SECTION II
ABSTRACTS OF TALKS AT
AMERICAN PHYSICAL SOCIETY MEETINGS
(July 1976–June 1977)
High Spin States of $^{125}$Ni Character in Odd-Mass $A = 35 - 43$ Nuclei.* H. NANN, Michigan State U.--Recent investigations of the $(g,6)$ reaction on $^{56}$Co, $^{57}$Fe, and $^{58}$Fe at 40 MeV bombarding energy have resulted in the discovery of many high spin states away from the yrast line. The optimization of the bombarding energy and spectral resolution together with systematic extensive measurements permit the unambiguous assignment of the transfer of different $l$ values in this reaction. Due to the characteristics of the $(g,6)$ reaction, levels of $1 = 4$ ($177^{2}ls_{1}$), $1 = 3$ ($177^{2}gs_{1}$), and $1 = 2$ ($177^{2}ps_{1}$), characterized by $L = 4$ and $L = 4$ angular distributions, respectively, are strongly populated. The strongest observed $L = 6$ transitions in each nucleus lead to the $(l_{imp})_{3}^{2}j_{3}^{2} = (l_{imp})_{3}^{2}j_{3}^{2} = (l_{imp})_{3}^{2}j_{3}^{2}$ configuration spin $17/2$ state. The $L$ transfers and the strengths of the transitions provide insight into the nature and the purity of the configurations of the states observed. The present results will be compared to the results of the $17/2^{+}$ spectroscopy of heavy-ion fusion-evaporation reactions* and of the inelastic alpha particle scattering.*

*Supported by the U.S. National Science Foundation.

Interplay Between Collective and Few-Nucleon Motion in High Spin States.** T.L. KNOO, Michigan State U.--In order to investigate the roles of collective and few-nucleon modes of motion in the behavior of nuclei at high spin, the intrinsic and ground band excitations of a number of nuclei in the $^{57}$Fe region have been studied. High spin states populated in the $(x,n)$ reactions were studied by a variety of $\gamma$-ray and conversion electron spectroscopic techniques. Many high-$K$ 2-, 4-, and 6- quasiparticle structures were identified. In an energy domain not hitherto explored in detail (2-5 MeV), it has been demonstrated that the configurations are well described by the collective model with axial symmetry. Thus, contrary to recent speculation based on the absence of high-$K$ isomers in numerous (heavy ion, xn) studies, axial symmetry is preserved, at least up to that 5 MeV excitation. Changes in the structure of yrast states from that of the ground band to that of different quasiparticle configurations have been observed. This provides the first evidence that intrinsic excitations of heavy deformed nuclei can become yrast. One consequence is the occurrence of several yrast traps; of particular note is a 22$^{+}$ six-quasiparticle isomer at about 5 MeV in $^{57}$Fe. The high angular moments of intrinsic states are generated by aligning the spins of only a few nucleons along the symmetry axis. In contrast, collective rotation involves many nucleons, with the rotation vector perpendicular to the symmetry axis. The similarities between the observed structures may occur at much higher ($\sim 100$-MeV) excitation energies. At ultra high spins, some nuclei may become oblate, the angular moments of yrast states will then arise from nuclear alignment instead of collective rotation, and yrast traps may occur.**

*Supported by the U.S. National Science Foundation.

Iso-spin Multipoles and Nuclei Far from Stability.* WALTER BENSON, Michigan State U.--Mass measurements of $^{79}$P and $^{81}$Cl now virtually complete the $T_s = 3/2$ nuclei in the $p$, $s$ and $d$-shells. Twenty-one isospin quartets based on these nuclei have been measured and, except for the most accurately measured case ($A = 9$, ground state), they are in extremely good agreement with the predictions of Wigner's iso-spin multiplet mass equation. The second mass quintet, $A = 8$, has now been completed, and both it and the $A = 8$ quintet agree well with the multiplet equation. Techniques for reaching the $T_s = 3/2$ and $T_s = 1/2$ nuclei and measuring their masses with high precision are discussed.

