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ANL/NDM-7
Neutron Total and Scattering Cross Sections of Some Even Isotopes of Molybdenum and the Optical Model

by

A.B. Smith, P.T. Guenther, and J.F. Whalen

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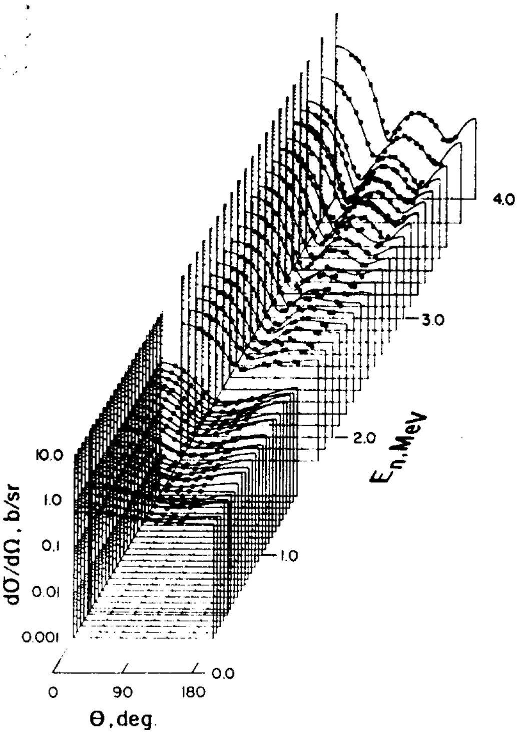

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*This work supported by the U.S. Atomic Energy Commission.

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NUCLEAR DATA AND MEASUREMENTS SERIES

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NEUTRON TOTAL AND SCATTERING CROSS SECTIONS OF SOME EVEN ISOTOPES OF MOLYBDENUM AND THE OPTICAL MODEL

By

A. Smith, P. Guenther and J. Whalen

Abstract

Neutron total and elastic and inelastic scattering cross sections of ^{92}Mo, ^{96}Mo, ^{98}Mo and ^{100}Mo were measured. Neutron total cross sections were determined at intervals of $\lesssim$ 10 keV from 1.6 to 5.5 MeV with resolutions of $\approx$ 10 keV. Neutron elastic and inelastic scattering cross sections were measured from 1.8 to 4.0 MeV at intervals of 0.2 MeV. Neutron groups corresponding to the excitation of forty states were identified. The experimental results were examined in the context of optical- and statistical-nuclear models. It was concluded that the real part of the optical potential includes a term proportional to $\left[\frac{N-Z}{A}\right]$ and suggested that the imaginary part is shell dependent with decreasing magnitude as N=50 is approached. Comparison of measured and calculated inelastic neutron excitation cross sections suggested a number of J^{π} assignments extending previous knowledge. The experimental and calculational results were used, together with previously reported values, to generate an evaluated neutron total and scattering cross section file in the ENDF format extending over the energy range 0.1 to 8.0 MeV.

I. Introduction

The phenomenological nature of the complex-well optical model (1,2,3) has been reasonably well established and the model is widely and successfully used in the interpretation of nuclear processes. The non-locality of the basic forces (4) results in an energy dependent potential as described by Perey and Buck (5) and Engelbrecht and Fiedeldey (6) among others. Comparisons with experimental results over a wide energy range generally indicate decreasing potential strengths with increasing energy. In a lower and narrower energy interval such a trend is not as clear and even a converse dependence has been reported (7). Moreover, the potentials may fluctuate from isotope-to-isotope in the low energy region. Green and Sood (8) and Lane (9) have pointed out that the real optical potential has an iso-spin dependence of the form $V=V_o \pm V_1\left[\frac{N-Z}{A}\right]$ where the positive sign applies to protons, the negative to neutrons and the magnitude of the proportionality constant V_1 is about 25 MeV. This iso-spin dependence has been verified by extensive analyses of, primarily, charged-particle data; for example, by Becchetti and Greenlees (10) and Lind and co-workers (11). Becchetti and Greenlees also attribute a similar isotopic dependence to the optical-potential absorption with a proportionality constant about half that attributed to the real potential. The iso-spin effect is not nearly as well defined for neutron induced processes as the experimental basis is less precise and far more fragmentary and the interpretation is often complicated by uncertain contributing factors such as compound-elastic and pre-compound components.

In addition to the above general energy and isotopic dependence of the optical potential, Lane et al. (12) have suggested a shell dependence of the absorption term with marked reductions in the region of shell closures primarily as a consequence of changes in level densities. The well known deep minimum in the $\ell=0$ strength function at $A \approx 100$ ($N \approx 50$) was partly attributed to this effect. More recently Vonach et al. (13) have observed rapid isotopic-dependent changes in elastic neutron angular distributions near A=208 and correlated these observations with a similar shell-dependent reduction in the optical-potential absorption.

The spectroscopy of the low-lying states in the even isotopes of molybdenum is influenced by a complex mixture of single-particle and collective configurations as discussed, for example, by Davydov and Filippov (14). There are a number of uncertainties and apparent omissions in the energetics and J^{π} assignments of states with excitation energies below a few MeV (15). The excitation of some of these states can be productively studied by means of inelastic neutron scattering.

Molybdenum is an excellent structural metal at elevated temperatures. As a consequence, it has a wide potential use in neutronic applications such as controlled nuclear fusion devices. Two thirds of the element consists of the even isotopes ^{92}Mo, ^{96}Mo, ^{98}Mo and ^{100}Mo. Study of these isotopic neutron cross sections substantially provides the quantitative nuclear data requisite to many engineering applications to a precision not easily achieved in elemental studies. Moreover, the isotopic cross sections are of explicit applied interest as these isotopes are among the most prominent of fission products.

The present study of the neutron total and scattering cross sections of ^{92}Mo, ^{96}Mo, ^{98}Mo and ^{100}Mo had the objectives of: a) improving the understanding of the optical model in neutron processes near A=100, particularly the energy, isotopic and shell dependence, b) extending the knowledge of the excited structure of these isotopes, and c) providing basic neutron data for engineering applications. These isotopes extend over nine mass units commencing at the neutron shell closure at N=50. The measurements, together with previously reported results from this laboratory (16), extend over a relatively large energy range. They include neutron total and elastic and inelastic scattering cross sections; providing a stringent experimental foundation for the selection of model parameters not easily achieved in charged-particle studies. Subsequent portions of this paper deal with; experimental methods (Sec. II), experimental results (Sec. III), model interpretations and conclusions (Sec. IV) and, finally, an evaluation of the results in the ENDF/B (17) format suitable for the applied user (Sec. V).

II. Experimental Procedures

All experimental samples were right cylinders approximately 2 cm in diameter and 2 cm long. The sample materials were isotopically enriched to more than 95% as summarized in Table 1. The samples were fabricated using powdered metallurgical procedures that resulted in densities approaching that of natural metal. Simple tests (e.g. balance) indicated that the sample densities were reasonably uniform. However, precise assay of uniformity was not possible as it would have required the destruction of all or part of the samples. The samples were believed to contain oxygen (16) with the oxygen-to-molybdenum atom ratios given in Table 1. All cross sections are reported in barns per effective atom of the particular sample. No corrections were made for very small effects due to the minority isotopes. Where appreciable, corrections were made for the oxygen content as discussed below.

All measurements employed the $^{7}Li(p,n)^{7}Be$ reaction as a neutron source (18). The targets were lithium films the thickness of which was adjusted to obtain the desired incident-neutron energy resolutions.

The total cross section measurements were made using the monoenergetic source technique (19) together with the fast time-of-flight methods. The latter assured against background perturbations. The geometry was "good" with the neutron beam incident upon the bases of the cylindrical samples. In-scattering corrections were estimated and found negligible. The incident neutron energy spread at the samples was nominally 10 keV and measurements were made in a redundant manner with repeated passes across the measured energy range. Concurrently a "reference" carbon sample was measured in order to verify the validity of the molybdenum measurements.

The neutron scattering cross sections were determined using a 10-angle time-of-flight system with flight paths of approximately 5.5 meters (20). The incident neutron energy spread was approximately 30 to 50 keV and the scattered-neutron velocity resolution 0.4-0.5 nsec/meter. All scattering cross sections were determined relative to that of H(n,n) by direct observation of scattering from a polyethylene sample (21). In addition the scattering cross sections of a carbon sample were measured in order to assure system performance. Measurements at a given energy were made essentially concurrently for all molybdenum isotopes and the carbon sample thereby minimizing relative errors between samples. All scattering results, including the polyethylene standard, were corrected for beam attenuation, angular resolution and multiple-event effects using a special-purpose analytical and Monte-Carlo computational system (22). The details of the experimental apparatii and procedures are described elsewhere (20,22).

III. Experimental Results

A. Neutron Total Cross Sections

The neutron total cross sections of ^{92}Mo, ^{96}Mo, ^{98}Mo and ^{100}Mo were measured from $\sim$ 1.6 to 5.5 MeV at intervals of less than 10 keV and with a resolution of $\sim$ 10 keV. The results are outlined in Fig. 1. The statistical accuracy of the measurements was $\lesssim$ 3 percent. Small corrections were made for contributions from the oxygen content of the samples. Possible non-uniformity of sample dnesity was a potential source systematic uncertainty. The magnitude was estimated at $\lesssim$ 5 percent but could not be verified without destruction of the samples. All the measurements at a given energy were made essentially concurrently including those associated with a carbon reference standard. The latter gave results in good agreement with published carbon total cross section values (23). The cross sections constructed from the average of the present isotopic measurements, weighted by the isotopic abundances, agreed with the respective cross sections of the natural element to within 100 to 200 milli-barns throughout the measured energy range (24). This agreement does not preclude an appreciable systematic error in a single isotope (e.g. ^{100}Mo) but makes significant errors in several unlikely unless they are compensating. The present results reasonably extrapolate to the lower energy values reported by Lambropoulos et al. (16) and are consistent with the ^{98}Mo total cross sections reported by Langsford et al. (25) though the latter displays more structure due to better energy resolution.

A notable feature of the total cross sections of Fig. 1 is the increase in average magnitude with isotopic mass amounting to $\approx$ 0.4 to 0.5 barn between ^{92}Mo and ^{100}Mo. The trend is relatively systematic rather than random as might be expected from many experimental effects (e.g. density uncertainties cited above). This isotopic dependence of the total cross section was a major consideration in the physical interpretation (see Sec. IV, below). The present experimental values fluctuated with energy with a trend toward greater magnitudes for the lighter masses (e.g. ^{92}Mo). This was partly attributed to the residual effect of resonance structure evident in Refs. 16 and 25, and not well resolved in the present measurements.

B. Neutron Elastic Scattering Cross Sections

The differential elastic scattering cross sections of ^{92}Mo, ^{96}Mo, ^{98}Mo and ^{100}Mo were measured from 1.8 to 4.0 MeV at intervals of 0.2 MeV with incident neutron resolutions of 30 to 50 keV. The angular range of the measurements extended from < 20 to > 155 deg. with approximately 20 differential measurements distributed over the angular interval. The experimental results are outlined by the data points of Fig. 2. Least-square fits of a Legendre expansion to these measured values resulted in angle-integrated elastic scattering cross sections that were reasonably consistent with measured total and inelastic scattering cross sections as illustrated in Fig. 1. In carrying out these fitting procedures a 180 deg. point, deduced from the model described in Sec. IV, was introduced to assure well behaved distributions at very large scattering angles. No constraints were placed upon the fits at 0 deg. For the highly peaked-forward distributions this was a sensitive area and extrapolation forward from 20 degrees could have led to uncertainties in the results of the fitting procedures.

Uncertainties in the elastic scattering measurements arose from a number of origins. The relative angular positions were determined optically and believed known to ± 0.5 deg. The effective source-sample geometry was controlled to within 1 to 2 milli-meters corresponding to an absolute angular uncertainty of approximately one degree. The absolute angular scale was calibrated by observing the energy dependent H(n,n) scattering process over a selected angular range both left and right of the relative angular zero. This calibration procedure was believed accurate to better than one degree. Collectively, these angular uncertainties implied minor cross section errors in the low-energy range of the measurements but became more serious as the energy increased and the elastic distributions became more anisotropic.

The relative energy response of the detectors was established by extensive measurements of H(n,n) scattering (21) at each measurement period. The ten detectors varied in sensitivity with energy-cutoffs ranging from 0.2 to 0.8 MeV. The relative energy sensitivities were determined at each incident neutron energy and at a large number of scattering angles selected so as to provide a good relative calibration of each detector over the full energy range of the measurements. This relative energy calibration was not dependent upon any absolute monitor response and was independent for each detector. The absolute sensitivity of each detector was then independently determined at each measurement energy, again by observation of the h(n,n) process. These absolute calibrations were generally redundant for each of the detectors. This extensive procedure has several advantages: a) it is entirely experimentally based on a primary standard, the H(n,n) cross section, b) each detector is independently treated, resulting in a large redundancy in determinations of absolute cross section magnitudes and c) it is free of many uncertainties associated with flux monitoring. The twenty sample values at each energy were measured in such a manner that adjacent angular results were obtained with the same detector (e.g. 62 and 68 degrees) and thus reflected the same systematic errors, if present.

Combining the above uncertainties the best differential measurements were judged accurate to ± 5 percent. The largest uncertainties were several times this value and tended to be at lower energies and associated with detectors 6 and 10 (i.e. energies below 2.4 MeV and the two angular intervals 60 to 70 and 150 to 160 degrees). In addition, there was a lower magnitude limit to the sensitivity of the system judged to be approximately ± 3 mb. This was a governing factor in the minima of the distributions at higher energies, particularly for ^{98}Mo and ^{100}Mo. The cumulative effects of the above uncertainties are indicated by the error bars on the data points of Fig. 2. Of course, the differential cross section uncertainties were reflected in the angle-integrated elastic scattering cross sections shown in Fig. 1. These benefit from the redundant normalization procedures outlined above and were judged known to within 5 to 10 percent. The consistency of the deduced angle-integrated values is in agreement with this estimate.

No results directly comparable with the present isotopic values were found in the published literature. The present results are consistent with reported elastic neutron scattering from the natural elemental molybdenum (26) but exact comparisons are difficult as the distributions evidently are sharply isotope dependent. It is noted in Sec. IV, below, that a model based upon the present results reasonably describes the isotopic elastic scattering reported by Lambropoulos et al. (16) at energies of $\lesssim$ 1.25 MeV.

C. Neutron Inelastic Scattering Cross Sections

The inelastic neutron scattering cross sections were measured concurrently with the elastic scattering values. The detector responses and calibrations were identical to those described above. Cross section values were accepted only when the scattered neutron energies were such as to be on a reasonably well determined portion of the detector-response curves (nominally scattered neutron energies above 500 keV). The minimum sensitivity of the detection system varied with the particular measurement but was generally a few milli barns per steradian. The excitation energies corresponding to the observed scattered neutron groups were determined from the known flight paths, flight-times and incident neutron energies and verified by the observation of well known inelastic scattering processes (e.g. the excitation of the 846 keV state in ^{56}Fe (27)). The uncertainties in these measured excitation energies were estimated from the particular experimental conditions, particularly resolution, and found generally consistent with values reported from charged particle work (15). The latter measurements generally gave more accurate values than the present neutron scattering measurements. Therefore, they were accepted as the more precise and the present determinations of excitation energies were used only to establish energy correlations with reported structure.

The differential cross sections for the excitation of the various states were determined at up to twenty scattering angles. The angle-integrated cross sections were deduced from least-square fits of a Legendre expansion to the measured differential values. Most of the measured distributions were nearly isotropic and all were essentially symmetric about ninety degrees. A few distributions associated with the excitation of 0+ states were pronouncedly anisotropic as illustrated by the ^{96}Mo example of Fig. 3. The uncertainties in the cross section values, including systematic effects, were subjectively estimated from the quality of the particular measurement. The estimated differential cross section errors were, at best, 5 to 8 percent in addition to a minimum uncertainty of $\approx$ 3 milli-barns per steradian. The associated angle-integrated estimated uncertainties were 5 percent or more.

Forty discrete inelastic neutron groups were observed with marginal observation of several more. The corresponding excitation energies are outlined and compared with those given in the most recent Nuclear Data Sheets (15) in Table 2 and Fig. 4. The respective cross sections and associated experimental uncertainties are summarized in Fig. 5.

The first four inelastic neutron groups observed in ^{92}Mo implied excitations of 1.51 ± .01, 2.28 ± .01, 2.52 ± .02 and 2.61 ± .02 MeV and were well correlated with structures reported from other spectroscopic studies (15). Neutrons corresponding to the excitation of a reported state at 2.76 MeV were not observed. This was not surprising as the proposed J^{π} assignment of 8+ implies very small cross sections and the observed excitation of the subsequent 6– state at 2.85 ± .02 MeV was weak. A final neutron group was observed corresponding to an excitation of 3.05 ± .05 MeV. This "state" was associated with contributions from three levels reported at approximately this energy.

Neutrons corresponding to the inelastic excitation of states in ^{96}Mo at: 0.78 ± .01, 1.17 ± .02, 1.50 ± .02, 1.64 ± .02, 1.90 ± .03, 2.00 ± .03, 2.12 ± .03, 2.24 ± .03, 2.50 ± .10, 2.70 ± .10 and 2.90 ± .10 MeV were observed. These states are generally consistent with previously reported structures. The 1.64 and 2.24 MeV states were attributable to reported closely spaced doublets of levels. Above excitations of approximately $\approx$ 2.3 MeV the previously reported structure becomes uncertain and was not clearly resolved in the present work. Thus the cross sections determined for the excitation of "states" at 2.50, 2.70 and 2.90 MeV were more correctly the cross sections for the emission of neutrons by inelastic scattering processes involving bands of states as suggested in Table 2. In these instances only qualitative association with the reported structure was meaningful as illustrated in Fig. 4.

Observed neutron scattering from ^{98}Mo corresponded to the excitation of states at: 0.74 ± .01, 0.78 ± .01, 1.44 ± .02, 1.51 ± .02, 1.78 ± .02, 1.96 ± .03, 2.07 ± .03, 2.20 ± .03, 2.38 ± .05, 2.50 ± .07, 2.70 ± .10 and 2.90 ± .10 MeV. Up to excitations of $\sim$ 2.2 MeV these observed states closely corresponded to the energies of those previously reported (15). The closely spaced doublets reported near 2.00 and 2.22 MeV were not resolved in the present measurements. There was a single observation of a weak neutron group corresponding to a 2.25 ± .05 MeV state. This was believed to be an erroneous level associated with the second neutron group from the ^{7}Li(p,n)^{7}Be source reaction. Again, it was not possible to clearly associate the present results with previously reported discrete levels at excitations above 2.3 MeV and the present cross sections for "states" at 2.38, 2.50, 2.70 and 2.90 MeV probably consisted of uncertain contributions from a number of ill-defined states within the general band structure outlined in Table 2.

