

SECTION IV

ABSTRACTS OF PAPERS IN PRESS

(AFTER JUNE 30, 1977)

The Acetylene Inhibition Method for Short-Term Measurement of Soil Denitrification and its Evaluation Using ^{13}N ¹
M. Scott Smith, Mary K. Firestone, and James M. Tiedje

Abstract: Acetylene was found to effectively inhibit the reduction of N_2O by anaerobic soils. With concentrations of C_2H_2 above 0.1 atm, added NO_3^- was quantitatively converted to N_2O , and added N_2O was reduced at an insignificant rate. Experiments with ^{13}N demonstrated that at low soil nitrate concentrations at least 0.1 atm C_2H_2 was required for effective inhibition. Denitrification rates determined by ^{13}N and by C_2H_2 inhibition methods correlated well, as did determinations of $\text{N}_2\text{O}/(\text{N}_2+\text{N}_2\text{O})$. The methods also revealed that an acceleration in denitrification rate occurred within a few hours after soil was exposed to anaerobic conditions. The acetylene method was generally used to measure denitrification rates in soils incubated as anaerobic slurries, but was also used to determine rates for field moist aggregates incubated anaerobically and aerobically. When assayed as anaerobic slurries, initial denitrification rates ranged from 0.1 to 0.7 nmoles N gas . g soil⁻¹ . min⁻¹ for the mineral soils examined. The denitrification rate in aerobic aggregates was approximately 1000 times less, showing the strong inhibitory effect of O_2 on the indigenous denitrifying enzymes.

Collective Model for Monopole Excitations in ^4He , ^{12}C and ^{24}Mg
H.P. Morsch and P. Decowski

Abstract: Transition densities for monopole excitations have been derived from a simple collective model. Two different monopole modes are obtained, a surface vibration and a compression of the nuclear density. Whereas the low lying monopole transition in ^{24}Mg is well described by a surface vibration monopole excitation in ^4He and ^{12}C are dominated by the compressional mode.

A Comparison of 180 MeV π^+ and π^- Scattering from ^{24}Mg
C.A. Wiedner, J.A. Nolen, Jr., W. Saathoff, R.E. Tribble, J. Bolger, J. Zichy, K. Stricker, H. McManus and J.A. Carr

Abstract: Angular distributions for elastic and inelastic scattering of 180 MeV π^+ and π^- beams from ^{24}Mg have been measured. Optical model calculations for the elastic scattering and DWBA calculations for three inelastic transitions are presented.

The Mass of ^{15}B via a Three Proton Stripping Reaction
T.S. Bhatia, H. Hafner, J.A. Nolen, Jr., W. Saathoff, R. Schuhmacher, R.E. Tribble, G.J. Wagner, and C.A. Wiedner

Abstract: The isotope ^{15}B was produced via the reaction $^{48}\text{Ca}(^{18}\text{O}, ^{15}\text{B})^{51}\text{V}$. The Q-value and mass excess were determined to be -21.76 ± 0.05 MeV and 28.97 ± 0.05 MeV, respectively. A search for the isotope ^{14}Be was unsuccessful.

Elastic Scattering of 130 MeV ^3He
A. Djaloeis, J.-P. Didelez, A. Galonsky, and W. Oelert

Abstract: Angular distributions of the elastic scattering of 130 MeV ^3He on ^{24}Mg , ^{90}Zr , ^{120}Sn and ^{208}Pb have been measured between 7° and 70° (lab.). An optical model analysis of the experimental data has been performed. Both volume and surface absorptions were found to give equivalent fits. Inclusion of a spin-orbit term was unnecessary. In the 60-200 MeV range of the real well depth investigated, there exist two potential families characterized by the volume integral $J_R \sim 330$ and ~ 450 MeV \cdot fm³, respectively. No unusual features, such as exceptionally large diffuseness, were observed in the geometrical parameters.

A Study of the $^{54}\text{Fe}(p,d)^{53}\text{Fe}$ Reaction at 40 MeV
T. Suehiro, J.E. Finck and J.A. Nolen, Jr.