*Supported by the U.S. National Science Foundation.

The Contribution of Second Forbidden Terms to Allowed Beta Transitions.** R.R. MISTRY, Oak Ridge Nat. Lab.--Angular distributions of the $^{56}$Ni($p,\gamma$)$^{57}$Ni reaction at $E_p = 40$ MeV have been measured for states in $^{57}$Ni up to an excitation energy of 6 MeV. Spins or limits on spin values are assigned on the basis of the characteristic shapes of the angular distributions. A comparison with recent results of the $^{56}$Ni($p,\gamma$)$^{57}$Ni reaction reveals that several states, in particular $5/2^{+}$, can be explained by the weak-coupling core-excitation model in which a $2p_{3/2}$ hole is coupled to the strong collective states in a $5/2^{+}$ core.**

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Three-quasiparticle States of $^{179}$Hf* I.E. REDDOUT, T.L. KOHO and R.A. WANNER, Mich. State U.--Studies of gamma-ray and conversion electron spectra of $^{179}$Hf, produced in the $^{179}$Hf(p,n)$^{179}$W reaction, reveal the existence of three 3-quasiparticle states. In addition to the well-known 1.1 sec. K$^{23/2}$ state at 1315 keV, two new 3-quasiparticle states have been found: a 25/2 state at 1395 keV and a 19/2 isomeric state at 1342 keV. The former decays via a 120.5 keV E1 transition into the K$^{23/2}$ state at 1355 keV, while the latter decays into the 25/2 state. The energies of these 3-quasiparticle states, compared with the energies of corresponding 2-quasiparticle states in neighboring even-even nuclei, will provide information on the residual nucleon-nucleon interactions.

Supported in part by the US National Science Foundation.

+4-Quasiparticle Isomers in $^{180}$Hf* S.R. FABER, P.M. BERNSTHAL, T.L. KOHO, and R.A. WANNER, Michigan State U.--Recent discovery of several high-K multi-quasiparticle isomers in $^{180}$Hf has motivated a search for similar isomers in the tungsten isotopes. Prompt and delayed $\gamma$-coincidence experiments carried out following the $^{178}$Hf(p,n)$^{178}$W reaction have revealed the band structure of the previously known 5/2$^-$ and 7/2$^+$ isomers in $^{180}$W. A delayed transition feeding the spin-15/2$^+$ 7/2$^+$ band member has been unambiguously assigned to a new 8/2$^+$ 15/2$^+$ 4-quasiparticle state, the first of its kind in any $^{180}$W isomer. Preliminary analysis of the data indicates a half-life of 3 sec for this proposed 4-quasiparticle isomer. Other high-spin features of the 180W level scheme can be discussed.

Supported in part by the U.S. National Science Foundation.

A Study of the Structure of $^{193,197,199}$Pt with the (p,d) and (p,p') Reactions. H.T. MEESON, C.H. KING, P.M. BERNSTHAL, T.L. KOHO, and J.A. HOLDER, Jr., Michigan State U.--We have studied the (p,d) and (p,p') reactions on $^{193,197,199}$Pt in order to shed light on the structure of this nucleus. This nucleus is nearly complete and that of the (p,p') reaction is in progress. Our results are still well understood within the context of any standard collective model. The (p,d) data was analyzed in detail using the rigid rotor, triaxial rotor, or spherical model. There are several trends in the (p,d) data noted among the nuclei studied and these will be discussed. For example, the second 4$^+$ state of this nucleus is well populated in all cases and the cross section of the 2$^+$ state increases with neutron number.

Supported in part by the US National Science Foundation.

The Decay of $^{232,238}$U, N.C. BECK, M.L. HORN, C.H. McHARD, R.A. WANNER, R.B. FIRESTONE, and W.H. KELLY, Michigan State U.--The decay of 2.4-h $^{232}$Pu was studied using Ge(Li) detectors and a coincidence system. The 797$^{232}$Pu decay was measured primarily by the reactions $^{232}$U(p,n)$^{235}$U and $^{232}$U(p,p)$^{232}$U using a 28 cm$^3$ NaI(Tl) scintillator and a Ge(Li) detector. The results of these measurements are presented.

