand canonical (abundant particles) systems. For canonical systems, the equilibrium multiplicity is much lower and the relaxation time is much shorter than the naive extrapolation from the grand canonical ensemble

results. Implications for particle chemical equilibration in heavy-ion collisions are also discussed.

Charm Meson Scattering Cross Sections with Pion and Rho Meson

Z. W. Lin, T. G. Di, and C. M. Ko
Nucl. Phys. A **689**, 965 (2001)

Using the local flavor SU(4) gauge invariance in the limit of vanishing vector meson masses, we extend our previous study of charm meson scattering cross sections by pion and rho meson, which is based only on the pseudoscalar-pseudoscalar-vector meson couplings, to include also contributions from the couplings among three vector mesons and among four particles. We find that diagrams with light meson exchanges usually dominate the cross sections. For the processes considered previously, the additional interactions lead only to diagrams involving charm meson exchanges and contact interactions, and the cross sections for these processes are thus not much affected. Nevertheless, these additional interactions introduce new processes with light meson exchanges and increase significantly the total scattering cross sections of charm mesons by pion and rho meson.

Charged Particle Rapidity Distributions at RHIC

Z. W. Lin, S. Pal, C. M. Ko, B. A. Li,
and B. Zhang
Phys. Rev. C **64**, 011902 (2001)

Using a multiphase transport model (AMPT), which includes both initial partonic and final hadronic scattering, we study the rapidity distributions of charged particles such as protons, antiprotons, pions and kaons in central Au+Au collisions at $\sqrt{s}$ = 56, 130, and 200*A* GeV at RHIC. We find that present data at 56 and 130*A* GeV by the PHOBOS collaboration are consistent with a rather weak jet quenching in the initial dense matter. We also find that the antiproton to proton ratio at mid-rapidity increases appreciably with $\sqrt{s}$, indicating the approach to a nearly baryon-antibaryon symmetric matter in high energy-collisions. Furthermore, the K^+/π^+ ratio is almost constant within the energy range studied here, suggesting the approximate chemical equilibrium for strangeness production in these collisions.

Baryon Number Fluctuation and the Quark-Gluon Plasma

Z. W. Lin and C. M. Ko
Phys. Rev. C **64**, 041901 (2001)

We show that ω_B or $\omega_{\bar{B}}$ the squared baryon or antibaryon number fluctuation per baryon or antibaryon, is a possible signature for the quark-gluon plasma that is expected to be created in relativistic heavy ion collisions, as it is a factor of three smaller than in an equilibrated hadronic matter due to the fractional baryon number of quarks. Using kinetic equations with exact baryon number conservation, we find that their values in an equilibrated matter are half of those expected from a Poisson distribution. Effects due to finite acceptance and non-zero net baryon number are also studied.

Strangeness Equilibration in Heavy Ion Collisions at Subthreshold Energies

S. Pal, C. M. Ko, and Z. W. Lin
Phys. Rev. C **64**, 042201 (2001)

Using a relativistic transport model for heavy ion collisions at energies that are below the threshold for kaon and antikaon production in nucleon-nucleon collisions, we study how their abundances approach the canonical equilibrium during the collisions. We find that kaons are far from chemical equilibrium at the initial and high density stage, and they approach equilibrium only during the expansion stage of the collisions when their production rate is small and becomes comparable to their annihilation rate. In contrast, antikaons approach chemical equilibrium much earlier but eventually fall out of equilibrium again as a result of their large annihilation cross sections in nuclear matter.