States observed in ^{100}Mo at: 0.52 ± .01, 0.69 ± .01, 1.06 ± .015, 1.14 ± .015 and 1.46 ± .03 MeV were associated with similar reported levels as shown in Fig. 4 and Table 2. Measurements involving the 0.52 MeV state were perturbed by contributions from the second neutron group from the ^{7}Li(p,n)^{7}Be source reaction. The requisite corrections increased the uncertainties in cross sections for the excitation of this state. The same second neutron group was probably the origin of the observed 1.60 ± .03 MeV state and as a consequence it was probably invalid. Observed states at: 1.77 ± .03, 1.91 ± .03, 2.10 ± .03 and 2.33 ± .03 MeV were in reasonable correspondence with reported states. Again, measured excitations of 2.50 ± .10 and 2.80 ± .10 MeV were considered as composite contributions from a number of uncertain levels. This is particularly so in this instance as ^{100}Mo is the farthest of these isotopes from the closed shell at N=50 and yet the reported structure at excitations greater than approximately 2.50 MeV is appreciably simpler than that of either ^{96}Mo or ^{98}Mo; probably implying less complete knowledge of ^{100}Mo.

Isotopic inelastic neutron scattering cross sections of the even-isotopes of molybdenum in the energy range of the present experiments are not generally available in the literature precluding detailed comparisons with the present measurements. The element is isotopically complex and it is difficult to quantitatively compare the elemental values with the above isotopic results. The present measured total and elastic and inelastic are consistent. In addition, the present results reasonably extrapolate to the lower energy values of Lambropoulos et al. (16) as illustrated in Figs. 5A to 5D. Direct comparison with $(n;n'\gamma)$ measured values is not straightforward in the presence of complex level structures as in these isotopes. However, the present measured values appear consistent with the energetics determined from the $(n;n'\gamma)$ measurements of Refs. 28 and 29 dealing with ^{92}Mo and ^{100}Mo.

IV. Interpretation and Discussion

A. The Optical Model

The above experimental results form a comprehensive data base for examining some of the physical aspects of the optical model (1,2,3). The measured values extend over a range of nine mass units of a single element commencing with the closed neutron shell at N=50. Level densities, strength functions and, possibly, deformations are rapidly changing. The data base is inclusive of total and scattering cross sections over a several MeV range where exit channels and associated excited structure are relatively well known. The directly calculable total cross section is available and the absence of a coulomb barrier makes possible measurements in a number of well defined neutron channels. These are features not readily available in conventional charged particle studies. The scope of this experimental information constrains the choice of optical model parameters with the consequent potential for the improved physical definition of model properties.

Basic considerations of nuclear matter and the optical model by Green and Sood (8), Lane (9), Perey and Buck (5), Engelbrecht and Fiedeldey (6), Becchetti and Greenlees (10) and others (3) have led to neutron potentials of the form:

$$V_{real} = V_o - A \cdot E \text{ (MeV)} - \left[\frac{N-Z}{A}\right] \cdot V_1 \quad \text{(volume)}$$

$$W_{imag.} = W_o - B \cdot E \text{ (MeV)} - \left[\frac{N-Z}{A}\right] \cdot W_1 \quad \text{(surface)} \qquad (1)$$

Experimental comparisons generally indicate that V_o and W_o have values of approximately 50 MeV and 12 MeV, respectively (10,3, 30). The energy dependent terms are physically related to the non-locality of the nuclear forces (5,6). The parameters A and B are phenomenologically determined from comparisons with measured values over a wide energy range as in the work of Becchetti and Greenlees and of Engelbrecht and Fiedeldey. The values A=0.32 and B=0.25 given by Becchetti and Greenlees are illustrative of the magnitudes of the commonly proposed energy dependence. The $\left[\frac{N-Z}{A}\right]$ term has its origin in the nature of the two body force (9) which leads to a potential term proportional to ($\underline{t} \cdot \underline{T}$) where $\underline{t}$ and $\underline{T}$ are incident particle and target isospins. In neutron interactions this term reduces to the simple $\left[\frac{N-Z}{A}\right]$ form of Eq. 1. From extensive comparisons with experimental neutron results Becchetti and Greenlees deduce the values $V_1 = 24$ MeV and $W_1 = 12$ MeV. Other estimates of V_1 give somewhat larger values (e.g. 30 MeV, quoted in Ref. 3). Studies of (p,n) and (p,p) processes at energies of 10 MeV and above qualitatively support these general magnitude estimates.

Beyond the above general energy and isotopic trends of the optical model, Lane et al. (12) have suggested a local shell dependence; resulting in sharply reduced absorption near shell closures. This effect is primarily attributed to rapid changes in level densities. Moreover, near shell closures the wave function has a node at the surface further reducing the surface absorption dominent at lower energies. Lane et al. point out that this shell influence on the absorption contributes to the well known deep minimum observed in the $\ell=0$ strength function near A=100 (N=50). In addition, Vonach et al. (13) have correlated observed elastic neutron angular distributions in the region of A=208 with the absorption of the optical potential. They find a factor of three reduction in the imaginary portion of the potential going from Au(A=197) to Bi(A=209). These are appreciable changes, exceeding those of Eq. 1 by large amounts. The present experiments provide a good foundation for the assay of this shell dependence of the potential in the region A=100 extending from the closed shell at N=50 through the neutron $d_{5/2}$ shell and into the $g_{7/2}$ shell.

It was the objective of the interpretation to explore these optical model concepts in the context of the present neutron data base and to deduce an optical potential suitable for extrapolation and interpolation in the region of A=100 and for the subsequent analysis of non-elastic neutron processes using statistical-model concepts.

The optical model interpretation of the present experimental results was carried out in three stages. The first was a broad survey consisting of Xi-square fitting of the model parameters to the elastic distributions. In the second stage a detailed description of the elastic distributions and the total cross section was developed by fine adjustment of the parameters deduced from the Xi-square fitting procedures. Particular attention was given to energy dependence, the $\left[\frac{N-Z}{A}\right]$ term of the potential of Eq. 1 and to possible shell dependence of the parameters. The third stage explored the possible contribution of collective deformations. All of the optical model calculations employed real potentials of the Saxon form, surface absorption imaginary potentials (alternately Gaussian or Saxon-derivative forms) and a Thomas spin-orbit term (3). Throughout, the compound-elastic contributions were computed using the Hauser-Feshbach formula (31) with the width fluctuation correction (32).

All six of the spherical optical-model parameters were adjusted in the Xi-square fitting procedures to obtain the optimum description of the observed elastic angular distributions. The data base consisted of the present experimental results to incident neutron energies of 3.0 MeV and 100 keV averages of the lower energy values reported by Lambropoulos et al. (16). Data obtained at incident energies above 3.0 MeV was not used in the fitting procedures since the compound-elastic contribution could not be simply calculated due to uncertain knowledge of the contributing exit channels. During the fitting the data was weighted by the estimated experimental uncertainty. At lower energies, the Lambropoulos values are not well defined above 1.2 MeV due to limited number of angular measurements. In addition, below 1.0 MeV, particularly the ^{92}Mo, the cross sections displayed appreciable energy dependent fluctuations even in the 100 keV average. Despite these uncertainties reasonably consistent potential parameter sets were obtained as illustrated by the real-potential depths and radii of Fig. 6. The real diffuseness was similarly well defined. The fitting procedures indicate a constant real potential of $\approx$ 49 MeV with a precision of $\lesssim$ 2.0 MeV. The slightly lower potential values in the region of 2.0 MeV were attributable to the experimental uncertainties in this region. The real potential form of Eq. 1 was not inconsistent with the results of the fitting procedures assuming the generally accepted parameter values of A $\approx$ 0.3 and $V_1 \approx$ 25 MeV and the parameter uncertainties. However no systematic trend in either energy or isotope was evident. The $A^{1/3}$ radial size effect was very small and well within the errors associated with the fitting procedures. The fitting yielded consistent imaginary parameters but with relatively larger uncertainties than for the real parameter values and well beyond the small energy and $\left[\frac{N-Z}{A}\right]$ effects indicated by Eq. 1. The fitting procedures gave the first evidence of a recurring problem; the inability to simultaneously fit the total cross sections and the elastic distributions. Parameters derived from a fit to the latter generally resulted in total cross section values smaller than the measured results, and increasingly so with mass, amounting to a discrepancy of $\lesssim$ 5 percent at ^{100}Mo. Attempts to obtain a good Xi-square fit to both the total cross sections and elastic distributions were not particularly rewarding. Elastic distributions calculated from the Xi-square derived values did not always give a particularly good description of the measured values in the diffraction minima. This is a region of lower experimental precision and consequently of low-weight in the fitting procedures. The quality of the fits in this area could be altered by artificial weighting of the measured values. This is a highly subjective artifice and it was judged more desirable to proceed further by way of explicit parameter adjustments as described below.

The point of departure for the second stage of the optical model interpretation was the parameters resulting from the above Xi-square survey. The six model-parameters were adjusted in detail to obtain the "judged-best" description of the ^{98}Mo and ^{100}Mo total and elastic scattering cross sections over the energy range of the present measurements. Implicit in this adjustment procedure was a real potential energy dependence given by A, of Eq. 1, equal 0.3. This proportionality was consistent with results reported elsewhere (5,6,10), though a small effect over the energy range of the present measurements. ^{98}Mo and ^{100}Mo were chosen for the reference adjustment procedures because of the relatively small compound elastic component over much of the energy range and their extreme positions in the present mass range. Even so the compound-elastic contribution was appreciable and parameter selection was sensitive to its magnitude. This contribution was calculated using the Hauser-Feshbach formula with width fluctuation corrections. Such calculations reliably give the shape of the distribution but the magnitude is less certain due to unknown exit channels at energies $\gtrsim$ 3.0 MeV and to shortfalls in the calculations themselves such as uncertain resonance overlap effects (32). Therefore the normalization of the compound-elastic components was treated as a free parameter in the adjustment procedures with only the constraint of a smooth energy dependence. In practice this procedure led to compound-elastic contributions somewhat larger (few percent) than the Hauser-Feshbach result at energies where the exit channel contributions were reasonably known with progressively lower compound-elastic values as uncertain channels open at higher energies (e.g. $\gtrsim$ 3.0 MeV). The low-energy compound-elastic values were consistent with the correction factors suggested by Moldauer (32) and implied overlap parameter (Q) values in the range 0.2 to 0.5. The latter were similar to those deduced from the inelastic neutron scattering studies (see below).

The above procedures resulted in a good description of the differential elastic scattering from ^{98}Mo and ^{100}Mo as indicated by the curves of Fig. 2. The total cross sections were more difficult as the calculated values were consistently a few percent smaller than the measured results. The total cross sections were not particularly sensitive to reasonable variations in the real portion of the optical potential and a simple $A^{1/3}$ size effect did not account for the marked differences between ^{92}Mo and ^{100}Mo total cross sections. The latter appeared to be associated with the absorption. Careful adjustments in that area led to ^{98}Mo and ^{100}Mo calculated total cross sections systematically lower than the measured values by no more than 5 percent, as illustrated in Fig. 1. An inspection of potentials found in the literature (30) may have shown the same inconsistency between total and elastic scattering cross sections possibly to a greater extent. Moreover, the presently measured total neutron cross sections were potentially uncertain by amounts equivalent to the measured-calculated discrepancy due to uncertain simple densities as noted above.

Using the parameters obtained for ^{98}Mo and ^{100}Mo the total and elastic scattering cross sections of ^{92}Mo and ^{96}Mo were calculated. In doing so the real potential was assumed to have the form

$$V = V_o - 0.3\ E\ (\text{MeV}) - \left[\frac{N-Z}{A}\right] \cdot 24 \qquad (2)$$

and the imaginary potential was adjusted to obtain the best description of the experimental values. The calculated results were good agreement with measured values as indicated by the curves of Figs. 1 and 3. The respective potential parameters are given in Table 3. A feature of these parameters is a trend toward increasing imaginary strength with isotopic mass. Extension of the model calculations to the lower energy values ($\lesssim$ 1.25) reported by Lambropoulos et al. (16) gave good results and, indeed, the present potential parameters are very similar to those independently proposed by Lambropoulos et al. From 1.25 to 1.5 MeV the agreement was not as good but the Lambropoulos measured results are not particularly well defined in the region as they approach the upper energy limit particularly in the minima of the distributions.

The $\left[\frac{N-Z}{A}\right]$ term of Eq. 2 is implicit in the above parameter selections. The effect is small ($\lesssim$ 2.0 MeV) changes in V over the entire isotopic range of the present measurements. However, it is clearly evident as illustrated by the curves of Fig. 7. The deletion of the $\left[\frac{N-Z}{A}\right]$ term results in calculated cross sections 2 to 3 times smaller than either the measured values or those calculated with Eq. 2 in the region of the first minimum of the diffraction pattern. The effect decreases with energy and at $\gtrsim$ 1.0 MeV is essentially negligible. Thus it was not observed in previous low energy measurements (16). The 24 MeV proportionality constant used in Eq. 2 appears essentially correct and is consistent with that of Becchetti and Greenlees (10) and others (3). However, comparisons with the present experiments probably could not define the value within an uncertainty of less than 5 to 10 MeV. Moreover, the potential is not unique and other parameter choices might yield other values of this proportionality constant.

Comparisons with the present experimental results did not precisely define the energy dependence of the absorption term, W. However, the trend was either toward constant or slightly increasing W magnitudes with energy. This is not the qualitative character of the energy dependence given in Eq. 1 nor that deduced from the analysis of measured values over a much wider energy range by Engelbrecht and Fiedeldey (6) and others (3). However, the present results were deduced from a relative narrow and low-energy range of measurements where potentials may fluctuate and similar trends at lower energies have been reported in the literature; for example, the potential of Mani et al. (7).

There was a qualitative trend toward increasing absorption (i.e. W magnitudes) with isotopic mass as illustrated by the parameter values given in Table 3. This effect was appreciably influenced by the corresponding tendencies of the observed total cross sections. The latter were subject to possible systematic uncertainties as discussed above. The trend in W with $\left[\frac{N-Z}{A}\right]$ is as large as implied by Eq. 1 using the W_1 value of Becchetti and Greenlees (10) ($W_1 \approx 12$ MeV) but of the opposite sign. It is suggested by the present experiments and interpretation that the isotopic dependence of the optical-potential absorption in the region of A=100 is significantly influenced by shell effects which, in these particular isotopes, transcend the more general $\left[\frac{N-Z}{A}\right]$ dependence of Eq. 1. The observed trends are qualitatively consistent with those outlined in Refs. 12 and 13. The present potentials result in $\ell=0$ strength functions of $\approx 0.75 \times 10^{-4}$. These values are consistent with systematic strength function behavior but it is difficult to make explicit comparisons with measured values as the latter fluctuate appreciably (e.g., 0.65 (92), 0.70 (96), 0.70 (98) and 0.30 (100), $\times 10^{-4}$ as given in Ref. 33).

The above adjustment procedures were repeated using a coupled-channel model coupling the ground and first-excited 2+ states assuming the latter were collective-rotational configurations (34). The deformations were taken from the compilation of Stelson and Grodzins (35). A considerable adjustment of the coupled-channel model parameters did not improve the description of the observed elastic distributions and the calculated total cross sections tended to be less suitable than those obtained with the above spherical potential. The comparisons with the experimental results improved as the coupling was weakened and concurrently the parameters tended toward those of Table 3. It was concluded that channel coupling did not appreciably contribute to the total and elastic scattering cross sections at the energies of the present experiments.

B. Statistical Calculations

The inelastic neutron excitation cross sections were calculated using the above optical potentials and the Hauser-Feshbach formula with resonance width fluctuation and overlap corrections (31,32). The overlap parameter, Q was varied to optimize the agreement between calculated and measured cross sections and tended to increase with mass from $\sim$ 0.2 at ^{92}Mo to $\sim$ 0.5 at ^{100}Mo. This is qualitatively expected from the character of the resonance structure shown in Fig. 1 and consistent with the compound-elastic contributions used above. The calculational objectives were: a verification of the above optical potential in the context of inelastic scattering, an assay of J^{π} assignments for various excited states, and the extrapolation of measured values for evaluation. The summary of the excited structure of the molybdenum isotopes given in recent Nuclear Data Sheets was used as an initial basis for the calculations (15).

The reported excited structure of ^{92}Mo is relatively simple to $\sim$ 3.2 MeV (see Fig. 4). Measured and calculated cross sections for the excitations of the 1.51 (2+) and 2.28

(4+) MeV states are in good agreement as illustrated in Fig. 5A. The 2.52 MeV state is reported to be a doublet consisting of 2.520(0+) and 2.526(5-) MeV components (15,28). The present experiments did not resolve this doublet. however, calculations based upon the premise of its existence gave good agreement with the measured cross sections if the prominent component had a J-value of 0 or 4; intermediate values resulted in too large calculated cross sections. The J=0 assignment is consistent with the results of Chung et al. (28) and accounts for the apparent fact that the gamma-ray transition to the 0+ ground state was not observed in their work. In addition, the scattered neutron distributions observed in the present work tended to be appreciably concave as would be expected of a 0+ state and not characteristic of a 4+ state. Therefore it is suggested that the prominent contribution is from a 0+ state of $\sim$ 2.52 MeV with the other component of the doublet a 5- state as reported from beta decay measurements (15). This suggestion is consistent with the collective model predictions of Davydov and Filippov (14) as discussed by Lambropoulos et al. (16) and with the energy-systematics of 0+ states in the even isotopes of molybdenum. The calculated cross sections for the excitation of 2.61(6+) and 2.85(3-) MeV states were in reasonable agreement with experiment. A state reported at 2.76(8+) MeV was not observed and the corresponding calculated cross sections were below the sensitivity of the present experiments. Three reported levels could have possibly contributed to the observed 3.050 MeV state (3.005, 3.063 and 3.092 MeV). One of these (3.092 MeV) has been identified as a 2+ state. Cross sections calculated assuming this was the only state were reasonably consistent with the present observations. This suggested that the remaining two states of the triad have rather large spins and as a consequence did not appreciably contribute to the inelastic neutron scattering observed in the present experiments. No attempt was made to quantitatively estimate calculated excitations above $\sim$ 3.2 MeV due to uncertainties in the structure though the number of speculative states were indicated at the higher energies for completeness.