Work supported by the National Science Foundation.

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+Supported by the National Science Foundation.

A Study of the Structure of $^{180}$Hf* S.R. FABER, P.M. BERNSTHAL, T.L. KOHO, and R.A. WANNER, Michigan State U.--The ratio of the spin-flip (V) to the non-spin-flip (T) components of the central charge-exchange part of the effective nucleon-nucleon interaction may be determined from the cross section for the reaction $^{180}$Hf(T,p)Me (0.00, 0.43 MeV) reactions. Previous experiments have been unable to resolve the ground state of $^{180}$Hf to the Me level. With the new "beam-widening" neutron time-of-flight facility at MSU, the authors have measured the angular distributions from 0$^\circ$ to 150$^\circ$ at 0.43 MeV. These data, combined with their previous measurement at 0.45 MeV, yield the magnitude of the V2 over this energy range.

Supported in part by the National Science Foundation.

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Supported in part by the US National Science Foundation.

Measurement of V2 with the *$^{7}$Li(p,n)Be* (0.00, 0.43 MeV) Reactions at E=25, 35, and 45 MeV. H.R. DEERING, L.E. YOUNG, R.R. BROWN, S.W. AUSTIN, B.D. SCHWEITZ, and B. DEVITO, Michigan State U.--The ratio of the spin-flip (V) to the non-spin-flip (T) components of the central charge-exchange part of the effective nucleon-nucleon interaction may be determined from the cross section for the reaction $^{7}$Li(p,n)Be (0.00, 0.43 MeV) reactions. Previous experiments have been unable to resolve the ground state of $^{7}$Be to the Me level. With the new "beam-widening" neutron time-of-flight facility at MSU, the authors have measured the angular distributions from 0$^\circ$ to 150$^\circ$ at 0.43 MeV. These data, combined with their previous measurement at 0.45 MeV, yield the magnitude of the V2 over this energy range.

Supported by the National Science Foundation.

Work supported in part by the U.S. National Science Foundation.
Excitation of Giant Resonances by Inelastic Scattering of 130 MeV $^9$Be* A. DUDEREY, J. P. DUGIS, J. P. DUGIS, A. GOLANOFF, and W. OELLENT, Institute for Nuclear Physics of the University of Eberhard Karls University of Würzburg, Germany—Energy spectra of $^{130}$ MeV $^{9}$Be scattered from $^{27}$Al, $^{40}$Ca, $^{129}$Sn, and $^{208}$Pb have been measured. The spectra exhibit a pronounced bump in the excitation energy region around $E_x$ = 63 MeV. While the giant resonance (GR) region of $^{27}$Al extends into several levels, the shape of that of $^{129}$Sn varies with angle, indicating different multiplicities of its components. The angular distributions leading to the GR in $^{27}$Al, $^{129}$Sn and $^{208}$Pb, the 1.18 MeV GR level in $^{129}$Sn and the 2.615 MeV GR level in $^{208}$Pb have been obtained for $\theta$ < 50°. DWUCK calculations using the optical model parameters fitting the elastic data resulted in good fits to the shape of the 2° and 5° levels in $^{129}$Sn and $^{208}$Pb, respectively. For $^{27}$Al and $^{129}$Sn the shapes of the GR angular distributions are well fitted by $L^2$ only. However, for $^{208}$Pb both $L^2$ and $L^4$ curves give comparable quality. Results of analysis in terms of the EWSR strengths and comparison with other available data will be presented.

*Supported in part by the National Science Foundation.

†On leave from IPN Orsay, France.

‡On sabbatical leave 1975–76 from Michigan State University.

Current and Velocity Fields of Rotating Nuclei,* L. M. TAMM and W. DRAKE, Michigan State University—Cranking model wave functions and the usual conversion current operator imply current fields of nuclear rotation, from which velocity fields can be derived. For the single-particle harmonic oscillator, the field components are given explicitly, but in the general case a solution is not given easily. In the cases considered ($^{40}$Ca and $^{129}$Sn) the velocity field does not closely resemble rigid rotation. The model can be compared to experiment for the precessing state of the first excited state of $^{129}$Sn.

