SECTION IV

ABSTRACTS OF PAPERS IN PRESS

(after June 30, 1976)

Anomalous Optical Model Potential for Sub-Coulomb Protons for 89<A<130

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The (p,n) cross sections for 14 nuclei from A = 89 to 130 were measured from about 2.5 to 5.8 MeV in order to obtain total reaction cross sections. These cross sections disagree with optical model predictions in that the predicted 3p resonance is missing near A = 105 and that the peak near A = 90 is replaced by a valley. The data can be described by introducing an anomalous A-dependence into the depth of the absorptive potential.

CORE POLARIZATION IN INELASTIC SCATTERING*

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ABSTRACT

Inelastic scattering is a source of much useful information about core polarization effects in nuclei near closed shells. Although there have been many theoretical treatments of core polarization effects reported in the literature, the results of these calculations have rarely been applied to the interpretation of inelastic scattering data. In the present paper we review the microscopic models for the treatment of inelastic proton and electron scattering and the microscopic models for the treatment of core polarization. Estimates are made of core excited admixtures in the wave functions for low-lying states in ^{42}Ca, ^{50}Ti, ^{89}Y, ^{90}Zr, ^{207}Pb, and ^{209}Bi. The resulting wave functions are used to calculate theoretical (p,p') cross sections and (e,e') form factors for comparison with available experimental data. "Realistic" G matrix interactions are used as the starting point in both the structure and the (p,p') calculations. In the structure calculations the interaction is modified by means of a "bootstrap" prescription to account for important long-range core correlations and in the (p,p') calculations it is modified by the addition of an imaginary component. It is concluded that the overall features of the experimental data can be understood from these calculations.

*Work supported in part by the U. S. Energy Research and Development Administration and the N.S.F.

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INTERPRETATION OF THE ANOMALOUS ε/β^+ RATIO IN $^{22}Na^*$

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THE ε/β^+ DECAY OF $^{143m+g}$Gd*

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...itation of Giant Resonance in ^{90}Zr by Inelastic ^{6}Li Scattering

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ABSTRACT

Inelastic ^{6}Li scattering by ^{90}Zr was measured at 74 MeV. A broad structure, which appears to be the giant quadrupole resonance, was observed at 13.8 MeV excitation energy. This observation is in agreement with previous work done with ions lighter than ^{6}Li.

*Work supported in part by the U.S. National Science Foundation.

PIONIC DISINTEGRATION OF THE DEUTERON

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Activation and Angular Distribution Measurements of $^{7}Li(p,n)^{7}Be(0.0 + 0.429$ MeV) for $E_p = 25$ to 45 MeV: A Technique for Absolute Neutron Yield Determination*

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Angular distributions of the combined $^{7}Li(p,n)^{7}Be$ reactions to the ground and first excited state of beryllium have been measured at proton energies of 24.8, 35.0, and 45.0 MeV with a typical accuracy of 5%. The total cross section was also obtained at eleven energies between 24 and 45 MeV by activation techniques. The reaction is a potentially convenient source for neutrons, and absolute neutron fluence can be determined independent of beam current and target thickness measurement if the amount of ^{7}Be ($\tau_{\frac{1}{2}} = 53.4$d) produced in the reaction is measured. Following the proton irradiation the amount of ^{7}Be produced is determined by observation of the 0.478 MeV gamma rays from a 10.4% branch of ^{7}Be and this information is combined with the total cross sections and angular distributions to give the neutron fluence at the time of irradiation.

* Work supported in part by the U.S. National Science Foundation.

Δ Production and the Spin Dependence of the PP Total Cross Section*

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Received 20 September 1976

Abstract

The general features of the spin dependence of the total pp cross section for laboratory momenta ≥ 1 GeV/c may be accounted for by considering the π- and ρ-meson-exchange contributions to NΔ and ΔΔ production.

* Research supported by the National Science Foundation

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The $^{40}Ar(p,d)^{39}Ar$ Reaction at $E_p = 35$ MeV*

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ABSTRACT

The $^{40}Ar(p,d)^{39}Ar$ reaction has been studied at a bombarding energy of 35 MeV. A thin planar gas cell target allowed an energy resolution of 30 keV to be achieved. Excitation energies of levels in ^{39}Ar up to 5.6 MeV were obtained, angular distributions being taken from 6° to 40° (laboratory). DWBA fits were made to the observed angular distributions of the stronger states and spectroscopic factors extracted. The results are compared to previous experiments and to shell-model calculations. The data supports the contention that much of the anti-analog state strength is contained in the 3.379 MeV state.