Abstract: The $^{54}\text{Fe}(p,d)^{53}\text{Fe}$ reaction was studied using 40 MeV protons with a split-pole magnetic spectrograph. 53 states were observed up to an excitation energy of 7.364 MeV in ^{53}Fe . At least 29 of these states have not been previously reported. Angular distributions were measured from 6 to 90° for transitions to 35 of these states, and were analysed with the distorted-wave Born approximation calculations. Excitation energies, transferred l values, spectroscopic factors and the implied J^π values are given. Difficulties encountered in obtaining a reliable set of spectroscopic factors were discussed in relation to various prescriptions in the DWBA calculations, and to the one-nucleon transfer sum rule.

Monopole Excitations in ^{12}C and ^{24}Mg
H.P. Morsch and P. Decowski

Abstract: The excitation of the lowest 0^+ states in ^{12}C and ^{24}Mg has been studied in inelastic α scattering at 40 MeV. The experimental data are well described by microscopic calculations which yield EO matrix elements and transition radii in excellent agreement with electron scattering. For ^{24}Mg the sensitivity to n particle - n hole configurations is discussed and phenomenological monopole densities are compared with results of large basis shell model calculations. Very different from the ^{24}Mg case, which is described by n particle - n hole configuration mixing, a large compression (described by a lplh density) has to be assumed for the strong monopole excitation in ^{12}C . These monopole densities are compared to simple macroscopic densities and the effect of short range forces in α scattering is discussed.

An Easily Prepared Scintillator for Viewing Accelerator Beam Spots
J.A. Nolen, Jr.

Abstract: The preparation of thin MgO scintillators and some of their applications for beam viewing are described.

Search for Parity Mixing in the $^{93}\text{Tc } 17/2^-$ Isomer: Measurements of Partial Gamma Decay Widths
B.A. Brown, O. Hausser, T. Faestermann, D. Ward, H.R. Andrews, and D. Horn

Abstract: The angular distributions and linear polarizations of γ rays emitted by the $\tau=15 \mu\text{s}$ $17/2^-$ isomer in ^{93}Tc have been determined. The results imply upper limits of $\leq 6\%$ for the parity-violating E2 component in the $750.78 \text{ keV } 17/2^- \rightarrow 13/2^+$ transition and of $\leq 0.06 \text{ eV}$ for the parity-violating matrix element, $|\langle 17/2^+ | H_{pv} | 17/2^- \rangle|$. The $17/2^- \rightarrow 17/2^+$ level spacing was determined to be $0.30 \pm 0.03 \text{ keV}$ and the corresponding E1 branch was found to be $\leq 6\%$ of the $17/2^- \rightarrow 13/2^+$ branch.

The $^{64}\text{Ni}(^6\text{Li},d)^{68}\text{Zn}$ Reaction
A.M. Bastawros, C.L. Bennett, H.W. Fulbright and R.G. Markham

Abstract: The $^{64}\text{Ni}(^6\text{Li},d)^{68}\text{Zn}$ reaction has been studied at 28 MeV bombarding energy. For several low-lying states in ^{68}Zn , S values extracted via DWBA analysis are compared with shell model and collective model (IBA) predictions.

Study of the $^{21}\text{Ne}(^3\text{He},p)^{23}\text{Na}$ Reaction
H.T. Fortune, J.R. Powers, R. Middleton, H. Nann and B.H. Wildenthal

Abstract: The reaction $^{21}\text{Ne}(^3\text{He},p)^{23}\text{Na}$ have been investigated at a bombarding energy of 18.0 MeV, using enriched ^{21}Ne gas contained in a rotating gas cell. Angular distributions for the positive-parity states have been analyzed with DWBA, using transfer amplitudes from an $(sd)^7$ shell-model calculation. Agreement with experiment is good. Tentative correspondences are suggested for all experimental and theoretical levels below 6 MeV excitation. Low-lying negative-parity states are very weakly populated.

Energy Levels in ^{57}Ni from a Study of the $^{59}\text{Ni}(p,t)^{57}\text{Ni}$ Reaction
H. Nann, A. Saha and S. Raman

Abstract: Energy levels in ^{57}Ni up to an excitation energy of 9 MeV have been studied by the $^{59}\text{Ni}(p,t)^{57}\text{Ni}$ reaction at 40 MeV bombarding energy. An energy resolution of 10-15 keV for the triton groups permitted the identification of about 50 new levels. Unambiguous spin and parity assignments of $3/2^-$ are made to the levels at 0.00, 3.01, 4.92 and 5.19 MeV on the basis of an L=0 admixture in the angular distributions. Values of the orbital angular momentum L transferred to several states have been deduced.