*Supported by the National Science Foundation.

††Submitted by DAV GLOF Riki.

Isoscalar Dipole Oscillations in $^{208}$Pb,* D. D. COHEN, H. P. MORSCH and W. BENDEEN, Michigan State University—Inelastic $\alpha$-scattering to states in $^{208}$Pb has been measured at $E_\alpha$ = 48 MeV. Three dipole states are observed at energies of 4.84, 5.29, and 5.50 MeV. Microscopic calculations were performed using $4l$-shell model wave functions. The calculated cross sections are at least one order of magnitude smaller than the experimental ones. This suggests that the excitation of this degree of collective form occurs. A simple collective model in which this excitation is described as a dipole deformation in which yield a good description of our experimental data with a diffuseness change of 0.4 $\hbar$.

*Supported in part by the U.S. National Science Foundation.


Particle-Hole Excitations in $^{16}$O,* H. P. MORSCH, W. BENDEEN, D. RASHY, D. MUELLER and H. HAHN, Michigan State University—In the investigation of giant resonance structures, particle-hole excitations of the closed shell nuclei $^{16}$O are of particular interest. In order to study this kind of excitation in the $^{16}$O parent, $^{16}$F, we measured the $^{16}$F($^{16}$O,$^{16}$F) reaction at 50 MeV and the $^{16}$O($^{16}$O,$^{16}$F) reaction at 35 MeV. In the $^{16}$F($^{16}$O,$^{16}$F) reaction the $^{16}$F($^{16}$O,$^{16}$F)$^{16}$O reaction predominantly $4l$-shell excitation with two particles occupying only the $4p_{\frac{3}{2}}$ shell are excited, whereas in the $^{16}$F($^{16}$O,$^{16}$F) reaction the $^{16}$F($^{16}$O,$^{16}$F)$^{16}$O reaction predominantly $4l$-shell excitation with only the $4p_{\frac{3}{2}}$ shell are excited. Our experiments show that the two reactions do indeed excite the final nucleus quite differently from each other and from the $^{16}$F($^{16}$O,$^{16}$F) reaction.

*Supported in part by the U.S. National Science Foundation.
Deformation Measurements via (p,p') Reactions: J. E. Finch, G. N. Craske, C. R. King, and J. A. Holin, Jr., Michigan State University.—The (p,p') reaction is being studied on targets of 154Sm, 197Au, 197Pt, and 240Pu at a beam energy of 35 MeV. Data have been taken and via a magnetic spectrograph with a position-sensitive proportional counter (10-13 keV FWHM) and with nuclear emulsions (5 keV FWHM). Qualitatively the angular distributions of the 0°, 2°, 4°, and 6° members of the ground state rotational bands are much more structured than either those from (p,γ) reactions on spherical nuclei or on deformed nuclei at lower bombarding energies. Coupled channel calculations including interferences between direct and multiple step excitations, using the nuclear deformation parameters, B2, B4, and B6, from (a,α') work at 50 MeV, and using Becchetti-Greenlees global optical model parameters, produce good fits to the 154Sm and 238Pu data, but do not well do for the 176Yb. The present results will also be compared to those from previous studies of Coulomb excitation, Coulomb-nuclear interference, and inelastic electron scattering experiments.

*Supported by the National Science Foundation.


2. M. D. Gaitanis, W. C. McHarris, A. R. Fink, and R. K. Kells, Michigan State University.—The 1/2- and 9/2+ isomers of 154Sm have been produced primarily by the 238U(α,3α) reaction, using a beam up to 48 MeV from the MSU Cyclotron. The half-life of the 9/2+ isomer was determined to be 54.9±1.7 sec, and that of the 1/2- isomer, 45 sec. Using a high-sensitivity -cooled liquid hydrogen spectrometer, experiments were performed which enabled us to place the y rays in a decay scheme containing several new levels in 154Sm. These states are discussed in shell-model terms.