Calculated and measured excitation cross sections of the 0.78 (2+), 1.15 (0+) and 1.50 (2+) MeV states in ^{96}Mo were in agreement to $\sim$ 3.0 MeV as shown in Fig. 5-B. Above $\sim$ 3.0 MeV the calculations deviated towards higher values as a complexity of uncertain channels progressively open. The 0+ assignment of the 1.15 MeV state is given as tentative in Ref. 15. The present results clearly indicated this J^{π} assignment, with characteristic concave angular distributions as illustrated in Fig. 3. The observed 1.64 MeV state was attributed to contributions from reported 1.626 (2+) and 1.628 (4+) states and the calculated cross sections are consistent with this premise. Calculations based upon smaller spins for the 1.628 MeV state were less acceptable. Similar agreement between measured and calculated cross sections for the excitation of the 1.87 (4+) and 1.98 (3+) MeV states was achieved. The spin of the 2.10 MeV state is uncertain with estimates ranging from one to four (15). The present calculations and measurements were reasonably consistent with J=1,2 or 3 with the latter preferred. The observed angular distributions were essentially isotropic, precluding J=0 values. The present experiments did not resolve the reported doublet at 2.22 (4+) and 2.23 (3-) MeV but the measured and calculated cross sections are consistent with the proposed energetics and J^{π} values. The remaining observed "states" at average excitation energies of $\overline{2.5}$, $\overline{2.7}$, and $\overline{2.9}$ MeV are clearly composites of a number of contributions. For example, at least six states, given in Ref. 15, were possible contributors to the observed 2.5 MeV excitation and this picture was very likely an over simplification. In view of this complexity and uncertainty no attempt was made to relate measured and calculated values at excitations above $\sim$ 2.4 MeV though estimated structures were included in the calculations for completeness.

The recent Nuclear Data Sheets (15) cite approximately forty states in ^{98}Mo to excitations of $\sim$ 3.3 MeV; i.e. an average separation of $\approx$ 80 keV. The average separation is thus comparable to the present experimental resolution. J^π values for the majority of these have not been identified at excitations $\gtrsim$ 2.5 MeV. Some may have high spin values and as a consequence not appreciably contribute to the present neutron observations. On the other hand the present picture is probably an over simplification. The results of the present calculations, employing 17 excited states selected from the better-established J^π values, are compared with experimental values in Fig. 5 C. The present measurements resolved the 0.74 (0+) and 0.79 (2+) MeV components only at the lowest energy (1.8 MeV). At higher energies the composite contribution was observed. Both experimental results are consistent with the calculated values and the angular distribution of neutrons from the excitation of the 0.74 MeV state had the concave "signature" characteristic of a 0+ state. Measured and calculated cross sections for the excitation of 1.43 (2+) and 1.51 (4+) MeV states were consistent to $\approx$ 3.0 MeV with calculations deviating toward larger values with energy due to the onset of uncertain exit channels. Measured excitations of the 1.76 (2+) state were somewhat smaller than the calculated results as expected. Reported states at 1.81 and 1.88 MeV were not observed and/or could possibly have been included with the 1.76 MeV state. However, in either case the calculations suggest that the spins of these possible contributions, if present, are $J>4$. The excitation of 1.97 (0+) and 2.02 (3-) MeV states was observed as a composite. Additional states have been reported at 1.99 and 2.04 MeV. Again, if present with $J \lesssim 4$, they would have led to calculated values appreciably larger than observed. Calculated and measured cross sections for the excitation of the 2.10 (2+) MeV state were consistent. The reported doublet at 2.21 (2+) and 2.22 (2+, 3+ or 4+) MeV was attributed to the observed 2.20 MeV state. The illustrated calculations were based upon J^π values of 2+ and 4+, respectively. Alternate values for the 2.22 MeV state of 2+ or 3+ gave less desirable results. Excitations of some states above 2.3 MeV were included in the calculations. However, incomplete knowledge of contributing structure made explicit correlation with the measured cross sections unrewarding.

Comparison of measured and calculated excitations of states in ^{100}Mo are outlined in Fig. 5 D. Calculated excitations of the 0.54 (2+) and 0.69 (0+) MeV states were slightly smaller than the experimental values. This shortfall was alleviated by increasing the overlap parameter, Q, to values above 0.5 but with a detrimental effect in the area of compound-elastic contributions. As noted above, there are experimental uncertainties associated with these two states. In view of these calculational and experimental factors the agreement between measured and calculated values was judged acceptable. The experiments left little doubt as to the 0+ assignment of the 0.69 MeV state as the observed scattered-neutron angular distributions displayed a characteristic concave shape. Measured and calculated cross sections for the excitation of 1.06 (2+), 1.14 (4+) and 1.46 (2+) MeV states are in reasonable agreement. Comparisons based upon a single 1.77 (2+) MeV state were less satisfactory. The calculated values are too large by an amount that cannot be reasonably accounted for by contributions from uncertain competing channels. Moreover, two states have been reported (15,29) at about this energy (1766 (2+) and 1770 (+)). The present results tend to indicate that the spins of one (or both) are larger than $\gtrsim$ 3. The reported 1.91 and 2.10 MeV states have been tentatively assigned J^{π} values in the range 2-4+ and 3-, respectively (15). The present calculations employing 3- and 2+ are reasonably consistent with the measured values. Alternate choices of 4+ and 3+ for the 2.10 MeV state were not as desirable. The present results are consistent with the reported 2.34 (2+) MeV state but this was a weak conclusion as excitations in this region are likely more complex than presently known. This is even more relevant to excitations at $\overline{2.5}$ and $\overline{2.8}$ MeV and no attempt was made to interprete the cross sections observed in these two regions though the calculations, again, included speculative structures for completeness.

In conjunction with the above, coupled-channel analysis of total and elastic scattering cross sections the contribution of direct-reaction processes to inelastic scattering was examined. The models found most suitable from the standpoint of total and elastic cross sections had rather weak direct-reaction strengths (the direct well $\stackrel{\sim}{\sim}$ 2/3 the real well). Consequently channel coupling contributed little to the inelastic neutron scattering at the energies of the present work. The contributions were generally smaller than either the experimental uncertainties or those associated with the choice of the overlap parameter, Q. Thus, in the context of inelastic scattering, there was no experimental justification for the added complexity of the coupled-channel model.

V. Evaluated Neutron Total and Scattering Cross Sections

Contemporary knowledge of neutron total and scattering cross sections of ^{92}Mo, ^{96}Mo, ^{98}Mo and ^{100}Mo is very largely confined to the present work and the results of Ref. 16, previously reported from this laboratory. The scope of this information and uncertain knowledge of other reactions in these even isotopes precludes the formulation of a definitive experimentally based evaluated data file. Therefore a limited evaluations were undertaken explicitly confined to: the isotopes ^{92}Mo, ^{96}Mo, ^{98}Mo and ^{100}Mo, the energy range 0.1 to 8.0 MeV and to the neutron total and scattering cross sections. These limited evaluations may be of direct use in some applied computations, form a basis for critical comparisons with the elemental file of ENDF/B-IV (17) and establish a foundation for the formulation of a future, more comprehensive file, as additional experimental information becomes available. The present files are based upon the above work and that reported previously in Ref. 16. In addition, spectroscopic information summarized in Ref. 15 is utilized where appropriate. The formulation is within the format of the ENDF system and comparisons are made with the elemental file of ENDF/B-IV where possible. Subsequent portions of this Section outline the formulation of these limited evaluated files. The respective numerical contents are given in the Appendix.

A. The ^{92}Mo File

The processes considered in the present limited file for ^{92}Mo are outlined in Table 4.

The total cross sections over the range 0.1 to 5.5 MeV were taken directly from the measured values. Below $\approx$ 1.5 MeV the total cross sections display considerable partially resolved structure as illustrated in Fig. 1A. In this region the evaluation was constructed by selecting measured values from the experimental data set in such a manner as to portray the structure with a minimum of numerical values. From 1.5 to 5.5 MeV the evaluation follows a smooth curve constructed through the present measured values. Above 5.5 MeV the total cross sections are obtained from the model described above, slightly renormalized to give agreement with the measured values in the region 5.0 to 5.5 MeV.

Below the first inelastic threshold at $\approx$ 1.53 MeV the elastic cross section file is assumed identical to the total cross section file. This assumption ignores a very small component from the (n,γ) process and corrections for that contribution should be made when they can be reliably established. More generally, similar corrections for minority exit channels not considered in this evaluation should be applied when they can be precisely determined. The effect of these corrections on the file will be relatively small to energies of $\approx$ 6.0 MeV; i.e. over the very large portion of the energy range of the present work. From the first inelastic threshold to 2.5 MeV the elastic cross section was constructed from the difference between the total cross section and sum of inelastic partial cross sections determined in the present work. From 2.5 to

4.0 MeV the elastic cross section was taken from the above measurements and interpretations as illustrated, for example, in Fig. 2. Above 4.0 MeV the evaluation relied upon an extrapolation using the model parameters of Table 3. The entire result is illustrated in Fig. 8.

The elastic angular distributions calculated with the model of Table 3 are very descriptive of the present measured values, as illustrated in Fig. 2, and generally of the energy average of those at lower energies reported in Ref. 16. Furthermore, the calculated results compare favorably with the elemental measured values at 8.0 MeV reported in Ref. 30. Thus the above experimentally based model was used to generate the elastic angular distributions. They are expressed in terms of f_ℓ cooefficients defined by

$$\frac{d\sigma}{d\Omega} = \frac{\sigma}{2\pi}\left[\sum_{\ell=o}^{n} \frac{2\ell+1}{2}\, f_\ell P_\ell\right] \qquad (4)$$

and are tabulated in the Appendix in the laboratory coordinate system. Transfer to the center of mass system will only slightly change the values. Applied parameters, such as $\overline{\cos}$ of the scattering angle, are readily calculated from the f_ℓ values if desired (36) and thus are not explicitly given here. The evaluated differential elastic scattering cross sections are well behaved as illustrated in Fig. 9 and satisfy "Wicks Limit" (37).

Below 3.0 MeV the discrete inelastic neutron excitation cross sections are based upon the present experimental measurements extrapolated to the respective thresholds using the calculational methods outlined above. They are explicitly the "eye-guide" dotted curves of Fig. 5. Above 3.0 MeV they were empirically extrapolated to a zero upper value at 8.0 MeV. This extrapolation has the intent of qualitative guidance and does not account for pre-compound contributions that will increase the magnitudes at higher energies. Discrete excitation of states at $\stackrel{>}{\sim}$ 3.2 MeV are uncertain and the evaluation treats them collectively as a continuum. The magnitude of the continuum component was constructed from the difference between the total cross section and known components (i.e. elastic and discrete inelastic). As noted above, this procedure ignores some contributions, such as (n,γ), and appropriate corrections must be made when suitable experimental information becomes available. The energy distribution of neutrons emitted via continuum processes is not specified in the Appendix. There appears to be no explicit experimental information and, in its absence, a simple "temperature" consistent with systematics is suggested. Such an approximation will lead to a shortfall in the higher energy portions of the emission spectrum. The relative magnitudes of the various inelastic components are illustrated in Fig. 8.

Implicit in the present evaluation is the assumption of isotropic inelastic neutron emission and this is not explicitly stated in the numerical files of the appendix. At excitations of $\stackrel{<}{\sim}$ 3.2 MeV this assumption is justified by the present experiments. An exception is the excitation of the $\sim$ 2.5 MeV, presumed 0+, state. However, the respective cross section is not large and the anisotropy relatively small. As the energies increase from $\sim$ 3.0 MeV to the upper limit of 8.0 MeV anisotropy should appear, due to pre-compound processes. However, at the energies of the present evalation it should not be large and uncertainties in the inelastic evaluation will be dominated by other factors.

B. The ^{96}Mo File

The processes in this file are outlined in Table 5. The methods and procedures employed in deducing the file were identical to those employed for ^{92}Mo, outlined above. The results are graphically summarized in Fig. 8 and explicitly given in numerical form in the Appendix.

C. The ^{98}Mo File

The content of this file is outlined in Table 6. The data base and evaluation procedures were identical to those of ^{92}Mo, above. In this isotope there is additional experimental total cross section information from Ref. 25. The latter is consistent with the present evaluation but shows more structure particularly at higher energies. For simplicity and consistency with the other isotopes this additional structure was omitted. For most applications this omission should not be a drawback. Wick's Limit was satisfied in this and the other cases. However, in order to satisfy this limit for ^{98}Mo and ^{100}Mo (and to a much less extent, ^{96}Mo) it was necessary to slightly distort the elastic angular distributions near zero degrees. This was believed another manifestation of the small inconsistency between measured total and elastic scattering cross sections noted in the above model discussion. The results of the present evaluation are given in Fig. 8 and the Appendix.

D. The ^{100}Mo File

The contents of this file is outlined in Table 7. The data base and procedures were identical to those of ^{92}Mo outlined above. The results are graphically summarized in Fig. 8 and listed in the Appendix.

E. Uncertainty Estimates

The uncertainties to be associated with the present limited evaluations are a matter of subjective judgement based, primarily, upon the available experimental data base and associated interpretation. Some guidelines are as follows:

i. The uncertainties in the total cross sections are probably $\lesssim$ 5% to 5.5 MeV. At higher energies the uncertainty may be as large as 10%. Comparisons of the weighted composite with the known elemental cross sections indicate better accuracies.

ii. Below the inelastic thresholds the uncertainties in the elastic cross sections are equivalent to those of the total cross sections. From threshold to 4.0 MeV the accuracy is $\lesssim$ 5 to 10% and at higher energies $\gtrsim$ 10%. The relative angular distributions are believed known to comparable accuracies.

iii. The discrete inelastic excitation cross sections are believed known to $\lesssim$ 10% to $\approx$ 4.0 MeV for the prominent components and to lesser relative accuracies for minor components. Specific estimates can be made from the discussion of Secs. III and IV, above. Above the maximum measured energy of 4.0 MeV the inelastic scattering components become increasingly matters of speculation. However, the non-elastic cross section is reasonably defined by total and elastic scattering cross sections.

F. Comparisons with the Elemental File of ENDF/B-IV

The present evaluations are not directly comparable with the elemental ENDF/B-IV file (38). Moreover, at the time of this writing the ENDF-IV molybdenum file was not available in final form. It appears to be essentially the ENDF-III file at energies comparable with the present work. However some qualitative interrelations can be established that may offer guidance as to future improvements of the file. Here we assume the available preliminary form of the file with references thereto denoted as ENDF/B.

The total neutron cross sections of ENDF/B are relatively consistent with the present evaluated results as illustrated by the respective curves in Fig. 8. The present evaluations reflect the trend toward increasing values with mass noted in the experimental measurements. The largest discrepancies appears at energies of $\lesssim$ 2.0 MeV and there are some differences near 8.0 MeV where the present work is based upon extrapolation. The ENDF/B file does not show the structure of the present work. The latter will average in the elemental composite. Generally, the consistency of the various total cross section files was judged reasonably good.

The evaluated neutron elastic scattering cross sections are difficult to compare as the cross sections differ rather sharply from isotope-to-isotope as illustrated in Fig. 2. These differences are most evident in the elastic differential distributions. Those given in ENDF/B appear to be neither particularly detailed nor consistent with the present work. This is particularly true at energies above $\sim$ 1.0 MeV. This may be a concern to those applications where deep minima of the scattering distributions are important. There is also a discrepancy between the angle-integrated elastic scattering cross sections of the present work and ENDF. This is a reflection of problems associated with inelastic neutron scattering outlined below. It is suggested that the elastic scattering cross sections of the ENDF/B file could be improved by utilizing a weighted average of the present isotopic evaluations.

The formulation of the ENDF/B file in the inelastic scattering area apparently is based upon an integrated inelastic cross section dating back to ENDF/B-I or II with the addition of a limited number (4) discrete inelastic groups. A very large portion of the file relies upon a simple continuum representation. Above energies of several MeV the total inelastic neutron cross sections of the present work and those of ENDF/B are very similar as illustrated in Fig. 8. As the thresholds are approached, a discrepancy arises amounting to possibly a factor of two or more at $\sim$ 1.0 MeV. The present evaluated inelastic cross sections of ^{96}Mo, ^{98}Mo and ^{100}Mo may be two to three times those of ENDF/B at 1.0 MeV. The cross sections of the odd isotopes ^{95}Mo and ^{97}Mo should have similar large values at 1.0 MeV due to the abundance of open exit channels. Further, $\sim$ 3/4 of the element consists of the molybdenum isotopes 95 through 100. Recognizing no 1.0 MeV inelastic contribution from ^{92}Mo and only a small component from ^{94}Mo (16) one must conclude that the 1.0 MeV inelastic neutron scattering cross section of the element is in excess of 1.0 barns. This conclusion is consistent with the elemental measurements of Smith and Hayes (39) and Glazkov (40). Thus the inelastic neutron scattering cross sections of ENDF/B may be considerably smaller than reality in the region of 1.0 MeV. This may be a matter of concern in some applications dealing with relatively "soft" spectra. An example is the "Central Worth" of molybdenum in a representative fast reactor spectrum.

This is particularly so as the inelastic neutron scattering cross sections of molybdenum are among the largest known. It is suggested that ENDF/B inelastic scattering cross sections be reviewed to assure that they are consistent with the present and previous work at lower energies.

The ENDF/B file contains extensive information dealing with neutron, particle and gamma-ray emission at energies well above the present work. These high energy portions of the file appear to be relatively consistent with a meager experimental base and known systematics. Unfortunately, the present studies do not provide appreciable insite into this high energy region. Measurements toward that end are now scheduled.

Finally, the reader is again cautioned that the above comparisons are based upon a preliminary version of the ENDF/B file.