NUCLEAR REACTIONS: $^{40}Ar(p,d)$, $E_p = 35$ MeV, $\Delta E = 30$ keV, measured $\sigma(E_d, \theta)$; DWBA analysis, deduced ℓ values and spectroscopic factors. Planar gas cell target.

On the Validity of a Model for Deep Inelastic Reactions*

by

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ABSTRACT: We show that within the DWBA theory less than 25% of the deep inelastic proton scattering cross-section on ^{208}Pb at E_p=62 MeV can be accounted for by direct one-step excitations of the target nucleus in an independent-particle model. A previous calculation which agrees well with the experimental result using this model probably has erred by misinterpreting the excitation strength amplitude $\beta_L(E)$ to make it about $(2L+1)^{\frac{1}{2}}$ times larger.

* Work supported under USERDA Contract E(11-1)-1764 and National Science Foundation.

Many - Body Exchange Currents and the Tri- and Four-nucleon Charge Form Factors.

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Abstract

We find that the three-body two-pion-exchange currents lead to an effect very similar to that of the two-body one-pion-exchange currents on the charge form factors of ^3H, ^3He and ^4He. Most of this effect is however cancelled by similar ρ-meson exchange currents. The four-body three-meson-exchange currents are of negligible importance for the α-particle charge form factor.

[NUCLEAR REACTIONS ^3He, ^3H, ^4He (e,e); calculated charge form factors with 2-,3- and 4-body meson-exchange operators; pion exchange with/without ρ exchange; simple wavefunctions; effects of correlations, vertex factors.]

* Supported by the National Science Foundation

Elasticity: A Useful Concept for Degenerate Fermi Systems

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The application of classical mechanics of continuous media to quantum systems has had a checkered history. In some instances, the classical equations agree with the results of quantum mechanics. For example, the description of the superfluid ^{4}He condensate by irrotational hydrodynamics and the classical calculation of the plasmon frequency of electron gases accord with quantum mechanics. The hydrodynamic description of the nuclear giant dipole vibration is also successful. In many other cases, however, classical theory seems inadequete. The zero sound mode in liquid ^{3}He and the nuclear giant quadrupole vibration are examples of such systems. A microscopic quantum mechanical treatment is successful for describing these oscillations, while a hydrodynamic theory gives an incorrect frequency. Also, in the description of the plasmon at finite wavenumbers, the correct coefficient of the wavenumber only is obtained by a detailed treatment of the degeneracy of the electrons.

I will show that a simplified picture for all of these phenomena can be made by introducing appropriate elastic constants for the medium. The Lamé constants λ and μ are conveniently defined in terms of an energy function [1],

$$W(\vec{u}) = \int d^3r\left[\tfrac{1}{2}\lambda(\vec{\nabla}\cdot\vec{u})^2 + \mu\sum_{\alpha\beta}(\nabla_\alpha u_\beta)^2\right] \tag{1}$$

where $\vec{u}$ is a displacement vector of the particles in the medium. The shear modulus μ vanishes for hydrodynamics, but not for high

Theory of Deeply Inelastic Heavy-Ion Collisions Based on a Random-Matrix Model

III. Calculation of Cross Sections. Comparison with the Reaction Ar + Th.

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Abstract

The transport equation deduced previously is cast into a form which allows for numerical computation of cross sections. The approximations, especially the moments approach, are exhibited, as are the essential points of the numerical procedure. The validity of the Einstein relation is discussed. Doubly differential cross sections for various fragments produced in the reaction $^{40}Ar + {}^{232}Th$ are calculated and compared with experimental data.

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Supported in part by Bundesministerium für Forschung and by GSI, Darmstadt.

Exchange Currents in Electron Scattering*

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Abstract

The effects of the pion exchange charge and current operators in electron scattering from nuclei is discussed. The definition of the exchange current operators is reviewed. Contributions to nuclear rms radii, charge, and magnetic form factors are discussed in detail.

* Supported in part by the National Science Foundation

Island of High Spin Isomers near N=82

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ABSTRACT: Experiments aimed at testing for the existence of yrast traps are reported. A search for delayed γ-radiation of lifetimes longer than ∿10 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 $64 \lesssim Z \lesssim 71$ and $N \gtrsim 82$

SPECTROSCOPY OF ^{16}C*

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The $^{14}C(t,p)^{16}C$ reaction locates five new states in ^{16}C, at excitation energies of 3020 ± 15, 3983 ± 10, 4083 ± 10, 4136 ± 10 and 6109 ± 15 keV, in addition to the g.s. and 1.76 MeV states. The 3.0 and 3.98 MeV states appear to be the second 0^+ and 2^+ 2p-2h states, respectively. The 4.14-MeV state has $J^\pi = 4^+$ and the 6.1-MeV state has $J^\pi = 2^+$, 3^-, or 4^+.