Island of High Spin Isomers near N=82
J. Pedersen, B.B. Back, F.M. Bernthal, S. Bjornholm, J. Borggreen, O. Christensen, F. Folkmann, B. Herskind, T.L. Khoo, M. Neiman, F. Puhlhofer and G. Sletten

Abstract: Experiments aimed at testing for the existence of yrast traps are reported. A search for delayed γ -radiation of lifetimes longer than $\sim 10 \text{ ns}$ and of high multiplicity has been performed by producing more than one hundred compound nuclei between Ba and Pb in bombardments with ^{40}Ar , ^{50}Ti and ^{65}Cu projectiles. An island of high spin isomers is found to exist in the region $64 < Z < 71$ and $N > 82$.

The $^{64}\text{Ni}(^6\text{Li},d)^{68}\text{Zn}$ Reaction
A.M. Bastawros, C.L. Bennett, H.W. Fulbright, and R.G. Markham

Abstract: The $^{64}\text{Ni}(^6\text{Li},d)^{68}\text{Zn}$ reaction has been studied at 28 MeV bombarding energy. For several low-lying states in ^{68}Zn , s values extracted via DWBA analysis are compared with shell model and collective model (IBA) predictions.

The Observation of the $T_3=45/2$ Components of Deep Hole States in ^{207}Pb via the $(^3\text{He},\alpha)$ Reaction at 70 MeV
S. Gales, G.M. Crawley, D. Weber, and B. Zwieglinski

Abstract: A number of narrow lines are observed around 20 MeV excitation energy in ^{207}Pb in the study of the $^{208}\text{Pb}(^3\text{He},\alpha)$ at 70 MeV. Their excitation energies and relative spacing suggest that these peaks arise from the neutron pickup of the inner filled sdhg shell between magic numbers 82 and 50 with isospin number $T=45/2$. In spite of the large reduction factor ($1/2T_3$) expected in the population of such states in transfer reactions and the large continuous background at 20 MeV excitation in ^{207}Pb , these levels are clearly observed with forward cross-section of about 30-90 $\mu\text{b}/\text{sr}$. In addition, distorted-wave Born approximation (DWBA) calculations of the angular distributions agree in shape with the data. Two approaches were used to compute the neutron form factor of such deeply bound states. The solution of coupled-channel Lane equations leads to a DWBA cross section in reasonable agreement with experiment.

Cross Sections for the Quasielastic $^{112,116,124}\text{Sn}$ (p,n) and $^{58}\text{Ni}(p,n)$ Reactions: A Test of the Forward Scattering Amplitude Approximation
S.D. Schery, S.M. Austin, A. Galonsky, L.E. Young, and U.E.P. Berg

Abstract: Cross sections for the $^{112,116,124}\text{Sn}$ (p,n) quasielastic reactions have been measured at $E_p=35.3$ MeV using isotopically mixed targets to provide accurate relative cross sections. $^{58}\text{Ni}(p,n)$ cross sections are measured at 32 MeV. Calculations based on an isospin potential whose imaginary part is calculated in the forward scattering amplitude approximation fit the data substantially better than calculations based on a pure real potential, provided a finite range correction is included.

Fast Resolution Optimization in a Magnetic Spectrograph
E. Kashy, P.S. Miller and J.A. Nolen, Jr.

Abstract: A technique for quickly tuning accelerator and beam optics parameters to obtain high resolution in a magnetic spectrograph is described.

Inner Hole States in ^{207}Pb via the $^{208}\text{Pb}(^3\text{He},\alpha)^{207}\text{Pb}$ Reaction at 70 MeV
S. Gales, G.M. Crawley, D. Weber, and B. Zwieglinski

