THURSDAY MORNING AT 8:30 (JEROME L. DUGGAN presiding) ROOM 303

SESSION AD

Nuclear Physics at High Energies. Radioactivity

Invited Paper

AD1. Very Light Nuclei Investigated with 600 MeV Protons. CHARLES F. PERDRISAT, *College of William and Mary*. (30 min.)

AD2. Backward Elastic PD Scattering at 316, 364, 470 and 590 MeV. C.F. PERDRISAT, J.C. ALDER†, W. DOLLHOPF and C. LUNKE†, College of William and Mary, W.K. ROBERTS, NASA Lewis Research Center, P. KITCHING, G. MOSS and W.C. OLSEN, U. of Alberta, Edmonton and J.R. PRIEST, Miami U. Oxford O.--Protons from the external beam of the N.A.S.A. Space Radiation Effects Laboratory were scattered on CD_2 targets to measure the differential cross section for CM angles from 90 to 165°. The lower energies were obtained with copper degraders in the transport system. Spark chambers and scintillation counters were used to determine the kinematics of each event. The time-of-flight of the forward particle was recorded. For any given CM angle between 140 and 165° we observe very little change of the CM cross section at the three larger energies, in agreement with a result by Booth e.a.[1] at 415 MeV.

†Fellows of the Swiss Institute for Nuclear Research (SIN)
[1]Booth, Dolnick, Esterling, Parry, Scheid and Sherden, preprint 1971.

AD3. PROTONS FROM 1.7 GEV/C π^- ON AG, BR. D. T. KING, The University of Tennessee.

AD4. Decay of ^{72}Br Produced by ^{58}Ni (^{16}O,p,n)^{72}Br, E. Collins, Jung Lin* and J. H. Hamilton, Vanderbilt U.† and R. L. Robinson, H. J. Kim and L. C. Ford, Oak Ridge Natl. Lab††.--The reaction products from 42.5 and 46 MeV ^{16}O ions on ^{58}Ni have been studied with Ge(Li) (singles) and NaI - Ge(Li) (coincidence) detectors. The gamma-rays were assigned to a given decay from half-life information and from a comparison of intensities at different bombarding energies. The following gamma rays are assigned to the decay of ^{72}Br: 454(16), 560(4), 752(4), 774(9), 862(100), 1137(9), 1317(25), and 1510(4) (relative intensities in parenthesis). From coincidence data the following levels are confirmed in ^{72}Se: 861.8,2^+; 1317.1,2^+; 1636.1,4^+; and 1998.5 keV. The half-life of ^{72}Br is 72.4 ± 1.0 sec.

* NSF Summer Research Participant from Tennessee Technological University.
† Work supported in part by a grant from the National Science Foundation.
††Research sponsored by the U. S. Atomic Energy Commission under contract with Union Carbide Corporation.

AD5. Investigation of Possible Perturbation of $\gamma - \gamma$ Directional Correlations. RAUF SARPER, J. T. CALLAHAN, N. S. KENDRICK, and E. T. PATRONIS, JR., Ga. Inst. of Technology.

AD6. Investigation of the Energy Levels in ^{132}Xe Populated in the Decay of ^{132}I, N. C. Singhal, J. H. Hamilton, A. V. Ramayya, Vanderbilt University+, and J. J. Pinajian, Oak Ridge National Laboratory††.--γ-γ coincidence measurements have been performed on the decay of ^{132}I using two high resolution Ge(Li) detectors. With the help of these measurements and energy sum relationships, we were able to place 112 of the 118 γ-rays assigned to the ^{132}I decay into 38 excited states of ^{132}Xe. In addition to the 20 energy levels reported earlier[1], we have proposed 18 new levels (15 based on coincidence data) with the following energies (in keV); 2167.3±0.3; 2187.4±0.3; 2303.6±0.2; 2916.9± .2; 2935.6±0.4; 2959.1±0.7; 3076.4±0.2; 3112.0±0.5; 3122.9±0.6; 3155.4±0.3; 3192.8±0.2; 3214.3±0.3; 3226.8±0.3; 3237.4±0.6; 3260.0±0.3; 3319.6±0.7; 3354.4±0.5 and 3385.1±0.7.

† Work supported in part by a grant from the National Science Foundation.
††Research sponsored by U. S. Atomic Energy Commission under contract with Union Carbide Corporation.
1.J. H. Hamilton, H. K. Carter and J. J. Pinajian, Phys. Rev. C1, 666 (1970).

AD7. Electron Capture to Positron Emission Ratios for ^{140}Pr, ^{141}Nd, and ^{143}Sm. J. L. EVANS, W. L. ALFORD, J. R. COOPER, and J. D. MOORE, Auburn U.

AD8. Neutron Capture Cross Sections in the keV Region for ^{154}Sm, ^{160}Gd, ^{164}Dy, and ^{165}Ho. * L. R. FAWCETT† and A. K. Furr, Virginia Polytechnic Institute and State University.