The low-lying T = 2 levels in mass 16 should be dominated by the configuration $(sd)^2(1p_{\frac{1}{2}})^{-2}$, i.e. two-particle two-hole (2p-2h) states with $T_p = 1$, $T_h = 1$. Additional positive-parity states of 4p-4h character may also exist at relatively low excitation. Weak-coupling calculations suggest that the only 4p-4h T = 2 states that are important

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FINE STRUCTURE IN THE GIANT RESONANCE REGION AND THE COLLECTIVE DIPOLE SPIN-FLIP EXCITATION IN ^{208}Pb

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NUCLEAR REACTIONS ^{208}Pb(p,p'), E=40 and 45 MeV, measured $\sigma(\Theta)$; ^{208}Pb(α,α'), E=48 MeV. Deduced excitation strengths for J=1,2 and 3 transitions in the excitation region 6-12 MeV.

Inelastic scattering of 40 and 45 MeV protons has been used to study the excitation region of 6-12 MeV in ^{208}Pb. This region is found to be strongly structured with states of different multipolarity. Fine structure peaks between 8.5 and 10 MeV show mainly quadrupole and octupole structure. The "Giant" M1 excitations observed recently are strongly excited and are described by microscopic form factors. Several strongly excited states between 6 and 8.5 MeV show angular distributions of characteristic dipole (L=1) structure. Ground state widths derived from our inelastic cross sections are many times larger than measured in γ induced reactions, this indicates a structure different from isovector dipole.
These states may represent a collective dipole spin-flip excitation (L=1, S=1) which in a simple collective picture can be interpreted as a collective dipole oscillation of spin-up particles against spin-down particles. Two of these states at 7.40 and 7.92 MeV were identified in 180° electron scattering as 2^- states. Derived B(M2) values from our data are in excellent agreement with the electron scattering results. The other two states at 6.26 and 8.37 MeV may represent collective 1^- spin-flip excitations.

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High-Spin Level Structure of the Five Neutron Hole Nucleus ^{203}Pb*

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Abstract: A pulsed-beam $^{202}Hg(\alpha,3n\gamma)$ experiment has revealed a 0.48-s ^{203}Pb isomer, which de-excites through high-spin positive parity levels to the known $13/2^+$ state at 825 keV. Comprehensive ($\gamma\gamma t$) coincidence measurements have established the complete isomeric decay scheme, and key transition multipolarities have been deduced from prompt γ-ray angular distribution data and from intensity balance requirements. The results clearly manifest a close structural relationship between the high-spin levels built on the ^{203}Pb $13/2^+$ isomer and previously known states of the ^{204}Pb core nucleus. The 0.48-s isomeric state is assigned $J^\pi = 29/2^-$, with the dominant neutron hole configuration $(p^{-2}_{1/2})_0\, f^{-1}_{5/2}(i^{-2}_{13/2})_{12}$, and the high-spin positive parity levels are interpreted as members of core hole multiplets of the type $i^{-1}_{13/2} \times 2^+$ and $i^{-1}_{13/2} \times 4^+$.

[NUCLEAR REACTIONS $^{202}Hg(\alpha,3n\gamma)$, E = 38.2 MeV; measured $E_\gamma, I_\gamma(\Theta)$, γ-γ coin, γ-t relationships; ^{203}Pb deduced high spin levels, J, π, $T_{1/2}$.]

THE EMPIRICAL $(1f_{7/2})^n$ MODEL

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Mass of ^{27}P and ^{31}Cl*

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ABSTRACT

The Q-values for the (^{3}He,^{8}Li) reaction on ^{32}S and ^{36}Ar have been measured. The resulting masses for the new nuclei ^{27}P and ^{31}Cl are compared to the predictions of various models. The lowest T=3/2 state in ^{27}Si was also observed in the $^{29}Si(p,t)^{27}Si$ reaction, and its excitation energy and mass excess were determined.