Abstract: The $^{208}\text{Pb}(^3\text{He},\alpha)^{207}\text{Pb}$ reaction at 70 MeV incident energy was used to populate hole states up to 28 MeV excitation energy in ^{207}Pb . A split-pole spectrometer was used for particle analysis and detection. For the excitation energy range between 0 to 4.5 MeV, about eleven well resolved states are excited. These levels contain the main part of the spectroscopic strengths of the $3p_{1/2}$, $2f_{5/2}$, $3p_{3/2}$, $2f_{7/2}$, $1i_{13/2}$, and $1h_{9/2}$ neutron subshells. Three additional regions of enhanced cross-sections, centered at 5.5, 8.5, and 14 MeV excitation energy in ^{207}Pb , are also observed. The 65 keV energy resolution of the present study revealed fine structure in the peak previously observed around 8.5 MeV in ^{207}Pb . About fifteen levels or groups of levels are populated between 4.5 and 10.5 MeV, and angular distributions have been extracted for each individual peak as well as for the gross structures. A DWBA analysis of the data was carried out and shows that the missing $l=3$ and 5 strengths in ^{207}Pb are located in some strong peaks at 5.13, 5.62, and 6.37 MeV. Thus, the full sum rule is obtained for the neutron subshells between $N=126$ and $N=82$. The highly fragmented peak located at 8.5 MeV excitation energy is shown to arise from $1h_{11/2}$ neutron pickup. Finally, the large structure, 7 MeV wide and centered around 14 MeV, observed for the first time in this work is tentatively interpreted as arising from neutron pickup from the $1g_{9/2}$ inner shell. The T_3 components of the deeply-bound states are also observed between 20 to 24 MeV in ^{207}Pb and therefore from the sum-rule analysis, centroid energies and total strengths for each inner subshell are deduced.

Mass of Lowest $T=2$ State of ^{12}C
R.G.H. Robertson, T.L. Khoo, G.M. Crawley, A.B. McDonald, E.G. Adelberger and S.J. Freedman

Abstract: A precise measurement of the excitation energy of the lowest $T=2$ state in ^{12}C has been made via the $^{14}\text{C}(p,t)^{12}\text{C}$ reaction. The value obtained, 27.5950 ± 0.0024 MeV, is in agreement with earlier (less precise) measurements and therefore does not explain the failure to observe the $T=2$ state in isospin-forbidden resonance reactions. Also reported in this work are an upper limit of 30 keV for the total width of the $T=2$ state and an excitation energy of 3.3492 ± 0.0012 MeV for the first excited state of ^{10}C

The $^{208}\text{Pb}(p,\alpha)^{205}\text{Tl}$ Reaction
P.A. Smith, G.M. Crawley, R.G. Markham, and
D. Weber

Abstract: The $^{208}\text{Pb}(p, \alpha)^{205}\text{Tl}$ reaction has been studied at $E_p=35$ MeV using the Michigan State University cyclotron. Excitation energies and angular distributions have been obtained for many new states in ^{205}Tl . Cluster model DWBA calculations are shown to produce excellent fits to the angular distributions. Among the new states, four are given $(15/2, 17/2)^+$ assignments and one is assigned as $(19/2, 21/2)^+$ on the basis of the DWBA fits.

Mass Measurement of Proton-Rich, Medium-Weight Nuclei by the $(^3\text{He}, ^6\text{He})$ Reaction
R.C. Pardo, E. Kashy, W. Benenson, and L.W. Robinson

Abstract: The $(^3\text{He}, ^6\text{He})$ reaction at 70 MeV on ^{70}Ge , ^{90}Zr , ^{106}Cd , ^{112}Sn , and ^{144}Sm has been used to study the proton-rich nuclei ^{67}Ge , ^{87}Zr , ^{103}Cd , ^{109}Sn , and ^{141}Sm . The observed ground state mass excesses have been determined to be -62.65 ± 0.03 , -79.344 ± 0.009 , $-80,620 \pm 0.018$, -82.634 ± 0.011 , and -75.914 ± 0.014 MeV, respectively. Excited states observed in these reactions are also reported. The cross sections for the $(^3\text{He}, ^6\text{He})$ reaction decreases with increasing A but not as dramatically as has been observed with the $(^3\text{He}, ^7\text{Be})$ reaction.

High-Spin Rotational Levels in ^{178}W Populated in the $^{177}\text{Hf}(\alpha, 3n\gamma)$ Reaction
C.L. Dors, F.M. Bernthal, T.L. Khoo, C.H. King, J. Borggreen and G. Sletten

Abstract: High-spin rotational levels in ^{178}W were populated in the $^{177}\text{Hf}(\alpha, 3n\gamma)$ reaction. The yrast sequence of states is identified to spin 16 and is contrasted with similar data for ^{180}W and ^{182}W . Two probable two quasi-neutron bands with $K^\pi=6^+$ and 7^- are characterized from derived g_K values and decay patterns. The $K^\pi=2^-$ octupole band is identified to spin 13, and the higher-spin members of the lowest $K^\pi=0^+$ band are placed. A 35-ns isomer is identified at 3528 keV.