AD9. Energy Spectra of Internal Bremsstrahlung Emitted During the Beta Decay of ^{170}Tm. F. T. AVIGNONE III and W. Y. HSIEH, Univ. of South Carolina. -- The spectral distribution of inner bremsstrahlung emitted in the first forbidden 883 keV end point energy beta decay of ^{170}Tm has been measured in a coincidence experiment. Recently, large high-energy anomalies in several first forbidden spectra have been reported.[1] These anomalies attributed to higher order electrodynamic processes called detour transitions and are not evident in the present experimental results.

[1] R.J.D. Beattie and J. Byrne, Nuclear Physics A161 (1971) 650.

AD10. The Energy Levels of Pa^{233} from the Alpha Decay of Np^{237}. D. M. PETERSON and A. W. WALTNER, North Carolina State University.--The alpha particle decay of Np^{237} to Pa^{233} was investigated using high resolution Si(Li) and Ge(Li) detectors, and Si surface barrier alpha detectors. The resolution of the Si(Li) detector was 220 eV (FWHM) at 6.4 keV, and for the Ge(Li) detector was 230 eV at 6.4 keV and 750 eV at 312 keV. Based upon the results of several α-γ and dual parameter $\gamma - \gamma$ coincidence experiments, a revised energy level scheme for Pa^{233} is suggested. The proposed decay scheme differs significantly from previously published results.[1,2]

[1] J. M. Vara and R. Gaeta, Nuclear Physics A130, 586, (1969)
[2] C. Sebille, G. Bastin, C. F. Leang, and R. Piepenbring, Compt. Rend., Series B, 270, 354, (1970)

Invited Paper

AD11. Recent Experiments at the University of Maryland Cyclotron, PHILIP G. ROOS, *University of Maryland*. (30 min.)

THURSDAY MORNING AT 8:30 (JOHN E. RIVES presiding) ROOM 308

SESSION AE

Numerical Methods, Instrumentation, and Applications

AE1. Numerical Differentation of Data. JOHN J. WHITE, III, Univ. of Georgia--Numerical derivatives of data obtained by polynomial least squares fitting have an interesting property that is not discussed in standard treatments on numerical analysis.[1] Suppose a set of data is fitted to polynomials of degree 2k and 2k-1. If the derivatives of the fitted polynomials are evaluated at the midpoint of the interval, they will be found to be equal, provided only that the data intervals are distributed symmetrically about the midpoint. The result applys equally when fitting a polynomial of degree 2k with a polynomial of degree 2k-1. This property may be understood from the decoupling of the equations for the expansion coefficients into two subsets. Proof of the property involves detailed examination of cofactors and Cramer's rule. The discussion includes several practical findings for the numerical differentiation of data.

[1]J. J. White, III, Am. J. Physics 39, November, 1971.

AE2. Initial Velocity of a Projectile from Times of Arrival at Two, Three or Four Slant Ranges. G. PRESTON BURNS, Naval Weapons Laboratory--Two methods have been developed for calculating initial velocity of a projectile from times between ejection from the gun and arrival at two to four specified values of slant range. The first method is based on the assumption that slant range is related to time of the projectile in flight by equations of the form $S = at + bt^2 + ct^3$ and $t = aS + bS^2 + cS^3$ from which the initial velocity, the rate of change of S with respect to t when S = 0, is given by a and 1/a, respectively. In the second method, it is assumed that second or third differences of successive values of average rate of change of slant range are constant.

AE3. Exact Computer Evaluation of Combinatorial Series by Prime-Number Representations.* D.A. PAYNE and W. J. THOMPSON, U.N.C. at Chapel Hill and Triangle Universities Nuclear Laboratory.--Conventional computer calculations use floating-point arithmetic even when formulas involved are expressible as fractions (as in combinatorial series appearing in quantum statistics or angular-momentum theory). An alternative is prime-exponent arithmetic (PEA), based on representation of rational numbers as products of integer powers of primes. Such arithmetic is especially useful when exact results are desired. In PEA (the Rotenberg form[1]) the algorithms manipulate the exponents of primes, rather than the rational numbers. Multiplication and division are simple; addition and subtraction are more involved, but still exact. (Only integers are used.) The program language used for PEA is not important. As an example of PEA the 3-j coefficients[1] have been programmed in PL/1 and compared with floating-point-arithmetic values.

*Research supported in part by the U.S.A.E.C. and by the N.S.F.
[1]M. Rotenberg, R. Bivins, N. Metropolis and J. K. Wooten, Jr., The 3-j and 6-j Symbols (M.I.T. Press, 1959).