Studies of Superdense Hadronic Matter in a Relativistic Transport Model

B. A. Li, A. T. Sustich, B. Zhang, and C. M. Ko
Int. Jour. Phys. E **10**, 267 (2001)

Transport models have been very useful in studying the properties of the hot dense matter that is created in relativistic heavy-ion collisions. We review here a Relativistic Transport (ART) Model and its applications in heavy ion collisions at beam energies below about 10 AGeV available from the Alternating Gradient Synchrotron at Brookhaven National Laboratory. The model allows one to study not only the reaction dynamics leading to the formation of a superdense hadronic matter but also to explore the effects due to the nuclear equation of state and the deformation/orientation of the colliding nuclei on the size and lifetime of the superdense matter. We also discuss the dependence of the central baryon and energy densities, the degree of thermalization, and the collective radial flow velocity of the superdense matter on the beam energy. We further review how the properties of the superdense hadronic matter can be determined from studying the collective flow of nucleons, pions and kaons in these collisions. We finally discuss the mechanisms for kaon production in relativistic heavy-ion collisions and review the progress in extracting the kaon in-medium properties from these collisions.

Cross Section for Charmonium Absorption by Nucleons

W. Liu, C. M. Ko, and Z. W. Lin
Phys. Rev. C **65**, 015203 (2002)

The J/ψ absorption cross section by nucleon is studied using a gauged SU(4) hadronic Lagrangian but with empirical particle masses, which has been used previously to study the J/ψ absorption cross section by pion and rho meson. Including both two-body and three-body final states, we find that with a cutoff parameter of 1 GeV at interaction vertices involving charm hadrons, the $J/\psi - N$ absorption is at most 5 mb and is consistent with that extracted from J/ψ production from both photo-nuclear and proton-nucleus reactions.

Multiphase Transport Model for Heavy Ion Collisions at RHIC

Z. W. Lin, S. Pal, C. M. Ko, B. A. Li, and B. Zhang
Nucl. Phys. A **698**, 375 (2002)

Using a multiphase transport model (AMPT) with both partonic and hadronic interactions, we study the multiplicity and transverse momentum distributions of charged particles such as pions, kaons and protons in central Au+Au collisions at RHIC energies. Effects due to nuclear shadowing and jet quenching on these observables are also studied. We further show preliminary results on the production of multistrange baryons from the strangeness-exchange reactions during the hadronic stage of heavy ion collisions.

Partonic Effects on the Elliptic Flow at RHIC

Z. W. Lin and C. M. Ko
Phys. Rev. C **65**, 034904 (2002)

The elliptic flow in heavy ion collisions at RHIC is studied in a multiphase transport model. By converting the strings in the high energy density regions into partons, we find that the final elliptic flow is sensitive to the parton scattering cross section. To reproduce the large elliptic flow observed in Au+Au collisions at $\sqrt{s}$ =130A GeV requires a parton scattering cross section of about 6 mb. We also study the dependence of the elliptic flow on the particle multiplicity, transverse momentum, and particle mass.

Charmonium Production from Relativistic Heavy Ion Collisions in a Multiphase Transport Model

B. Zhang, C. M. Ko, Z. W. Lin, B. A. Li, and S. Pal
Phys. Rev. C **65**, 054909 (2002)

Using A Multi-Phase Transport (AMPT) model, we study J/ψ production from interactions between charm and anti-charm quarks in initial parton phase and between D and $\overline{D}$ mesons in final hadron phase of relativistic heavy ion collisions at the Relativistic Heavy Ion Collider (RHIC). Including also the inverse reactions of J/ψ absorption by gluons and light mesons, we find that the net number of J/ψ from the parton and hadron phases is smaller than that expected from the superposition of initial nucleon-nucleon collisions, contrary to the

J/ψ enhancement predicted by the kinetic formation model. The production of J/ψ is further suppressed if one includes the color screening effect in the parton phase. We have also studied the dependence of J/ψ production on the charm quark mass and the effective charm meson mass.

Charmonium Interactions in Hadronic Matter

C. M. Ko and Z. W. Lin

In *Proceedings of the Sixth International Workshop on Relativistic Aspects of Nuclear Physics*, eds. T. Kodama, C. E. Aguiar, H. Y. Elze, F. Grass, Y. Hama, and G. Krein, World Scientific (2001) 334-344

Both charmonium and charm mesons are relevant for finding the signatures of the quark-gluon plasma formed in ultra-relativistic heavy ion collisions. To study their interactions in hadronic matter, a hadronic Lagrangian based on the SU(4) flavor gauge invariance has been introduced. With coupling constants determined either empirically or by the SU(4) symmetry, the absorption cross section of J/ψ and the scattering cross sections of D and D^* by π and ρ mesons are found to be appreciable.