Inelastic Scattering of 40 MeV Protons from ^{24}Mg :
(II) Microscopic Calculations for Positive Parity States

B. Zwiaglinski, G.M. Crawley, W. Chung, H. Nann, and J.A. Nolen, Jr.

Abstract: Proton inelastic scattering data at 40 MeV bombarding energy are compared to microscopic DWBA calculations for positive parity states in ^{24}Mg utilizing shell-model wave functions spanning the full 2s1d shell basis. Both empirical forces and forces derived from free nucleon-nucleon potentials are used in the calculations. Except for four transitions for which strong coupling effects are evident, the agreement between theory and experiment is quite good. Enhancement factors extracted for the natural parity transitions are consistent with the effective charges obtained from electromagnetic transition rates. Levels corresponding to the giant M1 resonance in ^{24}Mg have been resolved in the present experiment. The fact that the normalization factor between theory and experiment is close to unity for the 10.713 MeV 1^+ ; $T=1$ state indicates that little or no renormalization of the two-body force is necessary for this inelastic transition. It is argued that little renormalization is also involved for magnetic-type inelastic transitions of multi polarities higher than M1.

Study of the $^{10}\text{Be}(d,p)^{11}\text{Be}$ Reaction at 25 MeV
B. Zwiaglinski, W. Benenson, R.G.H. Robertson, and W.R. Coker

Abstract: The distribution of the single-neutron strength up to an excitation energy $E_x=7.0$ MeV in ^{11}Be was investigated with the $^{10}\text{Be}(d,p)^{11}\text{Be}$ reaction at $E_d=25$ MeV. The $1/2^+$, g.s., $1/2^-$, 0.320 MeV and $(5/2)^+$, 1.785 MeV states are found to be excited with significant strength. The spectroscopic factors for these states are compared to the shell model calculations to Teeters and Kurath and of Cohen and Kurath.

Electrostatic Problems? - Relax!
M. Distasio and Wm. C. McHarris

Abstract: We describe the numerical methods of relaxation and over-relaxation for solving Laplace's equation for a system of conductors. These methods are quite tractable nowadays using only modest sized computers. Several simple (analytically solvable) though moderately complicated (arising from experimental situations) examples of their use are given.

The $^{52}\text{Cr}(p,\alpha)^{49}\text{V}$ Reaction
P.A. Smith, J.A. Nolen, Jr., R.G. Markham and
M.A.M. Shahabuddin

Abstract: The $^{52}\text{Cr}(p,\alpha)^{49}\text{V}$ reaction has been studied at a bombarding energy of 35 MeV. The qualitative features of the spectra are discussed. These include the population of proton hole states, analog states, and high spin states. The spectra are compared with other pick-up reaction data and the comparison is shown to be a useful tool for identifying positive parity states in this region. Some states which are observed in $^{51}\text{V}(p,t)^{49}\text{V}$ data are not observed in the (p,α) spectra. j -dependence for $\ell=2$ and 3 transfers is discussed. DWBA calculations using mass three cluster form factors are described and shown to reproduce the experimental angular distributions of the previously known levels. DWBA calculations using microscopic form factors are discussed. These calculations also reproduce the shapes of the angular distributions reasonably well. Relative spectroscopic factors for the proton hole states deduced from the microscopic calculations are shown to be in good agreement with zero order shell model predictions. The general trends of the experimental cross sections for the negative parity microscopic states are shown to be reproduced by microscopic calculations assuming $0f_{7/2}^3$ pick-up.

Study of ^{60}Zn and ^{61}Zn
D.J. Weber, G.M. Crawley, W. Benenson, E. Kashy,
and H. Nann

Abstract: The $(^{12}\text{C},^{10}\text{Be})$ and $(^{12}\text{C},^9\text{Be})$ reactions on ^{58}Ni were studied at 77 MeV. New levels were determined for both residual nuclei, ^{60}Zn and ^{61}Zn . In the case of ^{61}Zn a significant difference from the previously accepted mass was verified by means of the $^{64}\text{Zn}(^3\text{He},^6\text{He})$ reaction. The new mass excess for ^{61}Zn is 56205 ± 20 keV. Angular distributions for the ^{12}C induced reactions are compared with finite range DWBA calculations and found to be insensitive to L- and J-transfer.