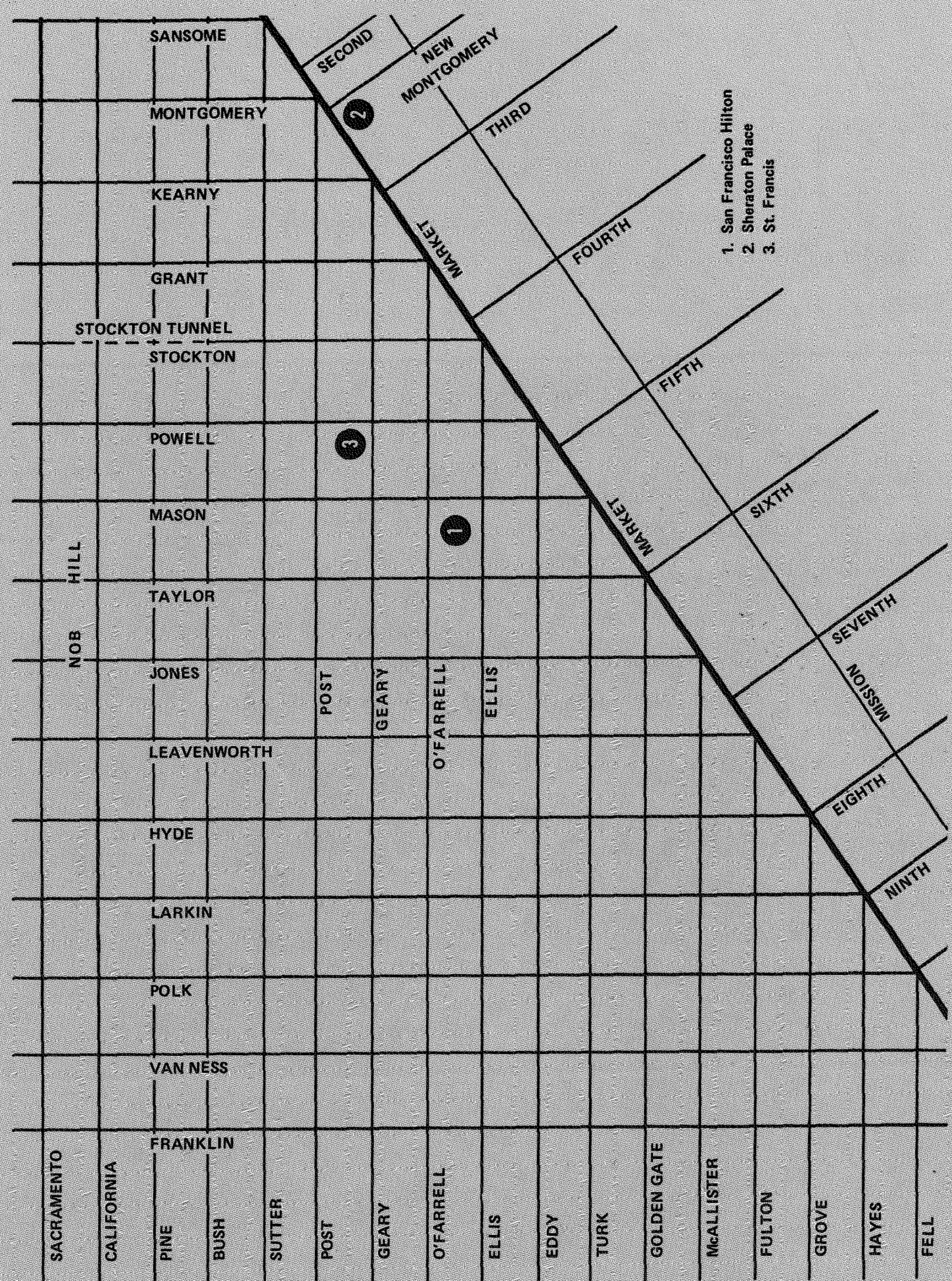
AE4. A Randomization Procedure for Determining Reliability of Mössbauer Parameters and Optimizing Experimental Conditions. D. G. AGRESTI, University of Alabama, Birmingham

AE5. Magnetic Suspension Torsion Balance.* J. W. BEAMS, Univ. of Virginia--Magnetically suspended rotors spinning rapidly around a vertical axis in a vacuum are known to possess almost negligible deceleration due to the magnetic support.[1] However, if while at rest, the rotor is given a small angular displacement it usually will encounter a small restoring torque and oscillate. This is here shown to be due mostly to (1) the lack of coincidence of the axis of permeability and the mechanical axis of the magnetically supported body as well as their slight inclination to the vertical (2) to the lack of symmetry of the supporting magnetic field and (3) disturbing magnetic fields including that of the earth. Methods are described by which the effects of each of the above are greatly reduced and the restoring torque made to have almost any desired value down to the noise level. This makes possible the measurement of very minute torques (10^{-9} to 10^{-10}dyne-cm). Magnetic suspension torsion balances not only possess extremely small restoring torques but unlike fiber suspensions will support large as well as small masses. Its unique advantages and uses will be discussed.

*Supported by Army Office of Research-Durham.
[1]J.W. Beams, D.M. Spitzer, Jr. and J.P. Wade, Jr., Rev. Sci. Instr. 33, 151 (1962).

AE6. Ultrahigh Vacuum Reflectometer M. Zivitz. Ga. Inst. of Tech.

AE7. The Effect of Nonlinearities on the Diffraction Efficiency of Grating Holograms. Cynthia R. Bendall*, B. D. Guenther, and R. L. Hartman, Redstone Arsenal, Alabama, 35809.



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