*Work supported by the National Science Foundation.


Cyclotron Beam Phase Probe: PETER MILLER, M.S. CHIN, J. P. HANCOCK, MICHIGAN STATE UNIVERSITY.—We have developed an apparatus for measuring the phase of the cyclotron beam with respect to the radio frequency accelerating voltage. A beam stopping wedge covered with MoO4 (Sein-LL detector) is inserted into the internal beam at the position where the phase is to be measured. The light pulse resulting from each beam pulse is analyzed by a photomultiplier outside of the cyclotron, connected to a computer-monitored sampling oscilloscope. The computer increases the signal-to-noise ratio by averaging many oscilloscope sweeps and processes the data to derive the beam phase.

The phase probe has been used with beam currents between 0.3 nA and 1.2 nA (8 and 16 ions/sec), but the measured phase data are used to infer corrections to the field trimming coils, we readily obtain isochronism to within 1° (2nd harmonic, 210 turns).

*Supported in part by the U.S. National Science Foundation.

Status Report on Superconducting Cyclotron Magnet: H. G. BLOSSFER, MICHIGAN STATE UNIVERSITY.—A full scale prototype magnet for a 500 MeV superconducting cyclotron is under construction: progress on most major parts has been good. Factory tests of the helium liquifier exceeded performance specifications by 10%; the liquifier is now (Aug. 1976) being set up in East Lansing. Condenser for the coil has been delivered; problems with shipping damage, impurities in cleaning and kinks appear resolved. Critical current for all coils exceeds design values except one at 5.7 tesla (specification value 770 amps—design operating current 700 amps). Factory assembly and inspection of the magnet yoke and pole base is scheduled for Aug. 20. The major delayed item in the project is the coil bobbin which was severely warped in fabrication due to an improper welding procedure; straightening and correcting have delayed the order by several months and we now expect to receive the bobbin on Sept. 1. If this is correct we expect to have coil winding completed at the time of the East Lansing meeting and to be engaged in sealing the cryostat.

*Work supported by the National Science Foundation.


Parity-Mixing Limit for 17/2- Isomer of 93Ge: R. A. BROWN, F. M. BERNHAUS, R. A. WARNER, and L. F. YOUNG, MICHIGAN STATE UNIVERSITY.—Earlier published work has shown that parity mixing could result in substantial E2 admixture in the isomeric 750.7-keV, [17/2-+ 17/2+] = 11/2- transition in 93Ge, provided that the parity-mixing mixing element is comparable to that recently observed in 93As, for example. A Si(Li) detector with a polycrystalline silicon crystal was used as an electron spectrometer to measure the angular correlation coefficient for the transitions in 93Ge produced in the 238U(p,2p) reaction with a 41 MeV beam. The result of the observed 750.7-keV transition is 0.07 ± 0.02, compared with theoretical values 0.065 ± 0.006. The angular systematics of the 1440 x 10^-3 and 3.3 ± 0.9 x 10^-3 levels will be discussed.

Research supported by the National Science Foundation.


High-Spin States in 146,147,148,149Sm.\textsuperscript{1,2,3}

C.H. KING, B.A. BROWN, and T.L. KHOO, Michigan State Univ., K. EICHLER and H.R. JONSBERG, Oak Ridge Natl. Lab., A.C. KAHLER and L.L. RIEDESCHER, U. of Tennes., and A.G. SCHEIDT, UNISON—Recent theoretical calculations\textsuperscript{4} have indicated that the light Sm nuclides may become oblate at low angular momenta, making possible the existence of yrast trapps.\textsuperscript{2} We have carried out the high spin structures in 146,147,148,149Sm using the (a,xn) reactions at MSU and in 146,147Sm using the (\textsuperscript{3}He,xn) reactions at ONR. No definite evidence for any rotational structures have been observed for states up to I=14. In addition, \textit{g}-time measurements between beam bursts in the (a,xn) reactions have revealed no isomers with half-lives longer than a few nanoseconds.