A Method for Localizing Small Helium Leaks in Large Cryogenic Vessels
M.L. Mallory and H.G. Blosser

Abstract: Small leaks in a large cryogenic helium vessel have been localized by rapidly changing the temperature in the lead vicinity. As the helium temperature decreases, the viscosity of helium lowers, thereby causing a greater leak into the vacuum jacket. The relative pressure surge then gives a signature which can be used to evaluate various possible leak locations.

High-Spin States in ^{146}Sm
C.H. King, B.A. Brown, and T.L. Khoo

Abstract: Transitions between states up to spin 16h populated in the $^{146}\text{Nd}(\alpha,4n)$ reaction were observed using γ - γ coincidence, γ -ray angular distribution and excitation function, and delayed γ -ray measurements. A level scheme was constructed up to 6.2 MeV with all levels above 3.8 MeV observed for the first time. Levels below 4.1 MeV were interpreted in terms of the coupling between two extra-core neutrons and excitations of the N=82 core. Rotational structures and isomers were searched for above 4.1 MeV, but none were found.

A Collective Model for Dipole Isoscalar Excitations in ^{208}Pb
P. Decowski, H.P. Morsch, and W. Benenson

Abstract: Dipole states in ^{208}Pb around 5 MeV are as strongly excited in (α,α') and (p,p') as are the collective states of higher multipolarity. The reaction strength scales with $B(E1)$ from electromagnetic decays to the ground state. We speculate that this mode of excitation can be described as a general collective mode involving a diffuseness oscillation.

Delayed Coincidence Techniques with Accelerator Beams
R.G.H. Robertson and T.L. Khoo

Abstract: An analysis of delayed coincidence methods with special reference to in-beam experiments is presented. A new technique is described which offers an advantage in efficiency over standard methods, and which is intended for the investigation of radiations populating isomeric states. Simple rules are given for the optimization of delayed coincidence experiments.

Tapped Delay Line Focal Plane Detectors
R.G. Markham

Abstract: The use of commercially available tapped delay lines in focal plane detectors is illustrated by four examples. These lines are small and rugged. They offer design flexibility, high resolution and dynamic range, moderately fast readout and simultaneous event suppression.

Short-Term Measurement of Denitrification Rates in Soils Using ^{13}N and Acetylene Inhibition Methods

J.M. Tiedje, M.K. Firestone, M.S. Smith, M.R. Betlach, R.B. Firestone

Abstract: Previous methods have required long-term incubations to establish denitrification rates in soils. We have used labeled gas production from $^{13}\text{NO}_3^-$ to assay for denitrification on a min-by-min basis for periods up to 3 h, and have used acetylene inhibition of N_2O reductase to measure denitrification from 1/2 to 10 h. $^{13}\text{NO}_3^-$ was generated by the $^{16}\text{O}(p,\alpha)^{13}\text{N}$ reaction. Soils were incubated anaerobically: as slurries for ^{13}N experiments, as both slurries and moist aggregates for acetylene inhibition experiments. The results among methods and treatments were similar. These methods revealed two phases of sequentially increasing rates of denitrification. For the conditions of our experiments their approximate time periods were: (I) 15 min to 1.5 h, (II) 4 h to 10 h, after which growth (phase III) sometimes occurred. Linear rates could be observed within phases I and II. Addition of chloramphenicol reduced the accelerated rate observed for phase II which suggests that derepression of denitrifying enzymes occurred during this period. The rates for phase I are suggested to reflect the activity of the denitrifying enzymes found *in situ*. Separation of $^{13}\text{N}_2\text{O}$ from $^{13}\text{N}_2$ by differential trapping showed that the major product in early periods following anaerobiosis was $^{13}\text{N}_2$ while $^{13}\text{N}_2\text{O}$ was the major product after longer periods.

The Absorptive P-Wave Pion-Nucleus Optical Potential

C.M. Ko and D.O. Riska

Abstract: We derive the absorptive part of the P-wave pion-nucleus optical potential from a two-body model for the absorption mechanism which involves rescattering of a pion and a ρ -meson through a Δ_{33} resonant state. The model gives an adequate explanation for the fundamental π^+d -pp reaction cross section and leads to values for the optical potential parameter which are in fair agreement with those obtained from pion-atom level widths.