VI. Summary Remark

The experimental results, together with those previously reported from this laboratory (16), reasonably defined the neutron scattering cross sections of ^{92}Mo, ^{96}Mo, ^{98}Mo and ^{100}Mo to 4.0 MeV and the total cross sections to 5.5 MeV. An optical model was constructed upon this experimental foundation with attention to the energy-, isotopic-, and shell-dependence of the optical potential in this region of $A \sim 100$. The real portion of the optical potential was well defined and was consistent with the energy and isotopic dependence of the form $V = V_o - 0.3.E(\text{MeV}) - \left[\frac{N-Z}{A}\right] \cdot 24$ (MeV) determined from broad-scope studies reported in the literature (5,6,8,9,10). The optical model absorption was not as precisely defined but tended to increase in strength with mass and, to a lesser extent, with energy. The trend in the mass dependence of the absorption was qualitatively similar to the shell dependence suggested in the region of N=50 from considerations of strength functions (12) and observed in $\sim$ 1.0 MeV neutron scattering near A=208 (13). The results of statistical-model calculations based upon previously reported structures of these isotopes were generally consistent with the measured inelastic scattering cross sections. In addition, comparison of calculated and measured values confirmed some tentative J^{π} assignments and suggested values where prior knowledge was entirely lacking; specifically, a) the inelastic scattering from the 2.52 MeV doublet in ^{92}Mo was primarily attributed to a 0+ state and that from a triad in the region of 3.0 MeV to a 2+ state, b) the 0+ assignment of the 1.15 MeV state in ^{96}Mo was confirmed together with the 4+ assignment of a member of the 1.62 MeV doublet and the results suggest J=1, 2 or 3 for the 2.10 MeV state, c) the states in ^{98}Mo at 1.81, 1.88, 1.99 and 2.04 MeV were not observed with the implication of relatively large J values and a 4+ assignment is suggested for the 2.22 MeV state, and d) the one or both of the reported states in ^{100}Mo at 1.766 and 1.770 MeV probably correspond to J values > 3 and a 2+ assignment is suggested for the 2.10 MeV state. The optical- and statistical-model results were re-examined in the context of collective deformations. The latter were not believed warranted in the present experimental context. The experimental and calculational results were utilized to construct a limited evaluated file in the ENDF format consisting of neutron total and elastic and inelastic scattering cross sections over the energy range 0.1 to 8.0 MeV.

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TABLE 1. Sample Composition[a]

Sample	^{92}Mo	^{94}Mo	^{95}Mo	^{96}Mo	^{97}Mo	^{98}Mo	^{100}Mo	O/Mo
1	<u>97.37</u>	0.68	0.52	0.37	0.18	0.40	0.50	4.4
2	0.22	0.27	1.06	<u>96.44</u>	1.02	0.86	0.14	2.3
3	0.14	0.10	0.22	0.34	0.58	<u>98.3</u>	0.31	3.8
4	0.60	0.23	0.40	0.81	0.36	1.69	<u>95.90</u>	6.8

a. All isotopic values are in atom-percent. The oxygen to molybdenum ratio (O/Mo) is given as atom ratio in %.

TABLE 2. OBSERVED INELASTIC NEUTRON EXCITATION ENERGIES OF ^{92}Mo, ^{96}Mo, ^{98}Mo and ^{100}Mo[a]

^{98}Mo

No.	Exp.	NDS
1	1510 ± 10	1509
2	2280 ± 10	2283
3	2520 ± 20	[2520 2526][b]
4	2610 ± 20	2615
5	2850 ± 20	2849
6	3050 ± 50	[3005 3063 3092][b]

^{96}Mo

No.	Exp.	NDS
1	780 ± 10	778
2	1170 ± 20	1147
3	1500 ± 20	1498
4	1640 ± 20	[1628 1626][b]
5	1900 ± 30	1870
6	2000 ± 30	1978
7	2120 ± 30	2096
8	2240 ± 30	[2219 2234][b]
9	2500 ± 100	[2400 ▼ 2600][c]
10	2700 ± 100	[2600 ▼ 2800][c]
11	2900 ± 100	[2800 ▼ 3000][c]

^{98}Mo

No.	Exp.	NDS
1	740 ± 10	735
2	780 ± 10	787
3	1440 ± 20	1432
4	1510 ± 20	1510
5	1780 ± 20	1758
6	1960 ± 30	[1965 2017][b]
7	2070 ± 30	2105
8	2200 ± 30	[2207 2224][b]
9	2250 ± 50	(?)[d]
10	2380 ± 50	[2330 ▼ 2430][c]
11	2500 ± 70	[2430 ▼ 2570][c]
12	2700 ± 100	[2600 ▼ 2800][c]
13	2900 ± 100	[2800 ▼ 3000][c]

^{100}Mo

No.	Exp.	NDS
1	520 ± 10	535
2	690 ± 10	694
3	1060 ± 15	1064
4	1140 ± 15	1136
5	1460 ± 20	1463
6	1600 ± 30	(?)[d]
7	1770 ± 20	[1740 1780][b]
8	1910 ± 30	1908
9	2100 ± 30	2101
10	2330 ± 30	2340
11	2500 ± 100	[2400 ▼ 2600][c]
12	2800 ± 100	[2700 ▼ 2900][c]

a. All energies in keV, NDS denotes most recent Nuclear Data Sheet values as given in Ref. 15.
b. Observed state probably a composite of reported states as in energy range indicated.
c. Observed excitations estimated to approximately correspond to the indicated block of excitation energies. As noted in the text.
d. Isolated observation, probably erroneous.

TABLE 3. Optical Model Potential Parameters

V_o^a = 50.2 MeV	R^b_{real} = 1.209 F	A_{real} = 0.66 F
W^c = 4.5 MeV (92) 5.5 MeV (96) 4.9 MeV (98) 5.7 MeV (100)	$R^b_{imag.}$ = 1.218 F	$A_{imag.}$ = 0.63 F
V^d_{s-o} = 8 MeV		

---

a. Saxon potential form where

$$V = V_o - 0.3 \cdot E \text{ (MeV)} - \left[\frac{N-Z}{A}\right] \cdot 24 \text{ (MeV)}$$

b. Where nuclear radius = $R \cdot A^{1/3}$.

c. Surface absorption of Saxon-derivative form.

d. Spin-orbit potential of Thomas form.

TABLE 4

Processes, Q-Values and Thresholds of the Partial ^{92}Mo Evaluation.

No.	Process	Q-Value(MeV)	Threshold(MeV)
1	$\sigma(n)$, total	--	--
2	$\sigma(n,n')$		
a.	Elastic	0.0	--
b.	$\sigma(n,n'_1)$	-1.5094	1.5258
c.	$\sigma(n,n'_2)$	-2.2825	2.3073
d.	$\sigma(n,n'_3)$	-2.5200	2.5473
e.	$\sigma(n,n'_4)$	-2.6115	2.6399
f.	$\sigma(n,n'_5)$	-2.8487	2.8796
g.	$\sigma(n,n'_6)$	-3.050	3.0831
h.	$\sigma(n,n')$ continuum	-3.165	3.200

TABLE 5

Processes, Q-Values and Thresholds of the Partial ^{96}Mo Evaluation

No.	Process	Q-Value(MeV)	Threshold(MeV)
1	σ(n), total	--	--
2	σ(n,n')		
a.	Elastic	0.0	--
b.	$\sigma(n,n'_1)$	-0.77826	0.78635
c.	$\sigma(n,n'_2)$	-1.1479	1.1598
d.	$\sigma(n,n'_3)$	-1.4978	1.5133
e.	$\sigma(n,n'_4)$	-1.6259	1.6428
f.	$\sigma(n,n'_5)$	-1.8695	1.8889
g.	$\sigma(n,n'_6)$	-1.9783	1.9988
h.	$\sigma(n,n'_7)$	-2.0956	2.1174
i.	$\sigma(n,n'_8)$	-2.2250	2.2481
j.	$\sigma(n,n'_9)$	-2.5000	2.5260
k.	$\sigma(n,n'_{10})$	-2.7000	2.7280
ℓ.	$\sigma(n,n'_{11})$	-2.9000	2.9301
m.	Continuum	-2.276	2.300

TABLE 6

Processes, Q-Values and Thresholds of the Partial ^{98}Mo Evaluation.

No.		Process	Q-Value (MeV)	Threshold (MeV)
1		σ(n), total	---	----
2		σ(n,n')		
	a.	Elastic	0.0	----
	b.	$\sigma(n,n'_1)$	-0.7349	0.7422
	c.	$\sigma(n,n'_2)$	-0.7874	0.7952
	d.	$\sigma(n,n'_3)$	-1.432	1.446
	e.	$\sigma(n,n'_4)$	-1.510	1.525
	f.	$\sigma(n,n'_5)$	-1.758	1.776
	g.	$\sigma(n,n'_6)$	-2.025	2.045
	h.	$\sigma(n,n'_7)$	-2.105	2.126
	i.	$\sigma(n,n'_8)$	-2.216	2.238
	j.	$\sigma(n,n'_9)$	-2.340	2.365
	k.	$\sigma(n,n'_{10})$	-2.500	2.525
	ℓ.	$\sigma(n,n'_{11})$	-2.700	2.727
	m.	$\sigma(n,n'_{12})$	-2.900	2.929
	n.	Continuum	-2.969	3.000

TABLE 7

Processes, Q-Values and Thresholds of the Partial ^{100}Mo Evaluation.

No.		Process	Q-Value(MeV)	Threshold(MeV)
1		σ(n), Total	---	---
2		σ(n,n')		
	a.	Elastic	0.0	---
	b.	$\sigma(n,n'_1)$	-0.5356	0.54095
	c.	$\sigma(n,n'_2)$	-0.6944	0.70134
	d.	$\sigma(n,n'_3)$	-1.0637	1.0743
	e.	$\sigma(n,n'_4)$	-1.1361	1.1474
	f.	$\sigma(n,n'_5)$	-1.4633	1.4779
	g.	$\sigma(n,n'_6)$	-1.7704	1.7881
	h.	$\sigma(n,n'_7)$	-1.9081	1.9272
	i.	$\sigma(n,n'_8)$	-2.1014	2.1224
	j.	$\sigma(n,n'_9)$	-2.340	2.3634
	k.	$\sigma(n,n'_{10})$	-2.500	2.5250
	ℓ.	$\sigma(n,n'_{11})$	-2.800	2.8280
	m.	Continuum	-2.475	2.500

FIGURE CAPTIONS

Fig. 1. Measured and calculated neutron total and elastic scattering cross sections of ^{92}Mo (A), ^{96}Mo (B), ^{98}Mo (C) and ^{100}Mo (D). The present measured total cross sections are noted by square data points, those of Ref. 16 by a light solid curve. Measured elastic scattering cross sections are denoted by circular data points where the values for $E \lesssim 1.5$ MeV are $\gtrsim 100$ keV averages of the results of Ref. 16 and those for $E > 1.5$ MeV from the present work. The heavy solid curves indicate the results of calculations as discussed in Section IV of the text.

Fig. 2. Differential elastic scattering cross sections of ^{92}Mo, ^{96}Mo, ^{98}Mo and ^{100}Mo. The present results and their uncertainties are indicated by data points. The solid curves represent the results of theoretical calculations as described in Section IV of the text.

Fig. 3. Elastic and inelastic differential cross sections for the scattering of 3.2 MeV neutrons from ^{96}Mo. Measured values are indicated by data points. The curves are the results of calculations as discussed in Sec. IV of the text. The measured distribution for the excitation of the 1.15 MeV level has the concave shape characteristic of the excitation of a 0+ state.

Fig. 4. Simplified comparison of excitations in ^{92}Mo, ^{96}Mo, ^{98}Mo and ^{100}Mo observed in the present experiments with those summarized in Ref. 15. Solid circles denote discretely observed structures with brackets indicating the collective observation of a number of states.

Fig. 5. Inelastic excitation cross sections of ^{92}Mo (A), ^{96}Mo (B), ^{98}Mo (C), and ^{100}Mo (D). Measured cross sections for the stated excitation energies (in MeV) are denoted by data points. Values at energies $\lesssim 1.5$ MeV are from the results of Ref. 16 averaged over $\gtrsim 30$ keV intervals. The dotted curves indicates an "eye-guide" evaluated cross sections and the solid curves the results of calculation as described in Sec. IV of the text.

Fig. 6. Values of the real potential strength, V, and real radius, R_V, deduced from Xi-square fitting of the optical potential to the

observed elastic scattering angular distributions. The incident energy range extends from 0.5 to 3.0 MeV and the fitting includes ^{92}Mo, ^{96}Mo, ^{98}Mo and ^{100}Mo as noted by the symbols.

Fig. 7. Illustrative comparisons of measured and calculated elastic scattering cross sections of ^{92}Mo. Measured values are indicated by data points. Calculated results are denoted by curves where A was obtained using the potential of Table 3 with a $\left[\frac{N-Z}{A}\right]$ dependence and B without such a dependence.

Fig. 8. Evaluated neutron total and elastic and inelastic scattering cross sections of ^{92}Mo, ^{96}Mo, ^{98}Mo and ^{100}Mo. Solid curves indicate the results of the present evaluations. The dotted lines are constructed from the elemental molybdenum evaluation of ENDF-IV.

Fig. 9. Evaluated differential elastic neutron scattering cross sections of ^{92}Mo.