\textsuperscript{1} Supported by the U.S. National Science Foundation and the USERN.


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A Neutron Scattering Facility.\textsuperscript{1,2} L.E. Young, R.D. Doering, R. Brown, S.H. Austin, A. Galeneky, and S.D. Scherry, Michigan State U.—A system to measure neutron scattering in the 20-40 MeV range has been constructed. Proton beams from the MSU cyclotron with a time resolution of 2 \textmu{}s have been passed through a beam swinger onto a Li neutron producing target. The resulting monenergetic neutron beam of \textsuperscript{10}KeV/sec is directed to a scattering sample on the swinger axis. Rotating the swinger allows angular distributions to be taken from 20-165 degrees with a large area fixed detector at a flight path of 4 to 32 meters. Overall time resolutions of 490 ps for \gamma-rays and 700 ps for neutrons have been observed. Preliminary results of neutron scattering experiments will be described.

\textsuperscript{1} Research supported in part by the National Science Foundation.

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Activation Measurements of the \textsuperscript{7}Be(p,n)\textsuperscript{7}B reaction on \textsuperscript{7}Be and \textsuperscript{7}Li(p,n)\textsuperscript{7}Li on \textsuperscript{7}Li.\textsuperscript{1,2} R.D. Doering, R.D. Doering, C.M. Austin, and R.P. Brown, Michigan State U.—We have been carrying out activation measurements of the \textsuperscript{7}Li(p,n)\textsuperscript{7}Li (0.429 MeV) on \textsuperscript{7}Li in the energy range 25 to 45 MeV. Since the 0.429 MeV state of \textsuperscript{7}Be is the only particle emission state excited in \textsuperscript{7}Be, the measured activation cross section for production of \textsuperscript{7}Be is exclusively due to the ground state and first excited state reactions. This cross section is measured by observing the 0.478 MeV gamma emission in \textsuperscript{7}Li that accompanies the decay of \textsuperscript{7}Be with a branching ratio of 10.4% and is independent of any neutron measurement. The total cross sections obtained by the activation technique have been used to normalize angular distributions of the reaction at a proton energy of 25, 35, and 45 MeV taken with scintillation detectors in neutron time-of-flight experiments.

\textsuperscript{1} Research supported by the U.S. National Science Foundation.

\textsuperscript{2} Present address: Moody College, Texas A&M Univ., College Station.

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Ionization Fluctuations in Drift Chambers.\textsuperscript{1} R.C. MELIN and R.C. MARKHAM, Michigan State U.—The effect of ionization fluctuations on pulse resolution has been simulated by dividing the primary ionisation path into bins corresponding to constant drift times. A random number generator, having a Blum-Leece frequency distribution, then assigns a random amount of charge to each bin. From this, the time development of an individual pulse is constructed. By generating many pulses we have studied the effectiveness of various time derivation techniques. In general we find that these ionization fluctuations make a substantial contribution to the spatial uncertainty of the drift chamber.

\textsuperscript{1} Supported in part by the U.S. National Science Foundation.

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P.V. Ramana Murthy and G.D. Demester, Nucl. Instr. and Meth. 56 (1967) 93.
Inelastic Proton Scattering from $^{24}\text{Mg}^*$

B. EMNELLIRSI, G.N. CRAWLEY, J.A. HOLLEN, Jr., and H. NANCE, Mich. State Univ.—The inelastic scattering of protons by $^{24}\text{Mg}$ has been studied at 46 MeV beam energy using the MSU cyclotron and the Enge split-pole magnetic spectrometer. The detection of protons with a resolution of 10-15 keV FWHM was achieved by a 30 cm long delay line position-sensitive detector mounted in the spectrometer. Resolved states were observed in $^{24}\text{Mg}$ up to an excitation energy of 13.5 MeV. The higher excited states at about 15.1 MeV excitation were also observed in this work. Distorted wave calculations with both macroscopic and microscopic form factors are being compared with the experimental angular distributions. Coupled channels calculations are also being carried out for the low lying states.