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Four-Particle, One-Hole States in ^{43}Ca Strongly Populated by the ^{41}K(α,d) Reaction*

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ABSTRACT

Angular distributions of the ^{41}K(α,d)^{43}Ca reaction have been measured at 40 MeV bombarding energy. Four-particle, one-hole states in which the stripped proton-neutron pair occupies a $(f_{7/2})^2_{J=7,T=0}$ configuration coupled to the unperturbed ^{41}K-core were identified by their characteristic L=6 angular distributions. These states lie at 2.95, 3.37, 3.94, 4.13, 4.19, 4.59, and 4.89 MeV. Evidence for their $[(f_{7/2})^4_{J=7,T=1}d^{-1}_{3/2}]$ 4p-1h character is discussed. Several other strong transitions were observed which show mixtures of L=4 and L=6 angular distributions.

NUCLEAR REACTIONS: ^{41}K(α,d), E_α=40 MeV; measured $\sigma(E_d,\theta)$; enriched target; deduced L transfer.

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Levels of ^{52}Fe Studied with the (p,t) Reaction*

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Abstract: The $^{54}Fe(p,t)^{52}Fe$ reaction at 45 MeV has been used to study states of ^{52}Fe. Characteristic L-transfers in the angular distributions were used to assign ~60 spins and parities. An $f_{7/2}$ shell model, with admixtures calculated in first order perturbation theory, successfully accounts for both the location and strength of many of the observed levels.

NUCLEAR REACTIONS $^{54}Fe(p,t)$ E = 45 MeV. E_x = 0 - 10.33 MeV measured angular distributions. Enriched target. Magnetic spectrograph. Shell model calculation.

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*Work supported in part by the National Science Foundation.

**On leave from the Institute of Experimental Physics of the University of Warsaw.

The $^{40}Ca(\alpha,d)^{42}Sc$ Reaction*

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Angular distributions of the $^{40}Ca(\alpha,d)^{42}Sc$ reaction at E_α = 40 MeV have been measured for states in ^{42}Sc up to an excitation energy of 5.2 MeV. Assignments of the L transfer are made on the basis of the characteristic shapes of the angular distributions. A strong L = 6 transition to a state at 3.61 MeV in the ^{42}Sc is observed. Evidence for the fragmentation of the $(f_{7/2})^2_{5,0}$ and $(f_{7/2}p_{3/2})_{5,0}$ configurations into the 5^+ states at 1.51 and 3.09 MeV is discussed.

NUCLEAR REACTION $^{40}Ca(\alpha,d)$, E_α = 40 MeV, measured $\sigma(E_d,\theta)$; enriched target; deduced L transfer.

*Work supported by the National Science Foundation

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Shell-Model Wave Functions for the Zinc Isotopes*

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In this report we present details of the ASDI wave functions used in the shell-model calculation for the Zinc isotopes with A = 60 - 68 as published in Nucl. Phys. A269(1976)159. The wave functions calculated in a full $0f_{5/2}$ - $1p_{1/2}$ - $1p_{3/2}$ model space are shown for the lowest four states of each A, J, T system only, and with T values equal to the lowest isospin value allowed in each Zn nucleus.

The conventions of the presentation are as follows: A particular model state is labeled by its mass number (A), twice its total angular momentum ($2J^{\pi}$), twice its total isospin (2T), its calculated binding energy (E) and an ordinal number, denoting whether it is the 1st, 2nd, 3rd, etc., lowest state for the particular A, J, T combination in question. Also noted on this initial identifying line are the number of core particles in the model (56 in all present cases) and the dimensionality (number of basis states) for that A, J, T.

Following this first line of information, all components of the wave function of this state whose amplitudes have an absolute

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**Fellow of the Niels Stensen Foundation, The Netherlands.

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Particle-Hole Excitations in ^{16}F*

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Abstract

Levels of ^{16}F have been investigated by means of the $^{19}F(^{3}He,^{6}He)$ reaction at 70 MeV bombarding energy and the $^{16}O(^{3}He,t)$ reaction at 35 MeV. Three new states at 4.71, 6.05, and 6.93 MeV have been found. Based on all available information about ^{16}F, particle-hole configurations for several states are suggested.

NUCLEAR REACTIONS $^{19}F(^{3}He,^{6}He)$, $E_{^3He}$ = 70 MeV, $^{16}O(^{3}He,t)$, $E_{^3He}$ = 35 MeV. ^{16}F deduced levels.