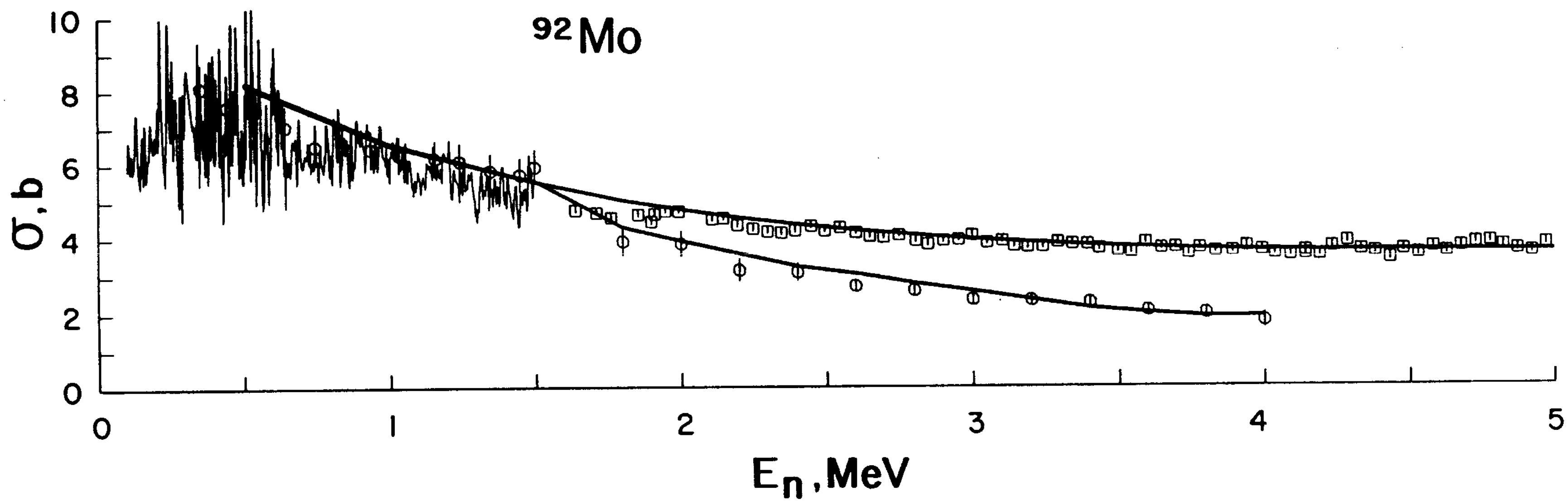


Fig. 1-A

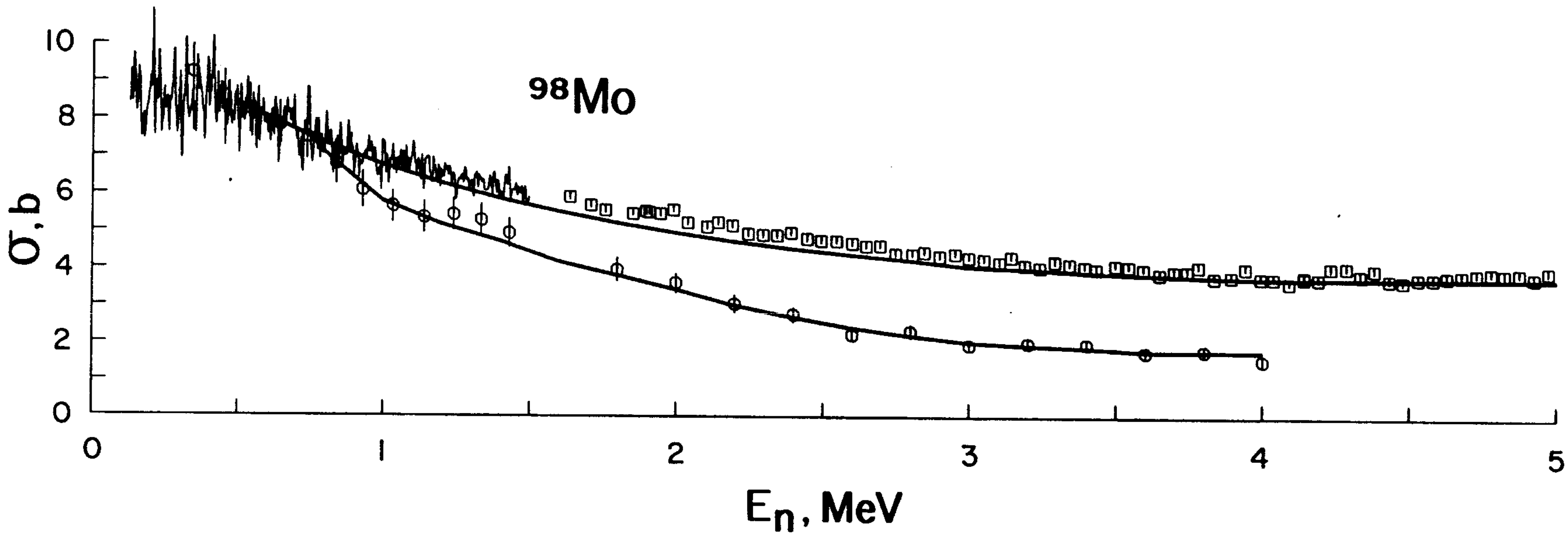


Fig. 1-B

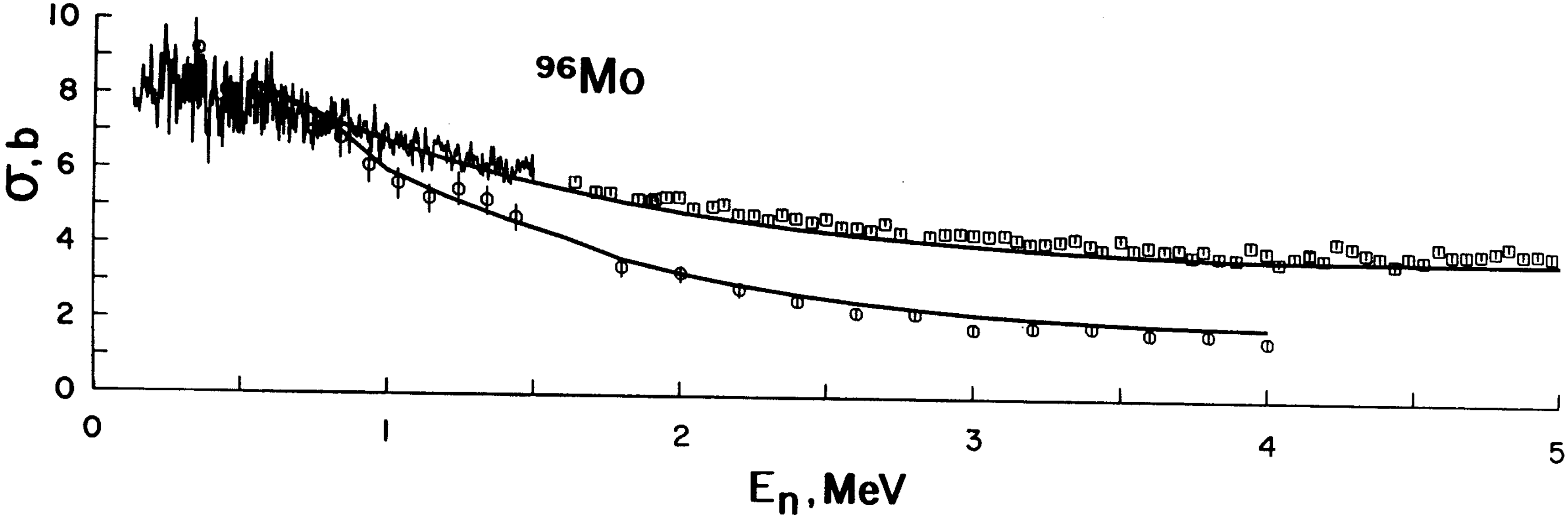


Fig. 1-C

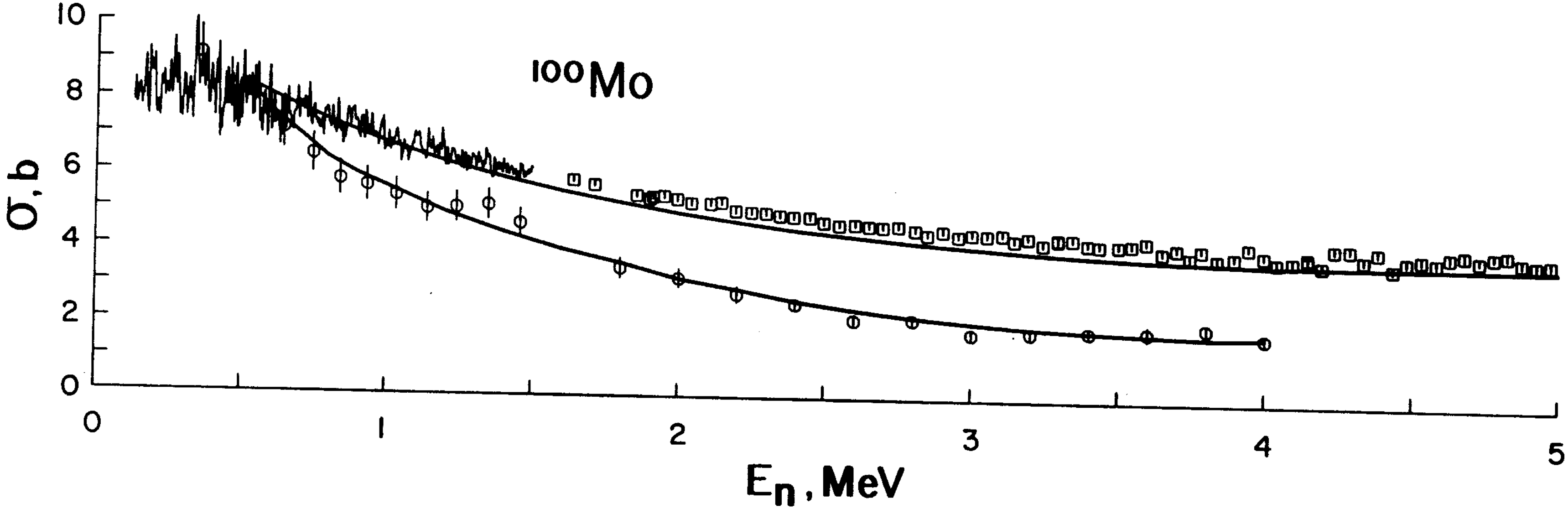
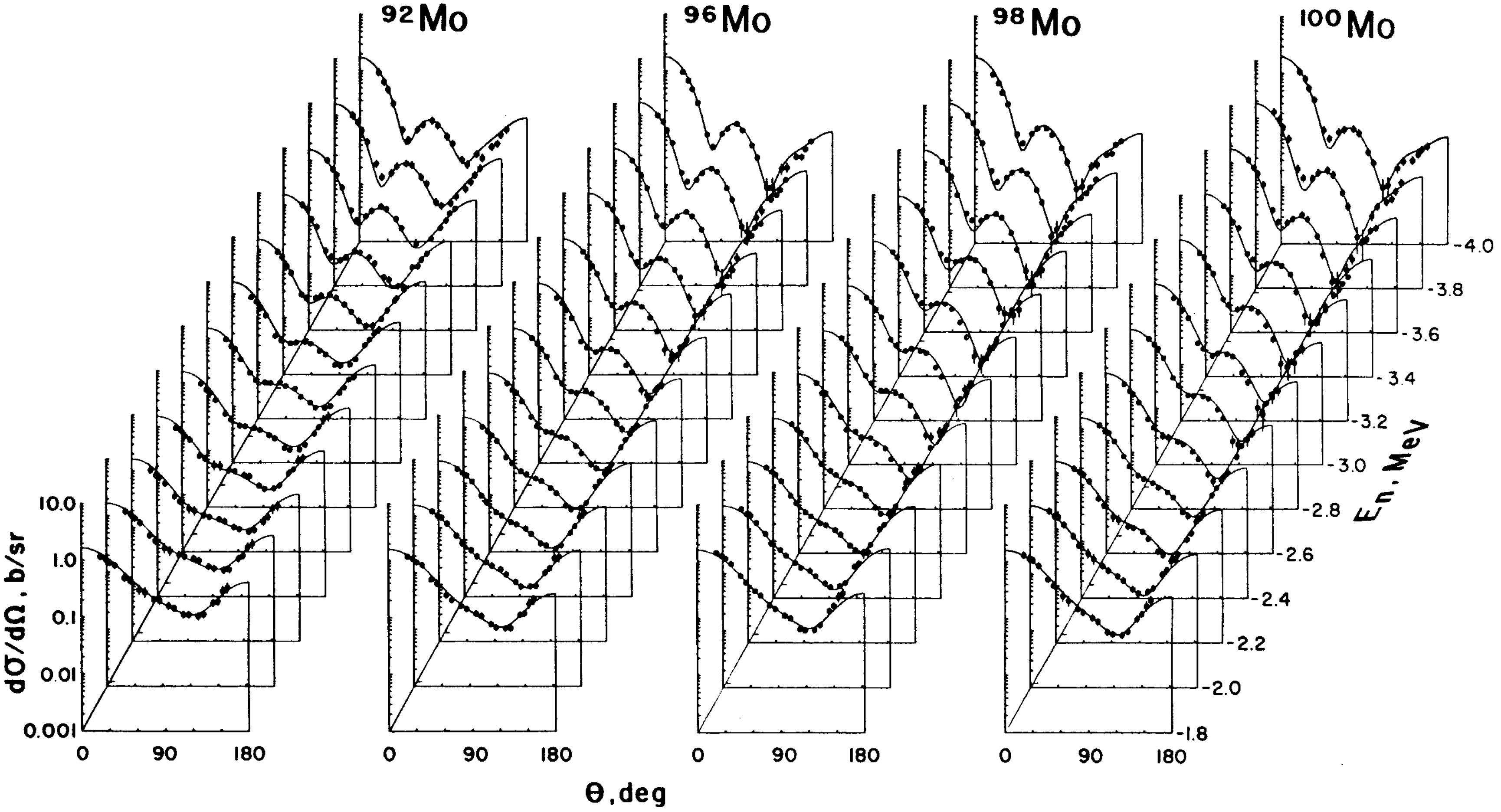
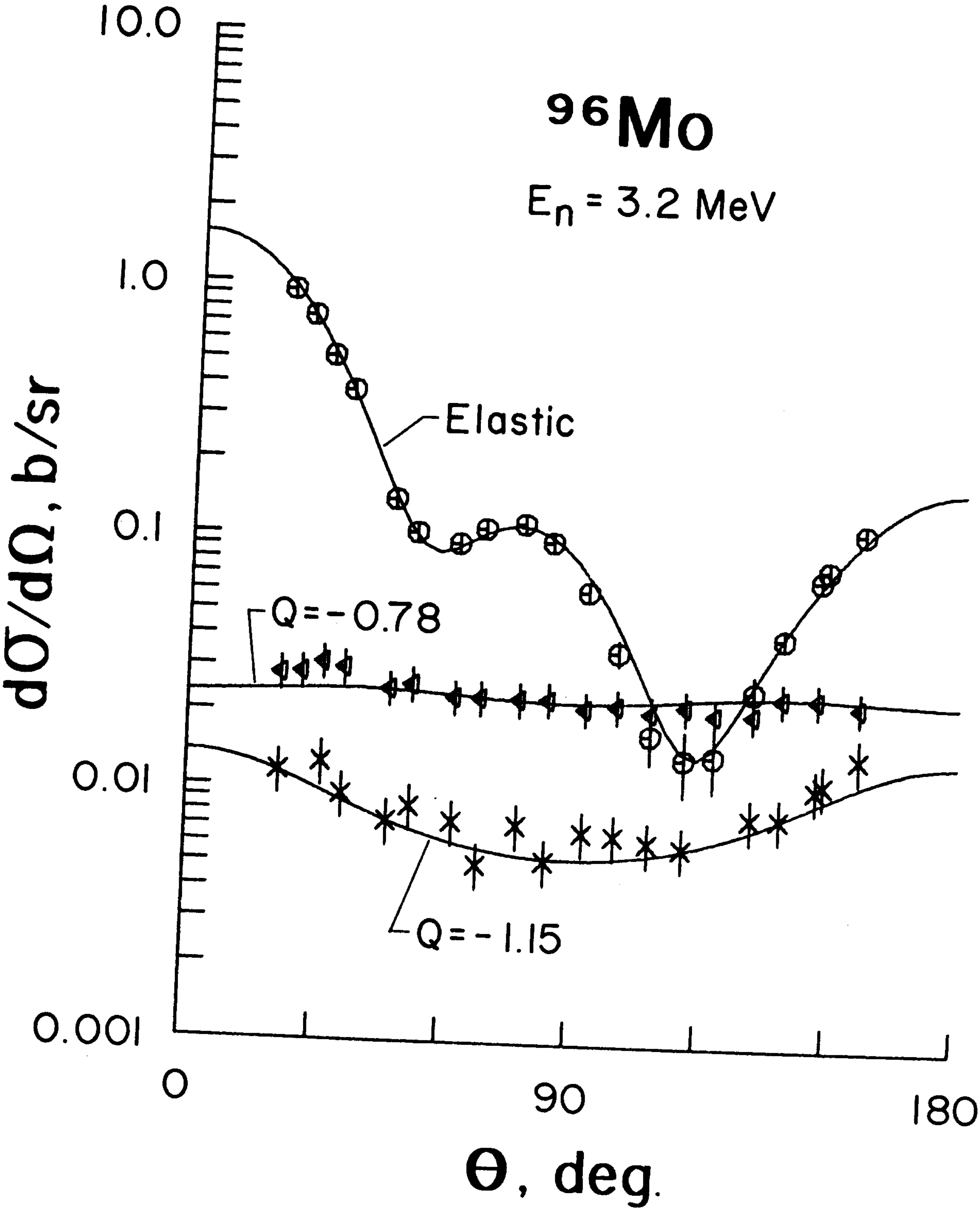


Fig. 1-D



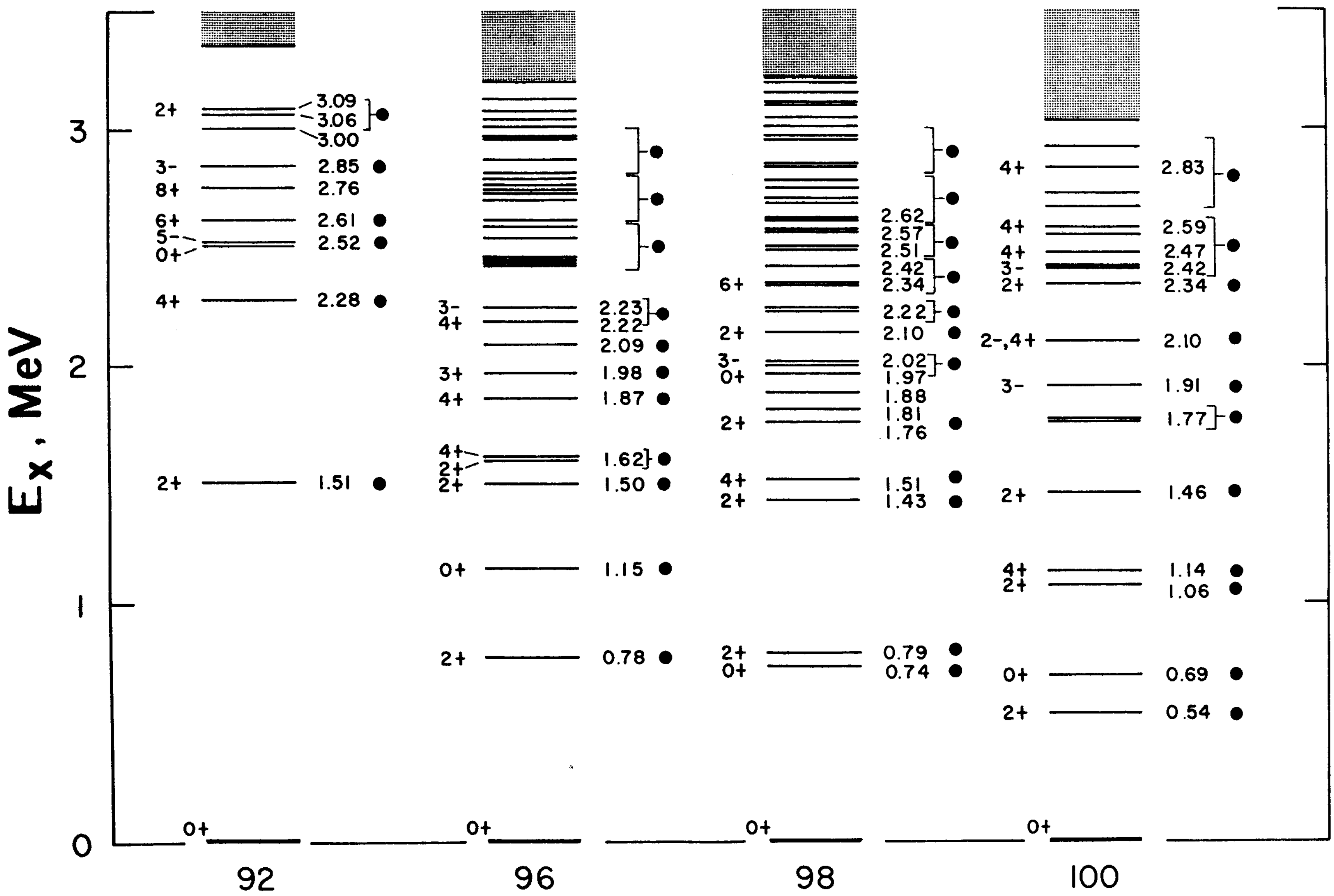
92Mo
96Mo
98Mo
100Mo
dσ/dΩ, b/sr
10.0
1.0
0.1
0.01
0.001
0
90
180
θ, deg
En, MeV
-4.0
-3.8
-3.6
-3.4
-3.2
-3.0
-2.8
-2.6
-2.4
-2.2
-2.0
-1.8

Fig. 2



96Mo
En = 3.2 MeV
Elastic
Q=-0.78
Q=-1.15
dσ/dΩ, b/sr
10.0
1.0
0.1
0.01
0.001
0
90
180
Θ, deg.