Strangeness Equilibration in Heavy Ion Collisions

C. M. Ko, Z. W. Lin, and S. Pal

In *Proceedings of the International Conference on Non-Equilibrium and Nonlinear Dynamics in Nuclear and Other Finite Systems*, eds. Z. Li, K. Wu, X. Wu, X. Wu, E. Zhao, and F. Sakata, AIP, New York, **597**, p. 71-80 (2001)

In terms of both kinetic and transport models, we discuss the chemical equilibration of strange particles in heavy ion collisions at both SIS, where their abundance is rare, and at SPS and RHIC, where the abundance is small for some strange particles but large for others.

Chemical Versus Mechanical Instability and Isospin Fractionation in Asymmetric Nuclear Matter

B. A. Li and C. M. Ko

Book on Isospin Physics in Heavy-Ion Collisions at Intermediate Energies, eds. B. A. Li and W. U. Schroder, Nova Science Publishers, New York (2001) p. 163-182

Based on phenomenological nuclear equations of state, we discuss the chemical and mechanical instabilities in a hot isospin-asymmetric nuclear matter. Although both instabilities depend strongly on the isospin asymmetry of the nuclear matter, the boundary of chemical instability in the pressure-density space is more extended than that of mechanical instability. Locations of these boundaries further depend sensitively on both the bulk compressibility of nuclear matter and the density dependence of the symmetry energy. For an asymmetric nuclear matter that is chemically and mechanically stable, a lower neutron excess exists in the liquid phase than in the gas phase. The relation of such isospin fractionation in the nuclear liquid-gas phase transition and the enhanced production of neutron-rich light particles observed in heavy ion collisions is also discussed.

Coulomb Energy Differences in Mirror Nuclei Revisited

B. K. Agrawal, Tapas Sil, S. K. Samaddar, J. N. De, and S. Shlomo

Phys. Rev. C **64**, 024305 (2001)

We calculate the Coulomb displacement energies (CDEs) of mirror nuclei using the recent parameter set (NL3) in the relativistic mean-field (RMF) model which includes self-coupling of the scalar meson. The results obtained are compared with the available ones calculated in the nonrelativistic Skynne-Hartree-Fock (SHF) approach that have the best fit to the experimental data. When adjusted to reproduce the charge root-mean- square (rms) radius r_c and the rms radii of the valence orbits, the results of the RMF model for the CDEs agree with those of the SHF model within ~1%. Our investigation also shows that, although the RMF with the NL3 parameter set reproduces the kink in the isotope variation of r_c, the values obtained for CDEs are too small to account for the experimental values without the addition of the contribution due to long-range correlation effects.

Equation of State and Phase Transitions in Asymmetric Nuclear Matter

V. M. Kolomietz, A. I. Sanzhur, S. Shlomo, and S. A. Firin

Phys. Rev. C **64**, 024315 (2001)

The structure of the three-dimension pressure-temperature-asymmetry surface of equilibrium of the asymmetric nuclear matter is studied within the thermal Thomas-Fermi approximation. Special attention is paid to the difference of the asymmetry parameter between the boiling sheet and that of the condensation sheet of the surface of equilibrium. We derive the condition of existence of the regime of retrograde condensation at the boiling of the asymmetric nuclear matter. We have performed calculations of the caloric curves in the case of isobaric heating. We have shown the presence of the plateau region in caloric curves at the isobaric heating of the asymmetric nuclear matter. The shape of the caloric curve depends on the pressure and is sensitive to the value of the asymmetry parameter. We point out that the experimental value of the plateau temperature $T \approx 7$ MeV corresponds to the pressure $P = 10^{-2}$ MeV/fm^3 at the isobaric boiling.