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May 1977

The (p,t) and (p,^{3}He) Reactions on ^{39}K*

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Angular distributions of the ^{39}K(p,t)^{37}K and ^{39}K(p,^{3}He)^{37}Ar reactions between 3° and 55° have been measured at 40 MeV bombarding energy. The experimental differential cross sections of the transitions to several of the low-lying mirror pairs of even-parity final states in ^{37}K and ^{37}Ar are compared to results of microscopic distorted-wave Born approximation (DWBA) calculations based on current shell-model wave functions. The sensitivity of these DWBA calculations to optical model parameters is studied. It is found out that a satisfactory test of the shell-model wave functions used in the analysis can be obtained provided that the DWBA calculations describe the shapes of the observed angular distributions well.

NUCLEAR REACTIONS ^{39}K(p,t), ^{39}K(p,^{3}He), E_p=40 MeV; measured $\sigma(E_t, E_{3He}, \theta)$; natural target; DWBA analysis.

*Work supported in part by the U.S. National Science Foundation

Cryogenic Helium Jet and Recoil Time-of-Flight Apparatus*

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An apparatus is described in which cyclotron-produced radioactivities are transported from the target area to a detection area in a stream of helium cooled to 92K. The apparatus is intended for investigations of β-delayed particle-emitting nuclei and includes a time-of-flight path which allows mass identification of the nucleus responsible for each particle group. A theoretical model for the transport of atoms in pure gases is presented which explains quantitatively many aspects of existing data both at room temperature and at low temperatures.

*Research supported by the U.S. National Science Foundation.

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June 1977

^{7}Li and ^{7}Be Production in the $\alpha+\alpha$ Reaction*

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ABSTRACT

Differential cross sections for the ^{4}He(α,p) reaction leading to the ground and 478-keV states of ^{7}Li have been measured at 11 energies between 39.0 and 49.5 MeV and used to determine integral cross sections for ^{7}Li production in ^{4}He(α,p). Comparison of the ground state cross sections with ^{7}Li(p,α) data using the principle of detailed balance indicates good agreement with the most recent ^{7}Li(p,α) measurements but not with some older results. Cross sections for ^{4}He(α,d)^{6}Li (ground state), extracted at three energies, are consistent with the most recent ^{6}Li(d,α) measurements. Cross sections for ^{7}Be production via ^{4}He(α,n)^{7}Be were determined at 9 energies between 39.4 and 47.4 MeV by direct collection of the ^{7}Be and detection of the γ rays following its decay. These cross sections are essentially identical to the ^{7}Li production cross sections above 43 MeV but are smaller below this energy because of threshold effects. The ^{4}He(α,p) and ^{4}He(α,n) reactions are involved in several mechanisms which have been proposed to explain the universal abundance of ^{7}Li, and calculations of these processes have assumed cross sections larger than our data. We therefore confirm earlier conclusions that ^{7}Li is unlikely to be produced by galactic cosmic-ray spallation alone, but the status of the other mechanisms remains unclear. Peaks in the ^{4}He(α,p) and ^{4}He(α,n) excitation functions are discussed in terms of resonances in ^{8}Be. Parameters determined by Kumar and Barker in a fit to ^{7}Li(p,α) data are inadequate to explain our ^{4}He(α,p)^{7}Li (478 keV) cross sections.

NUCLEAR REACTIONS ^{4}He(α,p), E=39.0-49.5 MeV; measured $\sigma(E;\theta,E_p)$, $\sigma(E)$. ^{4}He(α,n), E=39.4-47.4 MeV; measured $\sigma(E)$. ^{4}He(α,d), E=46.7-49.5 MeV; measured $\sigma(E;\theta)$, $\sigma(E)$. Astrophysical implications for ^{7}Li production considered. Discussion of ^{8}Be levels in R-matrix formalism.

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A Constraint on the Mean Baryon Density of the Universe from the Abundance of ^{7}Li*

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Abstract

Because the amount of ^{7}Li produced in a standard big bang increases with increasing mean baryon density ρ_b (for $\rho_b > 10^{-31}$ g/cm^{-3}), the observed abundance of ^{7}Li can be used to place an upper limit on ρ_b, whether or not ^{7}Li is also made by other processes. This limit favors an open universe.

*Research supported by the U.S. National Science Foundation.