Fig. 3



Ex, MeV
0
1
2
3
92
96
98
100
0+
2+
1.51
4+
2.28
0+
5-
2.52
6+
2.61
8+
2.76
3-
2.85
2+
3.00
3.06
3.09
2+
0.78
0+
1.15
2+
1.50
2+
4+
1.62
4+
1.87
3+
1.98
2.09
4+
2.22
3-
2.23
0+
0.74
2+
0.79
2+
1.43
4+
1.51
2+
1.76
1.81
1.88
0+
1.97
3-
2.02
2+
2.10
2.22
6+
2.34
2.42
2.51
2.57
2.62
2+
0.54
0+
0.69
2+
1.06
4+
1.14
2+
1.46
1.77
3-
1.91
2-,4+
2.10
2+
2.34
3-
2.42
4+
2.47
4+
2.59
4+
2.83

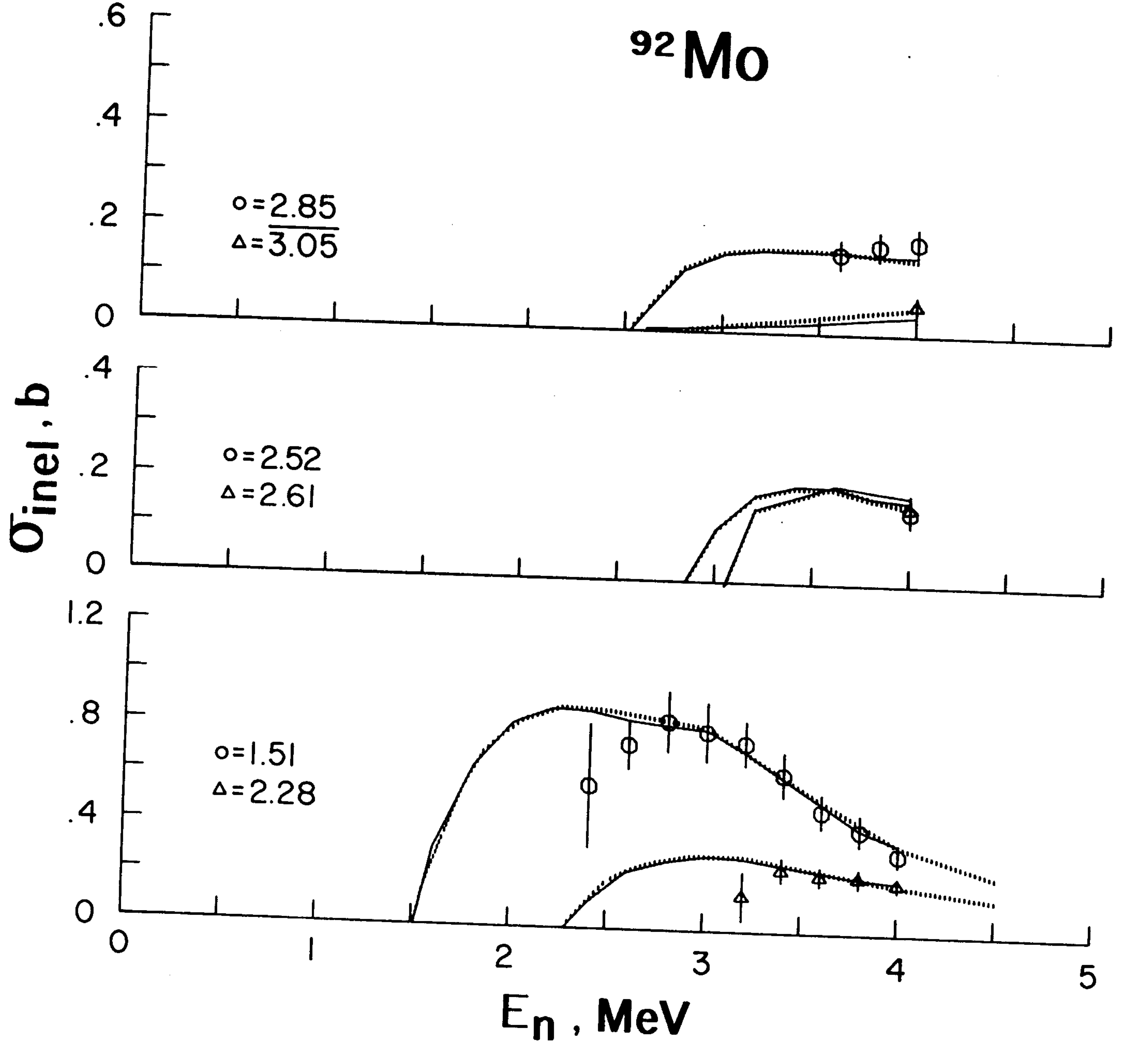
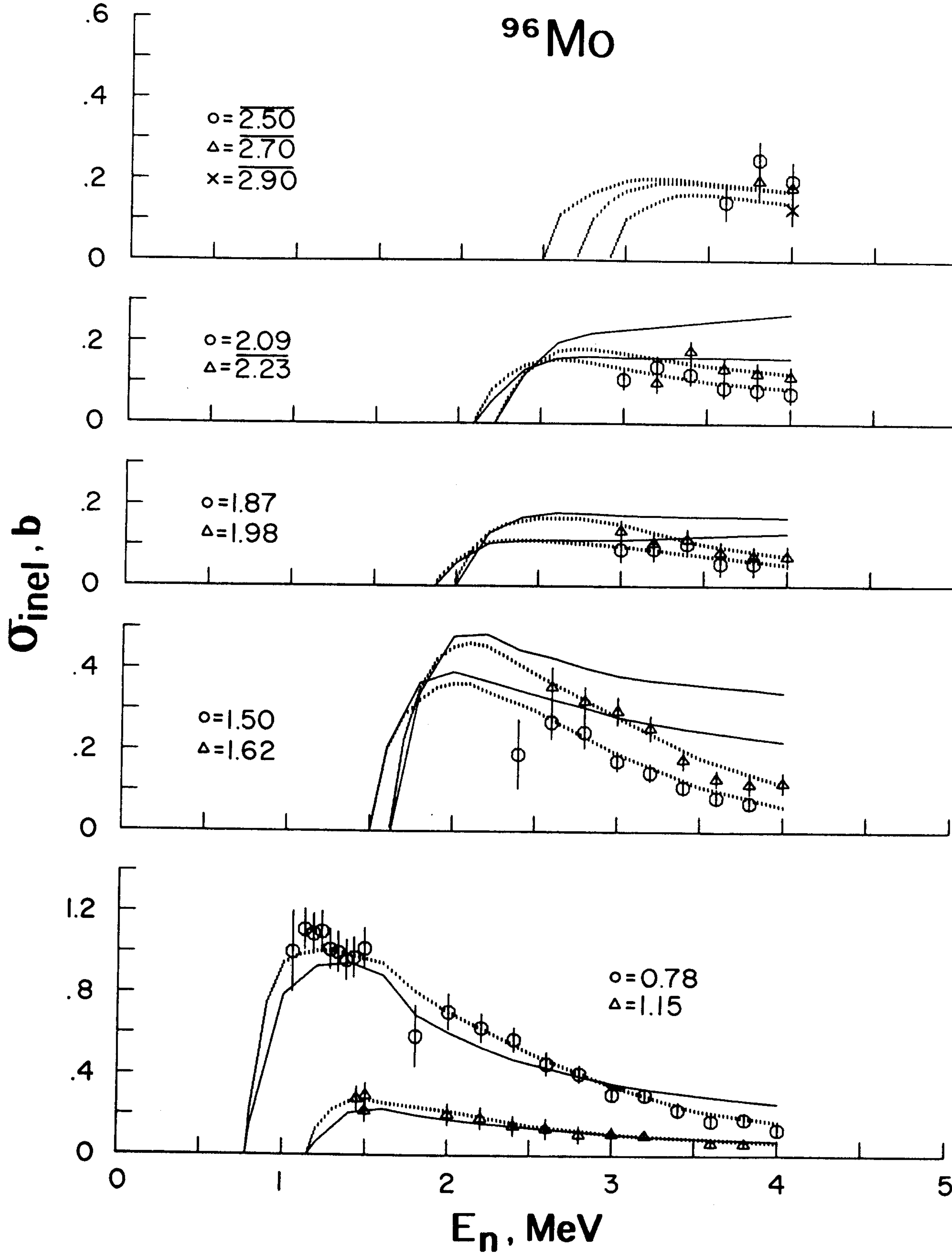
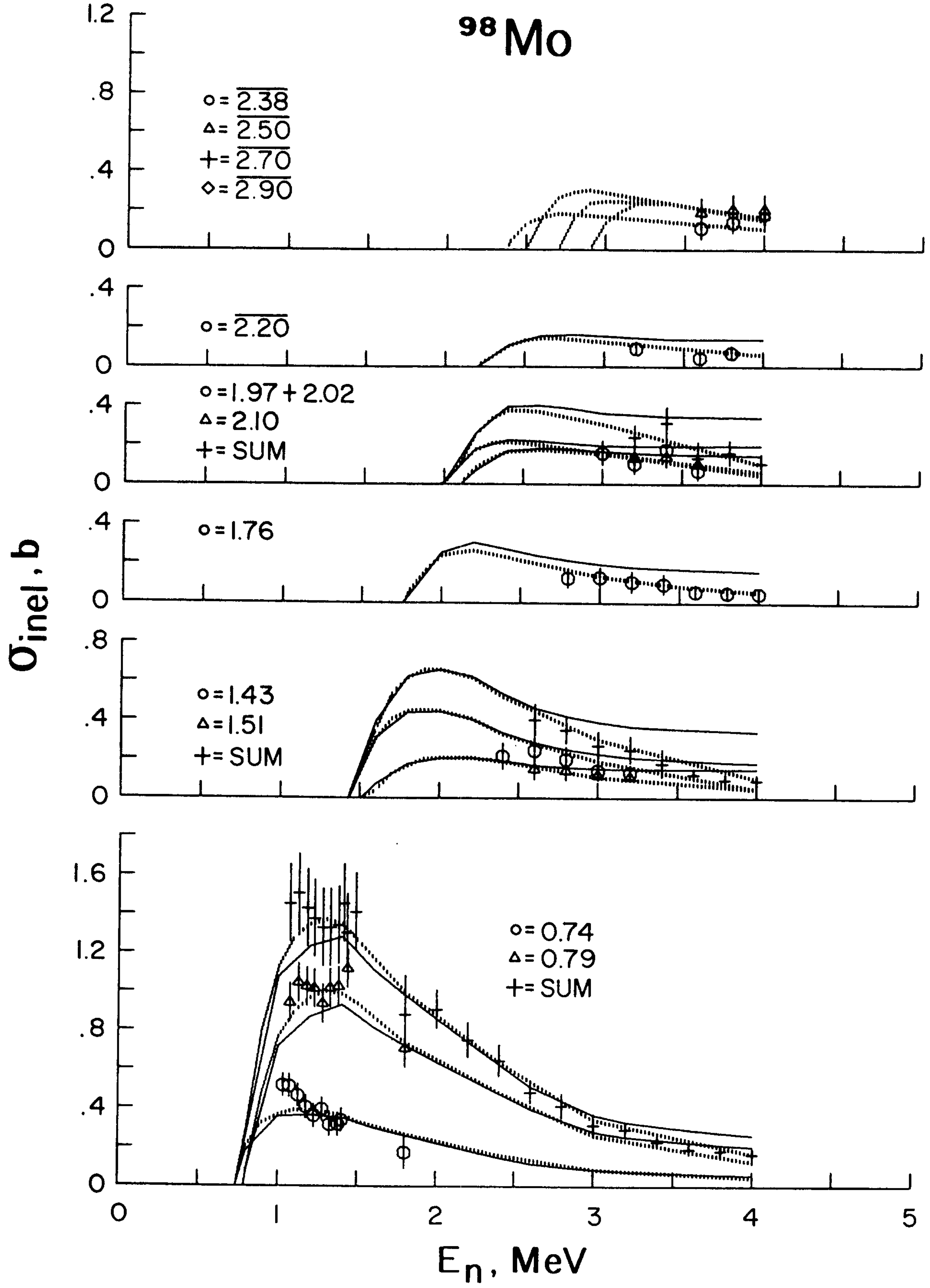


Fig. 5-A



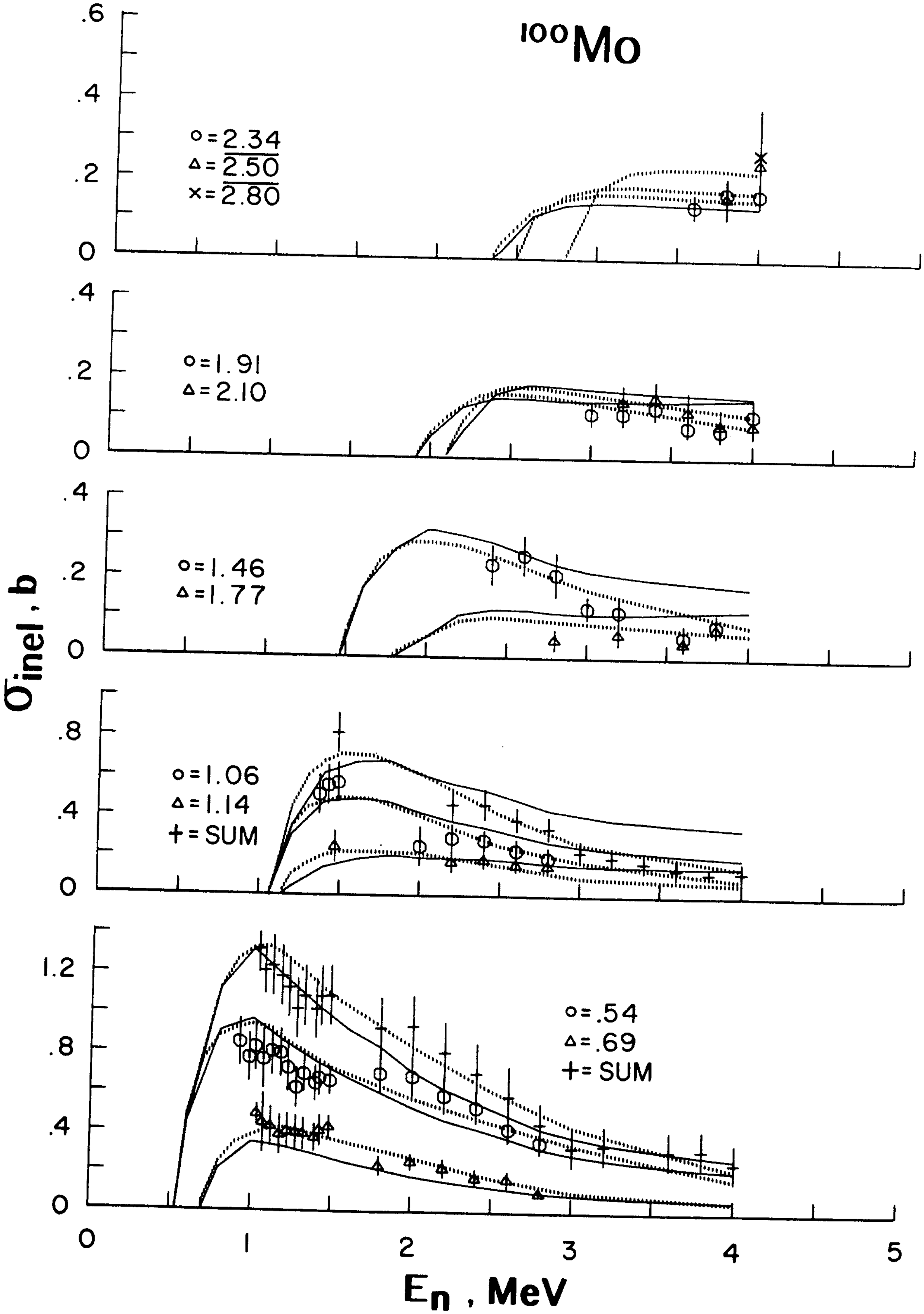
96Mo
○=2.50
Δ=2.70
×=2.90
○=2.09
Δ=2.23
○=1.87
Δ=1.98
○=1.50
Δ=1.62
○=0.78
Δ=1.15
σinel, b
En, MeV

Fig. 5-B



98Mo
o = 2.38
Δ = 2.50
+ = 2.70
◇ = 2.90
o = 2.20
o = 1.97 + 2.02
Δ = 2.10
+ = SUM
o = 1.76
o = 1.43
Δ = 1.51
+ = SUM
o = 0.74
Δ = 0.79
+ = SUM
σinel, b
En, MeV

Fig. 5-C



^{100}Mo
○ = 2.34
△ = 2.50
× = 2.80
○ = 1.91
△ = 2.10
○ = 1.46
△ = 1.77
○ = 1.06
△ = 1.14
+ = SUM
○ = .54
△ = .69
+ = SUM
σ$_{inel}$, b
E$_n$, MeV

Fig. 5-D

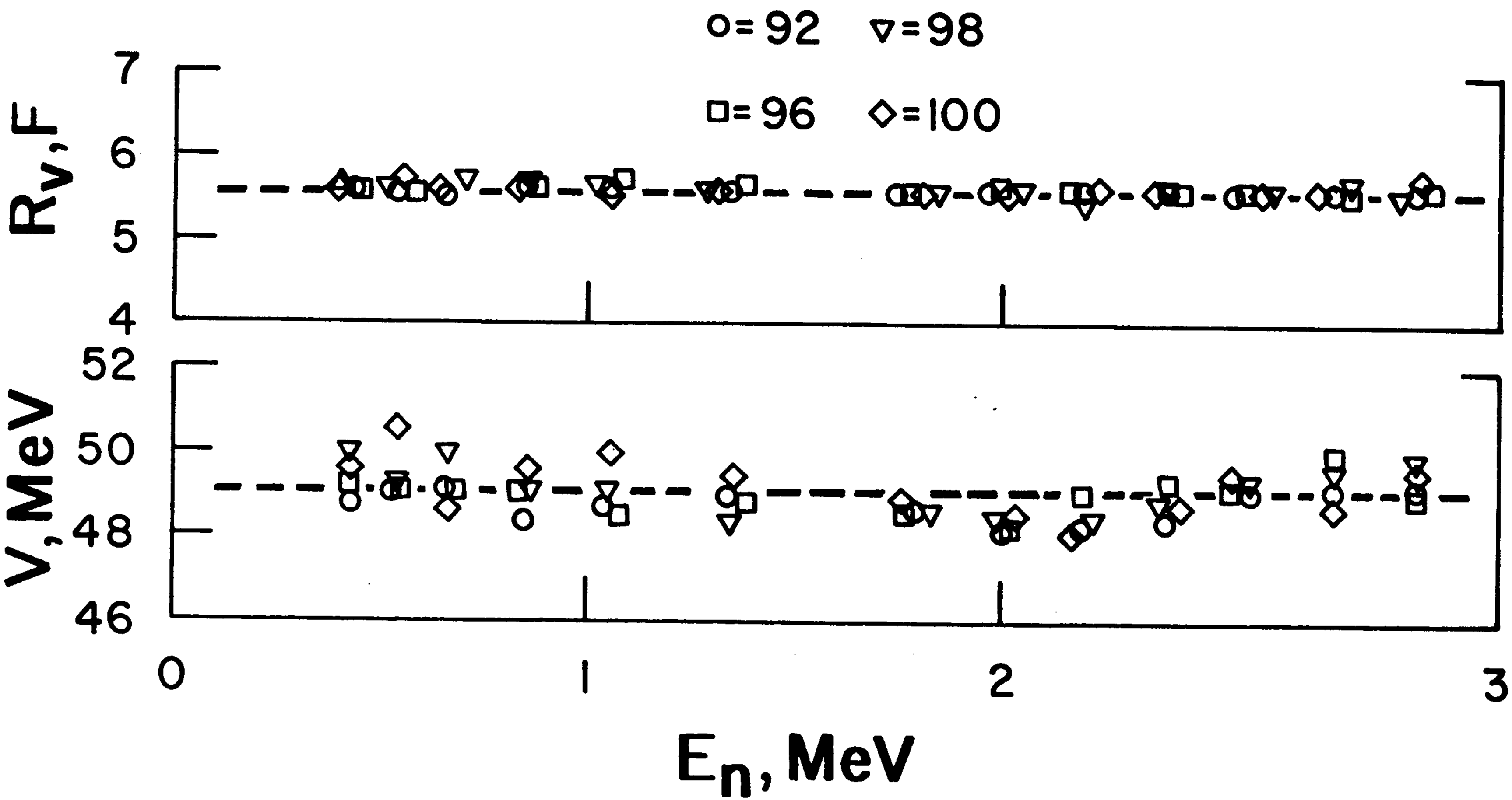
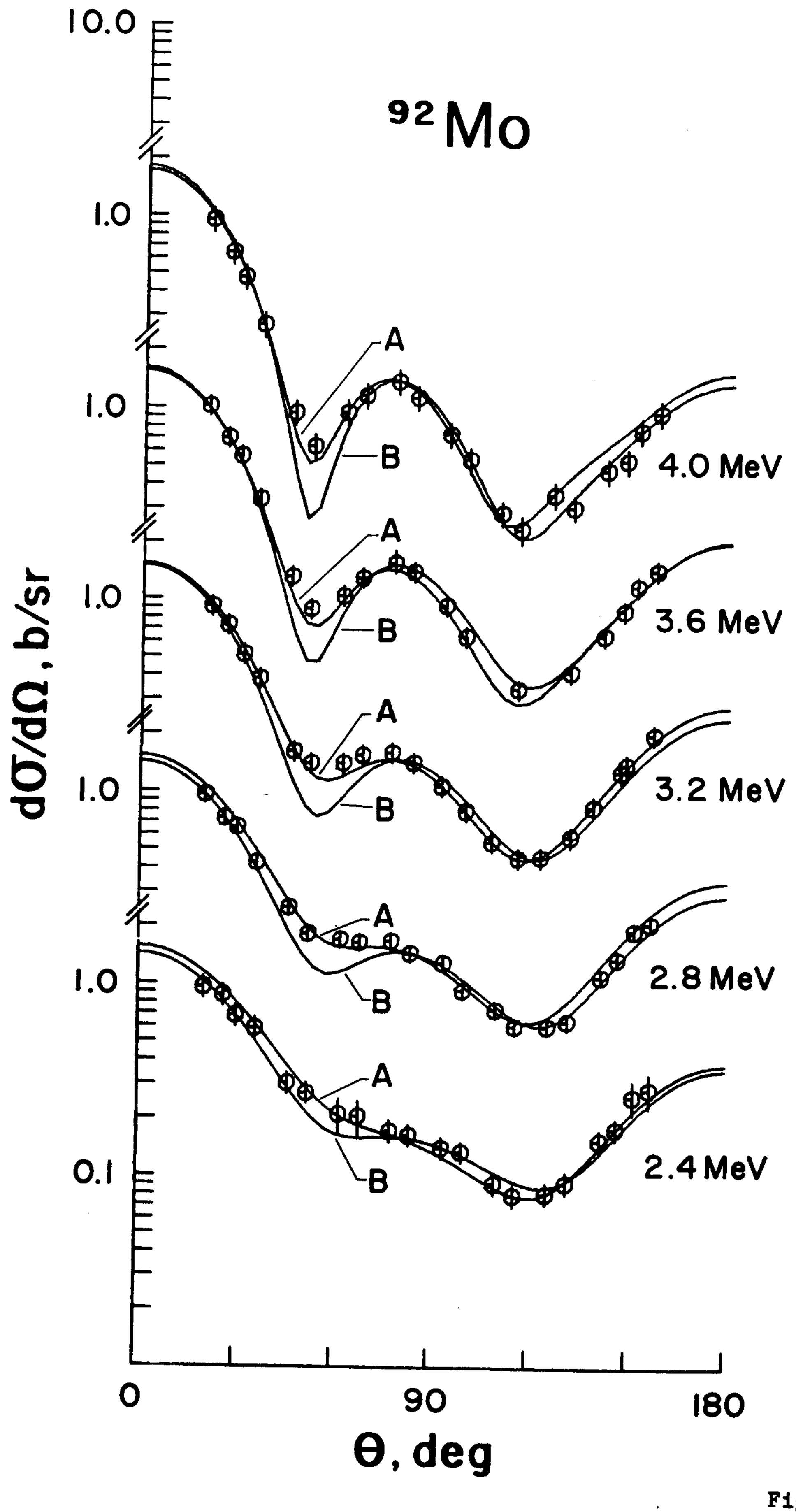