Work supported by the National Science Foundation.

The Excitation of M1 Strength in the $^{54}\text{Ni}$ (p, n)$^{54}\text{Co}$ Reaction at 45 MeV Proton Energy

J.E. YOUNG, SAM H. AUDIST, R.R. DOERING, and ARTHUR GALONESKI, Mich. State Univ.—Substantial magnetic dipole strength has been observed in the $^{54}\text{Ni}(p,n)^{54}\text{Co}$ charge exchange reaction using the time-of-flight technique to generate neutron spectra with 100 keV resolution (see figure). The states populated at 9.8 to 11.0 MeV excitation energy in $^{54}\text{Co}$ have been identified as the analogs of $\frac{1}{2}^+$ states in the neighboring nuclei $^{54}\text{Ni}$ and $^{54}\text{Co}$, as seen in the $^{58}\text{Ni}(e,e'p)^{58}\text{Ni}$ and $^{58}\text{Ni}(^3\text{He},p)^{58}\text{Co}$ reactions. Substantial cross section is present at about 4 MeV lower than the analog states, near the expected position of the anti-analog states of the M1 spin-flip excitation. Such states have been observed in the $^{58}\text{Sr}(p,n)$ reaction.

Research supported by the National Science Foundation.
High-Spin Levels in 206Pb Revisited.  S. K. Saba, N. Helper, P. P. Parfenen, F. J. Daily, Purdue Univ., T. L. Heo, C. L. Dobs, F. M. Berntshal, Mich. State Univ. - A 198 Pt(c, 2N) study using a highly enriched foil target has yielded a much more detailed, 206Pb level scheme than was previously known. Many new high-spin negative parity states have been identified, and the level energies and reduced transition probabilities have been found to be in excellent agreement with recent theoretical predictions based on a semidecoupled band description. Unexpectedly, in view of published results for 198, 199, 200Pb, no moderately high transition which could reasonably be interpreted as 8 + 6 was observed in 206Pb if an 8 + 10 doublet exists in this nucleus at about the same energy as in other Hg nuclei, the population of these levels is less than 0.2% of the total (0.2%) cross section. This puzzling result stimulated us to undertake the reinvestigation of the 198Hg level spectra described in the following talk.

Work supported by the USERDA and the NSF.


Froelch et al., preprint, 1976.


High-Spin Levels in $^{197}$Hg and $^{199}$Hg.  H. Helper, S. K. Saba, F. J. Daily, Purdue Univ., S. R. Fabel, T. L. Heo, F. M. Berntshal, Mich. State Univ. - Decoupled yj/2 bands and threeparticle 3/2 bands were identified earlier in $^{197}$Hg. We have reinvestigated the high-spin levels of these nuclei by (y, 3N) reactions on enriched $^{197}$Pt and $^{199}$Pt targets and have considerably extended the level schemes. Levels up to 3/2$^+$ of the yj bands in $^{197}$Hg have been firmly identified; this band exhibits sharp backbending above the 25/2$^+$ level, and the results demonstrate that two-proton transfer is the way in which these levels can be built. The rotation alignment description of the 199Hg level structure is supported, and the decoupled bands faithfully reproduce the ground band structure of $^{199}$Hg; core, with no backbending. A probable explanation for the contrasting $^{197}$Hg and $^{199}$Hg results will be given, and other interesting new features of the level spectra will be discussed.

Work supported by the USERDA and the NSF.