Compression Modes and the Nuclear Matter Incompressibility Coefficient

Shalom Shlomo

Pramana J. Phys. **57**, 557 (2001)

We review the current status of the nuclear matter ($N = Z$ and no Coulomb interaction) incompressibility coefficient, K_{nm}, and describe the theoretical and the experimental methods used to determine K_{nm} from properties of compression modes in nuclei. In particular, we consider the long-standing problem of the conflicting results obtained for K_{nm}, deduced from experimental data on excitation cross sections for the isoscalar giant monopole resonance (ISGMR) and data for the isoscalar giant dipole resonance (ISGDR).

Sound Modes in Hot Nuclear Matter

V. M. Kolomietz and S. Shlomo

Phys. Rev. C, **64**, 044304 (2001)

The propagation of the isoscalar and isovector sound modes in a hot nuclear matter is considered. The approach is based on the collisional kinetic theory and takes into account the temperature and memory effects. It is shown that the sound velocity and the attenuation coefficient are significantly influenced by the Fermi surface distortion (FSD). The corresponding influence is much stronger for the isoscalar mode than for the isovector one. The memory effects cause a nonmonotonous behavior of the attenuation coefficient as a function of the relaxation time leading to a zero-to-first sound transition with increasing temperature. The mixing of both the isoscalar and the isovector sound modes in an asymmetric nuclear matter is evaluated. The condition for the bulk instability and the instability growth rate in the presence of the memory effects is studied. It is shown that both the FSD and the relaxation processes lead to a shift of the maximum of the instability growth rate to the longer-wavelength region.

Memory Effects on Descent from the Nuclear Fission Barrier

V. M. Kolomietz, S. V. Radionov, and S. Shlomo

Phys. Rev. C **64**, 054302 (2001)

Non-Markovian transport equations for nuclear large amplitude motion are derived from the collisional kinetic equation. The memory effects are caused by Fermi surface distortions and depend on the relaxation time. It is shown that nuclear collective motion and nuclear fission are influenced strongly by memory effects at the relaxation time $\tau \geq 5 \times 10^{-23}$ s. In particular, the descent of the nucleus from the fission barrier is accompanied by characteristic shape oscillations. The eigenfrequency and the damping of the shape oscillations depend on the contribution of the memory integral in the equations of motion. The shape oscillations disappear at the short relaxation time regime at $\tau \to 0$, which corresponds to the usual Markovian motion in the presence of friction forces. We show that the elastic forces produced by the memory integral lead to a significant delay for the descent of the nucleus from the barrier. Numerical calculations for the nucleus ^{236}U

show that due to the memory effect the saddle-to-scission time grows by a factor of about 3 with respect to the corresponding saddle-to-scission time obtained in liquid drop model calculations with friction forces.

Surface Instability of a **Nuclear Fermi Liquid Drop**

V. M. Kolomietz and S. Shlomo
Phys. Atom. Nucl. **65**, 68 (2002)

A mechanical instability of an incompressible Fermi liquid drop with respect to surface distortions is considered. It is shown that the Fermi surface distortion (FSD) reduces the instability-growth rate for surface fluctuations due to its effects on both the viscosity and the increase in the stiffness coefficient. The dependence of the limiting temperature T_{lim} on the mass number and the multipolarity of the nuclear-surface distortion is calculated. It is shown that T_{lim} is not influenced by the FSD effect.

Isoscalar Giant Dipole Resonance and Nuclear Matter Incompressibility Coefficient

S. Shlomo and A. I. Sanzhur
Phys. Rev. C, **65**,044310 (2002)

We present results of microscopic calculations of the strength function S(*E)* and a-particle excitation cross sections $\sigma(E)$ for the isoscalar giant dipole resonance (ISGDR). An accurate and general method to eliminate the contributions of spurious state mixing is presented and used in the calculations. Our results provide a resolution to the long standing problem that the nuclear matter incompressibility coefficient *K* deduced from $\sigma(E)$ data for the ISGDR is significantly smaller than that deduced from data for the isoscalar giant monopole resonance.