Fig. 6



92Mo
dσ/dΩ, b/sr
10.0
1.0
1.0
1.0
1.0
1.0
0.1
A
B
4.0 MeV
3.6 MeV
3.2 MeV
2.8 MeV
2.4 MeV
0
90
180
θ, deg

Fig. 7

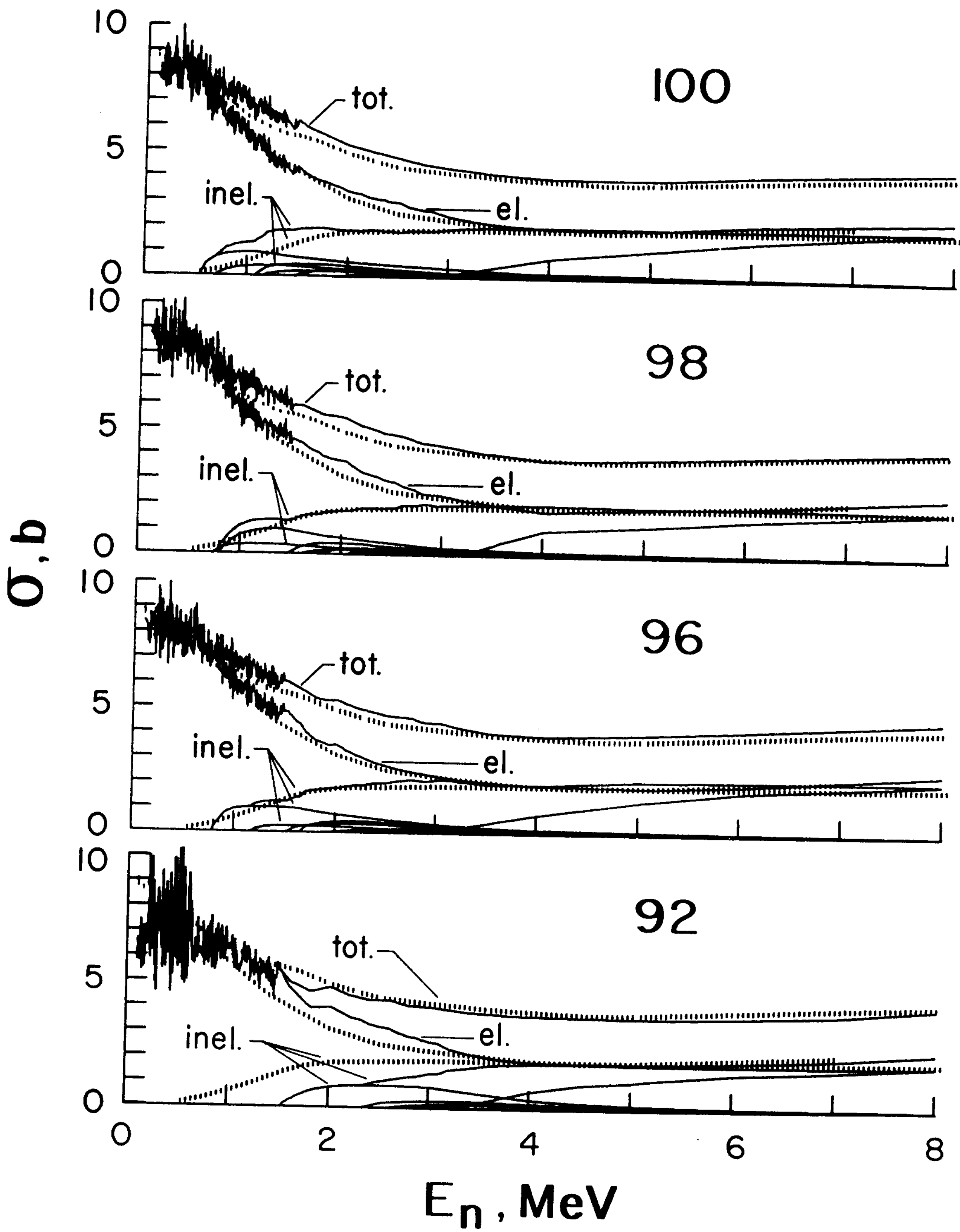


Fig. 8

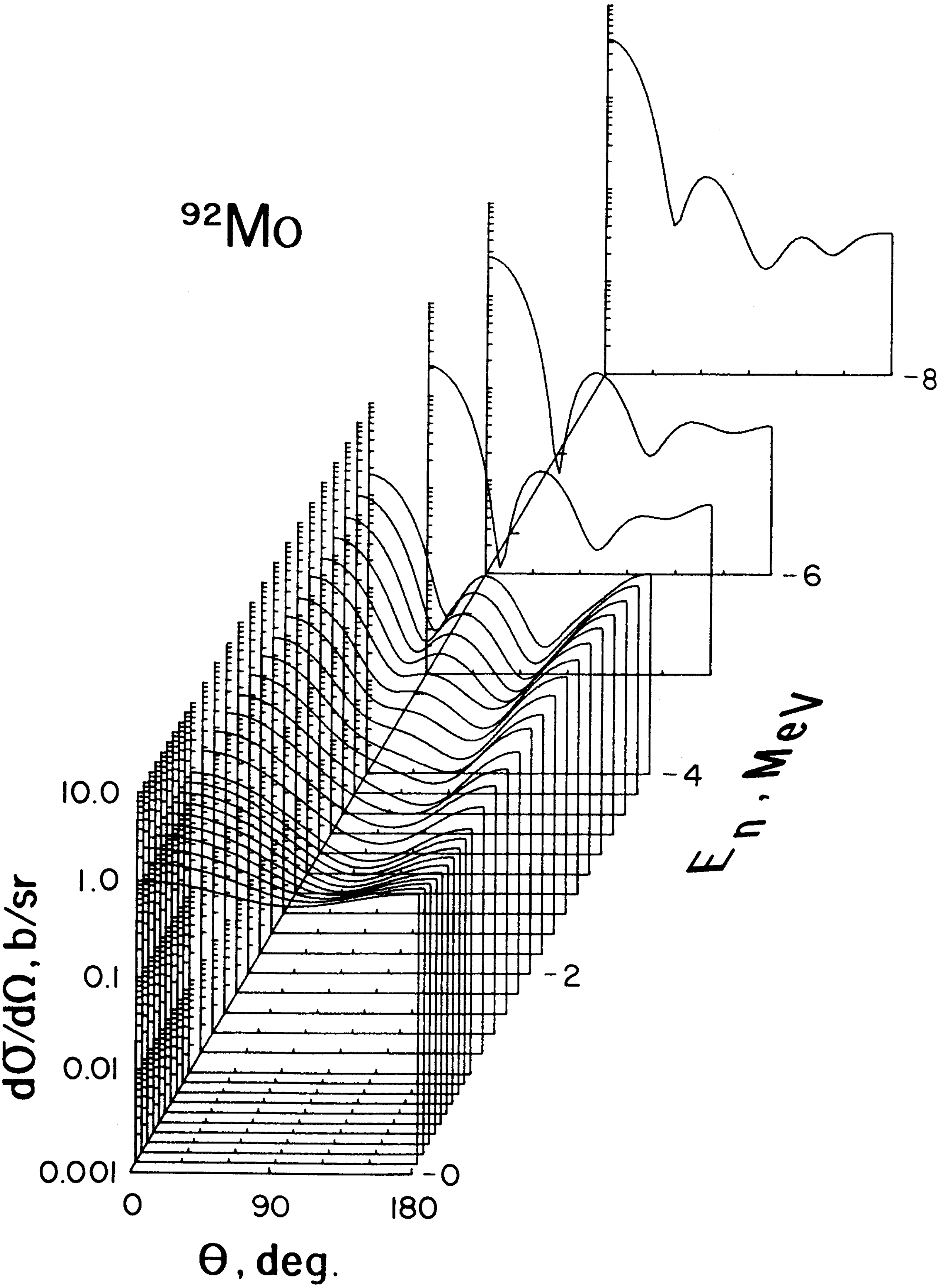


Fig. 9

```
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0.0       +00 0.0       +00          1          0          4          0 92 1451
----------------------- MØLYBDENUM-92 ------------------------ 92 1451
PARTIAL EVALUATIØN BY A. SMITH, P. GUENTHER AND J. WHALEN, ANL.  92 1451
CØMPLETE DØCUMENTATIØN IN ANL/NDM-7, 1974.                         92 1451
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                                 3          1         83            92 1451
                                 3          2         83            92 1451
                                 3          4         14            92 1451
                                 3         51          9            92 1451
                                 3         52          9            92 1451
                                 3         53          7            92 1451
                                 3         54          6            92 1451
                                 3         55          7            92 1451
                                 3         56          6            92 1451
                                 3         91          7            92 1451
                                 4          2         76            92 1451
                                                                    92 1  0
                                                                    92 0  0
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0.0    + 0 0.0     + 0           0          0          1        240 92 3  1
       240          2                                               92 3  1
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.71290E 06	.62940E 01	.74290E 06	.58810E 01	.74790E 06	.71530E 01	92	3	1	64
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.79600E 06	.56650E 01	.80000E 06	.57673E 01	.80800E 06	.61790E 01	92	3	1	67
.81300E 06	.73340E 01	.82300E 06	.61070E 01	.82800E 06	.76030E 01	92	3	1	68
.83300E 06	.54550E 01	.84800E 06	.68060E 01	.85050E 06	.62680E 01	92	3	1	69
.85550E 06	.67460E 01	.86550E 06	.54200E 01	.87050E 06	.70340E 01	92	3	1	70
.87550E 06	.56060E 01	.88550E 06	.62380E 01	.89050E 06	.72590E 01	92	3	1	71
.89550E 06	.66550E 01	.90000E 06	.66322E 01	.91560E 06	.65530E 01	92	3	1	72
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.95310E 06	.66450E 01	.96060E 06	.58320E 01	.97060E 06	.71340E 01	92	3	1	74
.97810E 06	.62750E 01	.10000E 07	.62646E 01	.10160E 07	.62570E 01	92	3	1	75
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.26000E 07	.42500E 01	.26399E 07	.42101E 01	.27000E 07	.41500E 01	92	3	1	97
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.32000E 07	.39000E 01	.34000E 07	.36000E 01	.35000E 07	.37800E 01	92	3	1	100
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						92	3	0	104
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.13160E 06	.74250E 01	.13360E 06	.73450E 01	.13970E 06	.57120E 01	92	3	2	110
.14570E 06	.53740E 01	.15370E 06	.68520E 01	.15770E 06	.54850E 01	92	3	2	111
.16180E 06	.71400E 01	.16780E 06	.55500E 01	.18180E 06	.71820E 01	92	3	2	112
.18580E 06	.64920E 01	.19790E 06	.63870E 01	.20000E 06	.65707E 01	92	3	2	113
.20390E 06	.69120E 01	.20590E 06	.76160E 01	.20790E 06	.64100E 01	92	3	2	114
.21390E 06	.10010E 02	.22190E 06	.68200E 01	.22990E 06	.58630E 01	92	3	2	115
.24000E 06	.99040E 01	.24400E 06	.76900E 01	.25000E 06	.66700E 01	92	3	2	116
.25200E 06	.67990E 01	.25600E 06	.89240E 01	.26000E 06	.61830E 01	92	3	2	117
.26800E 06	.78960E 01	.27400E 06	.60520E 01	.28000E 06	.48790E 01	92	3	2	118
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.35450E	06	.79440E	01	.35850E	06	.66500E	01	.36460E	06	.62310E	01	92	3	2	123
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.40460E	06	.62330E	01	.40660E	06	.84320E	01	.41060E	06	.72720E	01	92	3	2	128
.41460E	06	.70090E	01	.42060E	06	.92630E	01	.42660E	06	.57110E	01	92	3	2	129
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.63080E	06	.78430E	01	.64080E	06	.57580E	01	.66280E	06	.56700E	01	92	3	2	145
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.69290E	06	.73160E	01	.70000E	06	.61063E	01	.70040E	06	.60380E	01	92	3	2	147
.71290E	06	.62940E	01	.74290E	06	.58810E	01	.74790E	06	.71530E	01	92	3	2	148
.75290E	06	.69680E	01	.76040E	06	.55570E	01	.76540E	06	.65060E	01	92	3	2	149
.76790E	06	.61010E	01	.77790E	06	.57770E	01	.78800E	06	.71500E	01	92	3	2	150
.79800E	06	.56650E	01	.80000E	06	.57678E	01	.80800E	06	.61790E	01	92	3	2	151
.81300E	06	.73340E	01	.82300E	06	.61070E	01	.82800E	06	.76030E	01	92	3	2	152
.83300E	06	.54550E	01	.84800E	06	.68080E	01	.85050E	06	.62680E	01	92	3	2	153
.85550E	06	.67460E	01	.86550E	06	.54200E	01	.87050E	06	.70340E	01	92	3	2	154
.87550E	06	.56080E	01	.88550E	06	.62380E	01	.89050E	06	.72590E	01	92	3	2	155
.89550E	06	.66550E	01	.90000E	06	.66322E	01	.91560E	06	.65530E	01	92	3	2	156
.91610E	06	.58220E	01	.92560E	06	.71790E	01	.94810E	06	.58200E	01	92	3	2	157
.95310E	06	.66450E	01	.96060E	06	.58320E	01	.97060E	06	.71340E	01	92	3	2	158
.97810E	06	.62750E	01	.10000E	07	.62646E	01	.10160E	07	.62570E	01	92	3	2	159
.10280E	07	.67970E	01	.10380E	07	.58820E	01	.10460E	07	.65480E	01	92	3	2	160
.10510E	07	.55530E	01	.10560E	07	.66630E	01	.10630E	07	.55790E	01	92	3	2	161
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.11610E	07	.57350E	01	.11760E	07	.56740E	01	.11860E	07	.63850E	01	92	3	2	164
.12000E	07	.61626E	01	.12030E	07	.61150E	01	.12130E	07	.51260E	01	92	3	2	165
.12210E	07	.58300E	01	.12310E	07	.55730E	01	.12380E	07	.54740E	01	92	3	2	166
.12460E	07	.58550E	01	.12510E	07	.52040E	01	.12580E	07	.62360E	01	92	3	2	167
.12610E	07	.53080E	01	.12630E	07	.53790E	01	.12810E	07	.57140E	01	92	3	2	168
.12910E	07	.50990E	01	.13060E	07	.48040E	01	.13160E	07	.58420E	01	92	3	2	169
.13280E	07	.52760E	01	.13380E	07	.57830E	01	.13410E	07	.54600E	01	92	3	2	170
.13580E	07	.52340E	01	.13630E	07	.56670E	01	.13710E	07	.50810E	01	92	3	2	171
.13830E	07	.59650E	01	.13760E	07	.49550E	01	.14000E	07	.52466E	01	92	3	2	172
.14060E	07	.55840E	01	.14210E	07	.47550E	01	.14330E	07	.54350E	01	92	3	2	173
.14430E	07	.43460E	01	.14510E	07	.52050E	01	.14710E	07	.50760E	01	92	3	2	174
.14780E	07	[illegible]	01	.14960E	07	.54730E	01	.15258E	07	.53375E	01	92	3	2	175
.15500E	07	.51774E	01	.16000E	07	.47450E	01	.16500E	07	.45400E	01	92	3	2	176
.17500E	07	.41400E	01	.18000E	07	.39700E	01	.18500E	07	.39500E	01	92	3	2	177
.19500E	07	.39750E	01	.20000E	07	.39950E	01	.20500E	07	.38750E	01	92	3	2	178
.22000E	07	.35537E	01	.22500E	07	.35025E	01	.23073E	07	.34504E	01	92	3	2	179

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.36000E 07 .20000E 01 .38000E 07 .19200E 01 .40000E 07 .18600E 01   92 3  2   185
.45000E 07 .18200E 01 .50000E 07 .18500E 01 .51000E 07 .18500E 01   92 3  2   186
.60000E 07 .19200E 01 .70000E 07 .20600E 01 .80000E 07 .23000E 01   92 3  2   187
                                                                    92 3  0   188
.42092E 05 .91113E 02          0          99           0          0 92 3  4   189
.00000E 00-.15094E 07          0           0           1         32 92 3  4   190
        32           2                                              92 3  4   191
.15258E 07 .00000E 00 .15500E 07 .15000E 00 .16500E 07 .36000E 00   92 3  4   192
.17500E 07 .56000E 00 .18500E 07 .70000E 00 .19500E 07 .77500E 00   92 3  4   193
.20500E 07 .83500E 00 .22500E 07 .89000E 00 .23073E 07 .88771E 00   92 3  4   194
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.30831E 07 .13987E 01 .31000E 07 .14211E 01 .32000E 07 .15520E 01   92 3  4   198
.34000E 07 .16500E 01 .35000E 07 .17000E 01 .36000E 07 .17600E 01   92 3  4   199
.38000E 07 .17800E 01 .40000E 07 .18200E 01 .45000E 07 .18300E 01   92 3  4   200
.50000E 07 .17700E 01 .51000E 07 .17730E 01 .60000E 07 .17800E 01   92 3  4   201
.70000E 07 .17400E 01 .80000E 07 .16000E 01                         92 3  4   202
                                                                    92 3  0   203
4.2092 + 4 9.1113 + 1          0           1           0          0 92 3 51   204
0.0    + 0-1.50940+ 6          0           0           1         16 92 3 51   205
        16           2                                              92 3 51   206
.15258E 07 .00000E 00 .15500E 07 .15000E 00 .16500E 07 .36000E 00   92 3051   207
.17500E 07 .56000E 00 .18500E 07 .70000E 00 .19500E 07 .77500E 00   92 3051   208
.20500E 07 .83500E 00 .22500E 07 .89000E 00 .25000E 07 .88000E 00   92 3051   209
.30000E 07 .82000E 00 .35000E 07 .58000E 00 .40000E 07 .36000E 00   92 3051   210
.45000E 07 .24000E 00 .51000E 07 .16000E 00 .60000E 07 .80000E-01   92 3051   211
.60000E 07 .00000E 00 .00000E 00 .00000E 00 .00000E 00 .00000E 00   92 3051   212
                                                                    92 3  0   213
4.2092 + 4 9.1113 + 1          0           2           0          0 92 3 52   214
0.0    + 0-2.2825 + 6          0           0           1         16 92 3 52   215
        16           2                                              92 3 52   216
.23073E 07 .00000E 00 .25000E 07 .19200E 00 .26000E 07 .23200E 00   92 3 52   217
.27000E 07 .26200E 00 .28000E 07 .28000E 00 .29000E 07 .29600E 00   92 3 52   218
.30000E 07 .30000E 00 .31000E 07 .30000E 00 .32000E 07 .29800E 00   92 3 52   219
.35000E 07 .25800E 00 .40000E 07 .19400E 00 .45000E 07 .14200E 00   92 3 52   220
.51000E 07 .10800E 00 .60000E 07 .50000E-01 .70000E 07 .17000E-01   92 3 52   221
.80000E 07 .00000E 00 .00000E 00 .00000E 00 .00000E 00 .00000E 00   92 3 52   222
                                                                    92 3  0   223
4.2092 + 4 9.1113 + 1          0           3           0          0 92 3 53   224
0.0    + 0-2.520  + 6          0           0           1         11 92 3 53   225
        11           2                                              92 3 53   226
.25473E 07 .00000E 00 .26000E 07 .37000E-01 .28000E 07 .12700E 00   92 3 53   227
.30000E 07 .16000E 00 .32000E 07 .16800E 00 .34000E 07 .16800E 00   92 3 53   228
.36000E 07 .16500E 00 .38000E 07 .15800E 00 .40000E 07 .15000E 00   92 3 53   229
.60000E 07 .60000E-01 .80000E 07 .00000E 00 .00000E 00 .00000E 00   92 3 53   230
                                                                    92 3  0   231
4.2092 + 4 9.1113 + 1          0           4           0          0 92 3 54   232
0.0    + 0-2.6115 + 6          0           0           1          9 92 3 54   233
         9           2                                              92 3 54   234
.26399E 07 .00000E 00 .28000E 07 .20000E-02 .30000E 07 .12000E-01   92 3 54   235
.34000E 07 .28000E-01 .38000E 07 .46000E-01 .40000E 07 .54000E-01   92 3 54   236
.51000E 07 .40000E-01 .60000E 07 .25000E-01 .80000E 07 .00000E 00   92 3 54   237
                                                                    92 3  0   238
4.2092 + 4 9.1113 + 1          0           5           0          0 92 3 55   239
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0.0      + 0-2.8487 + 6              0           0           1              10   92 3 55   240
  10                 2                                                            92 3 55   241