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Search for Parity Mixing in the ^{93}Tc $17/2^-$ Isomer: Measurements of Internal Conversion Coefficients*

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Abstract

The internal conversion coefficients were measured for several transitions in ^{93}Tc with an electron spectrometer and a Ge(Li) detector. The ^{92}Mo(α,p2n) reaction was used to study the decay of the isomeric $\tau = 15$ μsec $\overline{17}/2^-$ level at 2185.3 keV as well as the decay of the prompt $17/2^+$ level at 2185.0 keV. The experimental K-shell conversion coefficients for the $\overline{17}/2^- \to 13/2^+$ and $17/2^+ \to 13/2^+$ transitions imply $\Gamma(E2, \overline{17}/2^- \to 13/2^+)/\Gamma(E2 + M2 + E3, \overline{17}/2^- \to 13/2^+) \leq 0.33$. The energy difference between the prompt and delayed γ transitions to the $13/2^+$ level was measured to be 0.32 ± 0.03 keV. These results imply $|\langle 17/2^+ | H_{pv} | 17/2^- \rangle| \leq 0.13$ eV for the matrix element of the parity violating Hamiltonian.

NUCLEAR REACTIONS ^{92}Mo(α,p2n), E = 43 MeV; measured pulsed beam electronic timing, I_{ce}, I_γ, E_γ; deduced α_K, γ-multipolarity, parity mixing. Enriched target, electron spectrometer, Si(Li) and Ge(Li) detectors

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Inelastic Scattering of 40 MeV Protons from ^{24}Mg: (I) Natural Parity Transitions*

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ABSTRACT

Angular distributons for the inelastic scattering of protons from ^{24}Mg have been measured at a proton energy E_p=40 MeV with a resolution of 16 keV. The results for the natural parity states in the excitation energy range from the ground state up to $E_x \simeq 13.5$ MeV are presented. The data has been analysed using a macroscopic collective model. Coupled-channel calculations assuming the rigid-rotor model have been performed for the ground-state rotational band in ^{24}Mg. Previous conclusions on the smallness of the parameter of the hexadecapole deformation have been confirmed. The angular distribution for the 6^+ member of the ground-state rotational band at 8.120 MeV made it possible to extract the sixth order deformation parameter. Negative values of β_6 are suggested by the data. Collective model DWBA calculations were performed to determine the deformation parameters β_L and isoscalar transition rates, B(IS, $0_1^+ \rightarrow L$) for most of the observed states. Nearly half of the strength observed below E_x=13.5 MeV for the transitions of multipolarities L=2,3 and 4 is contained in the high-energy region between E_x=7.5 and 13.5 MeV. Good agreement with the inelastic electron scattering data has been obtained for most of the low energy transitions which were previously studied via (e,e'). Evidence is presented in favor of a particular spin value for a number of states for which only multiple spin assignments were previously made.

NUCLEAR REACTIONS $^{24}Mg(p,p')$, E=40 MeV; measured $\sigma(E_{p'};\theta)$; deduced β_L's, optical parameters. Enriched target.

... optical parameters.
Enriched target.

The pathways of assimilation of $^{13}NH_4^+$ by cyanobacterium, *Anabaena cylindrica*[*]

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Running title: Assimilation of NH_4^+ by *Anabaena*

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The Observation of Hole States at High Excitation in (p,t) Reactions*

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ABSTRACT

A peak about 2 MeV wide is observed at 8 to 9 MeV of excitation in a number of even even tin isotopes and at lower excitation in ^{104}Cd and ^{102}Pd in studies of the (p,t) reaction at 42 and 45 MeV. The excitation energy of the peak centroid and the peak width are observed to increase with increasing neutron number. It is suggested that the peak arises from two neutron pickup from the lower lying filled gpf shell between magic numbers 28 and 50. This explanation is reasonably consistent with the observed excitation energies. In addition, distorted wave born approximation (DWBA) calculations of the angular distributions for two neutron pickup from this shell agree in shape with the data. About 40% to 50% of the predicted total strength is observed experimentally.

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Mass of ^{6}He ÷

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ABSTRACT

A precise value for the ^{6}He mass excess has been obtained by comparison of the Q values for the $^{7}Li(d,^{3}He)^{6}He$ and $^{19}F(d,^{3}He)^{18}O^{*}$ reactions, the latter populating the first excited state of ^{18}O. The measurements were performed at 0° in a magnetic spectrograph. The result for the ^{6}He mass excess is (17593.7 ± 1.1) keV, about 3 keV less than the previous value, and 3 times more accurate. The effect on the A=8 isobaric quintet and on the β-decay of ^{6}He is discussed.

NUCLEAR REACTIONS $^{7}Li(d,^{3}He)^{6}He$, $^{19}F(d,^{3}He)^{18}O$. E_d=20.8 MeV, θ =0°, magnetic spectrograph. ^{6}He, measured mass excess.