Mass of Lowest $^{12}$C State of $^{12}$C.  R.G. Robertson, T.L. Heo, and G.M. Crandell, Mich. State Univ., A. M. Nicoll, Atomic Energy of Canada Ltd., E.G. Auerber, Unv. of Wash., and S.J. Freedman, Stanford Univ. - Despite many efforts, the 2-state mass of $^{12}$C has not been seen in isospin-forbidden resonance reactions, although there is evidence for weak ground state proton and deuteron decay. In order to check the possibility that the resonance might have been missed due to an errorely accepted value for the excitation energy of the state (27.60361.14 MeV), and to improve the precision of that quantity, we have remeasured the $^{12}$C(p, t) $^{12}$C(2+) Q-value. Tritons from this reaction were detected in nuclear emulsions in the focal plane of a split-pole spectrograph simultaneously with protons, deuterons, and alphas from reactions on $^{12}$C and $^{14}$C. An electrostatic deflector in the spectrograph was used to separate different particle types. In a preliminary analysis of the data, we find E = 27.6261±0.007 MeV.

Work supported by the National Science Foundation.

1. S.J. Freedman et al., unpublished.

Heavy Ion Beam Acceleration on the Michigan State University Cyclotron.** W. J. WALSTON, F. S. MILLER, and W. E. CHEN, Mich. State Univ.—An axial code cathode focusing heavy ion source has been operating on the Michigan State University Cyclotron since Sept. 1976. Ion beams from lithium to argon and mass numbers up to 90 have been accelerated and extracted from the cyclotron. Extraction in intensities of pico- to nano-ampere levels have been obtained for lithium, carbon, nitrogen, and oxygen isobars. The lithium beam was obtained from LiF pellets, which were sputtered by a "cold bombardment" beam of neon. The heavy ion source has also been used for the production of a proton beam. The ion source is designed for long cathode life and short maintenance times. Maintenance is routinely handled by the experimentalist.

Work supported by the National Science Foundation.

May 3 Body Exchange Current Effects on the Charge Form Factors of 9Be and 9Li.** D. O. MEIKER and M. KADOMSFI, Mich. State U.—We have evaluated the three- and four-phonon-exchange contributions to the charge form factors of the three- and four-body nuclei. At momentum transfers 10 fm^-2 to 20 fm^-2 the three-phonon-exchange effect is somewhat smaller but of the same order of magnitude as that of the two-phonon-exchange effect.** The four-phonon-exchange effect is considerably less. When p-phonon exchange is taken into account in addition to pion exchange, the role of the many-body currents is reduced significantly.

Work supported by the National Science Foundation.

High-Spin Isomers in 122Sn.** D. HORN, A. R. McDOUGALL, G. KAUFER, T. KAHLER, T. PAISTRYMANN, J. R. BEEH, ROCHELLE, K. H. KOCH, A. M. HANSELMAN, MICHIGAN STATE UNIVERSITY, AND K. A. SJOSTRAND, STOCKHOLM—High-spin isomers in 122Sn have been populated by means of the 208Pb(19F, 5n) reaction. Excitation functions, g-factors, angular distributions, and half-lives have been measured. The level ordering obtained is well explained by theory up to the 6.20 MeV (T_1/2 = 113 ns) level. On the basis of the excitation energy and the y-ray factor (0.7601,0.01) coupling to the 5th state of the 209Pb, we suggest that this level is an isomeric state. Three consecutive transitions leading this level were identified from y-y coincidence data, placing the uppermost level (T_1/2 = 100 ns) at more than 8.0 MeV in excitation, with a possible split of 25 or 26. Additional isomers were found at energies of 2.86 MeV (T_1/2 = 11 ns; T_1/2 = 8 ns), 4.95 MeV (T_1/2 = 28 ns; T_1/2 = 0.010100;T_1/2 = 7.90 MeV (T_1/2 = 35 ns; T_1/2 = 0.060100).**

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**Work supported by the National Science Foundation.

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**Research sponsored by the US ERDA under contract with Union Carbide Corporation and MGH.

**Research sponsored by the US ERDA under contract with Union Carbide Corporation and MGH.
Nuclear Scattering of Low Energy Pions.*
H. McMANNUS, and K.S. STRICKER, Michigan State
Univ.—The sensitivity of low energy (10–65 MeV)
pion-nucleus scattering to effective s and p-wave
pion-nucleon scattering lengths is investigated.
The relationship of these scattering lengths to
those used in pionic atoms, and the impulse ap-
proximation, is discussed.

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