Production of A=6 and 7 Isotopes in the $\alpha+\alpha$ Reaction

B.G. Glogola, G.J. Mathews, H.F. Breuer, V.E. Viola, Jr., P.G. Roos, A. Nadasen and Sam M. Austin

Abstract: Cross sections have been measured for the production of ^6He , ^6Li , ^7Li and ^7Be in the $\alpha+\alpha$ reaction between 61.5 and 158.2 MeV. The significance of these measurements for theories of lithium nucleosynthesis and the nature of the galactic cosmic ray spectrum is discussed.

Energy Levels in ^{57}Ni from a Study of the $^{59}\text{Ni}(p,t)^{57}\text{Ni}$ Reaction

H. Nann, A. Saha and S. Raman

Abstract: Energy levels in ^{57}Ni up to an excitation energy of 9 MeV have been studied by the $^{59}\text{Ni}(p,t)^{57}\text{Ni}$ reaction at 40 MeV bombarding energy. An energy resolution of 10-15 keV for the triton groups permitted the identification of about 50 new levels. Unambiguous spin and parity assignments of $3/2^-$ are made to the levels at 0.00, 3.01, 4.92 and 5.19 MeV on the basis of an L=0 admixture in the angular distributions. Values of the orbital angular momentum L transferred to several states have been deduced.

Interpretation of the Anomalous Electron Capture to Positron Decay Ratio in ^{22}Na

R.B. Firestone, William C. McHarris and Barry R. Holstein

Abstract: The impact of second-forbidden corrections is studied in order to relate the ϵ/β^+ ratio, the spectral shape factor, and the β - γ directional correlation measurements in ^{22}Na decay.

Nucleon Tunnelling Model of Mass Diffusion in Deep Inelastic Heavy Ion Collisions

C.M. Ko, G.F. Bertsch and D. Cha

Abstract: We derive a simple expression for the mass diffusion coefficient in deep inelastic collisions, based on a proximity formulation of nucleon tunnelling. The predicted value of the coefficient is consistent with empirical data. The mass diffusion coefficient has a negligible dependence on excitation energy in the physically interesting domain.

Calculation of Kr and Xe Induced Deeply Inelastic Heavy-Ion Collisions with the Help of a Transport Equation
D. Agassi, C.M. Ko and Hans A. Weidenmuller

Abstract not available

Analysis of the Deep Inelastic Collision ^{136}Xe on ^{209}Bi with a Transport Equation Including Deformations
C.M. Ko

Abstract not available

On the Least Chi-Square Fit of Elastic Proton-Nucleus Scattering Using the Glauber Model
C.M. Ko

Abstract not available

Initial Organic Products of Fixation of ^{13}N by Root Nodules of Soybean (*Glycine max*)
John C. Meeks, C. Peter Wolk, N. Schilling, Paul W. Shaffer, Y. Avissar, and W.-S. Chien

Abstract not available

The Initial Organic Products of Assimilation of ^{13}N Ammonium and ^{13}N Nitrate by Tobacco Cells Cultured on Different Sources of Nitrogen
Thomas A. Skokut, C. Peter Wolk, Joseph Thomas, J.C. Meeks, Paul W. Shaffer and W.-S. Chien

Abstract not available

Direct Determination of $[(sd)^3]_{5/2\ 1/2}^{(1p^{-2})_{01}}$ Component in ^{17}O (g.s.)
H.T. Fortune, J.N. Bishop, L.R. Medsker, and B.H. Wildenthal

Abstract: Data for the reaction $^{17}\text{O}(^3\text{He},p)^{19}\text{F}$ to the predominantly five-particle, two-hole $3/2^+$ state at 3.91 MeV in ^{19}F are used to estimate the amount of three-particle, two-hole configuration in ^{17}O (g.s.). The result is 4-5%.

SECTION V
THESIS TITLES
(JULY 1977-JUNE 1978)

Department of Physics

Ph.D. Thesis

Smith, Paul Alexander

Features of the (p, α) Reaction

M.S. Thesis

Motzny, Stephen Joseph

Median Plane Magnetic Field Due
to a Pair of Circular Arc Currents
and A Source to Puller Program for
the Calculation of Ion Trajectories