.28796E 07 .00000E 00 .30000E 07 .11000E 00 .32000E 07 .18200E 00    92 3 55   242
.34000E 07 .20100E 00 .36000E 07 .19900E 00 .38000E 07 .17900E 00    92 3 55   243
.40000E 07 .16800E 00 .51000E 07 .10000E 00 .60000E 07 .50000E-01    92 3 55   244
.60000E 07 .00000E 00 .00000E 00 .00000E 00 .00000E 00 .00000E 00    92 3 55   245
4.2092 + 4 9.1113 + 1                                                 92 3  0   246
                             0           6           0               0   92 3 56   247
0.0      + 0-3.05     + 6    0           0           1               8   92 3 56   248
  8                  2                                                    92 3 56   249
.30031E 07 .00000E 00 .32000E 07 .16000E 00 .36000E 07 .21000E 00    92 3 56   250
.38000E 07 .18800E 00 .40000E 07 .16800E 00 .51000E 07 .98000E-01    92 3 56   251
.60000E 07 .45000E-01 .80000E 07 .00000E 00 .00000E 00 .00000E 00    92 3 56   252
.42092E 05 .91113E 02                                                 92 3  0   253
                             0           99          0               0   92 3 91   254
.00000E 00-.31656E 07        0           0           1              12   92 3 91   255
  12                 2                                                    92 3 91   256
.32000E 07 .00000E 00 .34000E 07 .16870E 00 .35000E 07 .26550E 00    92 3 91   257
.36000E 07 .36780E 00 .38000E 07 .54140E 00 .40000E 07 .72600E 00    92 3 91   258
.45000E 07 .99959E 00 .50000E 07 .11262E 01 .51000E 07 .11715E 01    92 3 91   259
.60000E 07 .14700E 01 .70000E 07 .15930E 01 .80000E 07 .18000E 01    92 3 91   260
                                                                      92 3  0   261
.42092E 05 .91113E 02                                                 92 0  0   262
.42092E 05 .91113E 02        0           1           0               0   92 4  2   263
.00000E 00 .00000E 00        0           1           0               0   92 4  2   263
  28                 2       0           0           1              28   92 4  2   264
.00000E 00 .10000E 06                                                 92 4  2   265
.65667E-01 .65520E-01        0           0           4               0   92 4  2   266
.00000E 00 .20000E 06 .57657E-04 .61633E-04 .00000E 00 .00000E 00    92 4  2   267
.14057E 00 .87040E-01        0           0           4               0   92 4  2   268
.00000E 00 .30000E 06 .46786E-03 .29956E-03 .00000E 00 .00000E 00    92 4  2   269
.20187E 00 .10402E 00        0           0           4               0   92 4  2   270
.00000E 00 .40000E 06 .14457E-02 .75678E-03 .00000E 00 .00000E 00    92 4  2   271
.24987E 00 .11956E 00        0           0           4               0   92 4  2   272
.00000E 00 .50000E 06 .30686E-02 .14722E-02 .00000E 00 .00000E 00    92 4  2   273
.26493E 00 .13438E 00        0           0           4               0   92 4  2   274
.00000E 00 .60000E 06 .54557E-02 .25878E-02 .00000E 00 .00000E 00    92 4  2   275
.31117E 00 .14814E 00        0           0           6               0   92 4  2   276
.00000E 00 .70000E 06 .84571E-02 .38000E-02 .45064E-04 .43154E-03    92 4  2   277
.33073E 00 .16152E 00        0           0           6               0   92 4  2   278
.00000E 00 .80000E 06 .12189E-01 .56833E-02 .12164E-03 .67962E-03    92 4  2   279
.34233E 00 .17314E 00        0           0           6               0   92 4  2   280
.00000E 00 .90000E 06 .16429E-01 .80689E-02 .16391E-03 .93769E-03    92 4  2   281
.35233E 00 .18532E 00        0           0           6               0   92 4  2   282
.00000E 00 .10000E 07 .21286E-01 .11040E-01 .32136E-03 .12815E-02    92 4  2   283
.35900E 00 .19712E 00        0           0           6               0   92 4  2   284
.00000E 00 .12000E 07 .26600E-01 .14578E-01 .54555E-03 .16892E-02    92 4  2   285
.36467E 00 .21880E 00        0           0           6               0   92 4  2   286
.00000E 00 .14000E 07 .37886E-01 .23111E-01 .13009E-02 .26023E-02    92 4  2   287
.36267E 00 .23840E 00        0           0           6               0   92 4  2   288
.00000E 00 .16000E 07 .49471E-01 .33456E-01 .26391E-02 .36631E-02    92 4  2   289
.37833E 00 .25900E 00        0           0           8               0   92 4  2   290
.43847E-04 .32406E-04 .64300E-01 .44522E-01 .49891E-02 .44315E-02    92 4  2   291
.00000E 00 .18000E 07 .00000E 00 .00000E 00 .00000E 00 .00000E 00    92 4  2   292
.39800E 00 .27940E 00        0           0           8               0   92 4  2   293
.96400E-04 .20882E-04 .75500E-01 .60667E-01 .90400E-02 .63200E-02    92 4  2   294
.00000E 00 .20000E 07 .00000E 00 .00000E 00 .00000E 00 .00000E 00    92 4  2   295
.37233E 00 .28700E 00        0           0           8               0   92 4  2   296
.13220E-03 .23624E-03 .82914E-01 .74567E-01 .13082E-01 .84000E-02    92 4  2   297
                      .00000E 00 .00000E 00 .00000E 00 .00000E 00    92 4  2   298
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.34727E-03	.78568E-04	.00000E 00	.00000E 00	.00000E 00	.00000E 00	92	4	2	301
.00000E 00	.24000E 07	0	0	8	0	92	4	2	302
.39000E 00	.31920E 00	.11336E 00	.11111E 00	.29255E-01	.12362E-01	92	4	2	303
.54487E-03	.27071E-04	.00000E 00	.00000E 00	.00000E 00	.00000E 00	92	4	2	304
.00000E 00	.26000E 07	0	0	8	0	92	4	2	305
.39033E 00	.33080E 00	.13016E 00	.12756E 00	.36973E-01	.15492E-01	92	4	2	306
.94733E-03	.18700E-03	.00000E 00	.00000E 00	.00000E 00	.00000E 00	92	4	2	307
.00000E 00	.28000E 07	0	0	8	0	92	4	2	308
.38567E 00	.33400E 00	.13697E 00	.14633E 00	.51618E-01	.19308E-01	92	4	2	309
.12893E-02	.68176E-04	.00000E 00	.00000E 00	.00000E 00	.00000E 00	92	4	2	310
.00000E 00	.30000E 07	0	0	8	0	92	4	2	311
.40200E 00	.35220E 00	.16057E 00	.16178E 00	.64100E-01	.24838E-01	92	4	2	312
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.00000E 00	.32000E 07	0	0	8	0	92	4	2	314
.40867E 00	.35080E 00	.16771E 00	.16700E 00	.84945E-01	.31915E-01	92	4	2	315
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.00000E 00	.34000E 07	0	0	8	0	92	4	2	317
.43433E 00	.36100E 00	.18886E 00	.21133E 00	.10718E 00	.40923E-01	92	4	2	318
.40820E-02	.75647E-03	.00000E 00	.00000E 00	.00000E 00	.00000E 00	92	4	2	319
.00000E 00	.36000E 07	0	0	8	0	92	4	2	320
.45400E 00	.36760E 00	.20614E 00	.23033E 00	.12855E 00	.50585E-01	92	4	2	321
.54787E-02	.10418E-02	.00000E 00	.00000E 00	.00000E 00	.00000E 00	92	4	2	322
.00000E 00	.38000E 07	0	0	8	0	92	4	2	323
.47100E 00	.37140E 00	.22257E 00	.24722E 00	.14973E 00	.60746E-01	92	4	2	324
.72267E-02	.14029E-02	.00000E 00	.00000E 00	.00000E 00	.00000E 00	92	4	2	325
.00000E 00	.40000E 07	0	0	8	0	92	4	2	326
.50467E 00	.39920E 00	.25314E 00	.25778E 00	.16300E 00	.68031E-01	92	4	2	327
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.00000E 00	.50000E 07	0	0	8	0	92	4	2	329
.56600E 00	.41740E 00	.31829E 00	.30000E 00	.23464E 00	.11585E 00	92	4	2	330
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.00000E 00	.60000E 07	0	0	10	0	92	4	2	332
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.00000E 00	.80000E 07	0	0	12	0	92	4	2	335
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.12720E 00	.60235E-01	.25989E-01	.89190E-02	.46217E-02	.17728E-02	92	4	2	337
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						92	0	0	339
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PARTIAL EVALUATIØN BY A. SMITH, P. GUENTHER AND J. WHALEN, ANL.   96 1451
CØMPLETE DØCUEMENTATIØN IN ANL/NDM-7, 1974.                       96 1451
------------------------------------------------------------------ 96 1451
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                                   3          53           8         96 1451
                                   3          54           8         96 1451
                                   3          55           7         96 1451
                                   3          56           7         96 1451
                                   3          57           7         96 1451
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                                   3          59           8         96 1451
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0.0      + 0 0.0      + 0          0          99           0           0 96 3  1
       242           2             0           0           1         242 96 3  1
                                                                     96 3  1
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.97820E	06	.70070E	01	.98420E	06	.65130E	01	.99020E	06	.72130E	01	96	3	1	73
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.13230E	07	.58080E	01	.13350E	07	.61910E	01	.13410E	07	.57010E	01	96	3	1	89
.13500E	07	.66180E	01	.13530E	07	.61130E	01	.13590E	07	.66190E	01	96	3	1	90
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.14000E	07	.59750E	01	.14040E	07	.62310E	01	.14100E	07	.56740E	01	96	3	1	92
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.14490E	07	.58990E	01	.14580E	07	.62410E	01	.14640E	07	.60140E	01	96	3	1	94
.14700E	07	.63640E	01	.14760E	07	.60160E	01	.14970E	07	.60470E	01	96	3	1	95
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.27280E	07	.45870E	01	.27500E	07	.45800E	01	.28000E	07	.45000E	01	96	3	1	103
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.34000E	07	.40720E	01	.35000E	07	[illegible]	01	.36000E	07	.39800E	01	96	3	1	107
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.00000E	00	.00000E	00		0		0		1		242	96	3	2	112
	242		2									96	3	2	113
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.20000E	06	.80264E	01	.21200E	06	.69930E	01	.22200E	06	.90080E	01	96	3	2	119

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.34630E	06	.91870E	01	.35030E	06	.75110E	01	.35630E	06	.75890E	01	96 3	2	127
.36030E	06	.89910E	01	.36430E	06	.80970E	01	.37440E	06	.81730E	01	96 3	2	128
.37840E	06	.68380E	01	.38240E	06	.71970E	01	.38640E	06	.71440E	01	96 3	2	129
.39440E	06	.80250E	01	.39840E	06	.76180E	01	.40000E	06	.79735E	01	96 3	2	130
.40440E	06	.89510E	01	.40840E	06	.78080E	01	.42040E	06	.73530E	01	96 3	2	131
.43240E	06	.74140E	01	.44440E	06	.88030E	01	.45040E	06	.76310E	01	96 3	2	132
.46240E	06	.74250E	01	.46840E	06	.82370E	01	.47240E	06	.68980E	01	96 3	2	133
.47850E	06	.82490E	01	.48250E	06	.81300E	01	.48650E	06	.69080E	01	96 3	2	134
.49450E	06	.66060E	01	.50000E	06	.71137E	01	.50050E	06	.69780E	01	96 3	2	135
.51450E	06	.71390E	01	.51850E	06	.82940E	01	.52850E	06	.73340E	01	96 3	2	136
.53450E	06	.64980E	01	.53850E	06	.78280E	01	.54650E	06	.88320E	01	96 3	2	137
.55050E	06	.72580E	01	.57850E	06	.70010E	01	.58250E	06	.88860E	01	96 3	2	138
.58650E	06	.71720E	01	.59050E	06	.84050E	01	.59450E	06	.77330E	01	96 3	2	139
.59860E	06	.90770E	01	.60000E	06	.88360E	01	.60460E	06	.80440E	01	96 3	2	140
.61860E	06	.75130E	01	.62660E	06	.72630E	01	.63260E	06	.82150E	01	96 3	2	141
.63860E	06	.71420E	01	.64460E	06	.75440E	01	.64790E	06	.81730E	01	96 3	2	142
.65690E	06	.73560E	01	.66290E	06	.66360E	01	.67190E	06	.82440E	01	96 3	2	143
.67790E	06	.70010E	01	.68690E	06	.73160E	01	.69900E	06	.74530E	01	96 3	2	144
.70000E	06	.74039E	01	.71400E	06	.67160E	01	.72000E	06	.80210E	01	96 3	2	145
.72600E	06	.69420E	01	.73500E	06	.68960E	01	.74400E	06	.65150E	01	96 3	2	146
.75000E	06	.76070E	01	.75900E	06	.67540E	01	.78000E	06	.71530E	01	96 3	2	147
.76600E	06	.68470E	01	.78635E	06	.68821E	01	.79200E	06	.73662E	01	96 3	2	148
.79600E	06	.67173E	01	.80000E	06	.70162E	01	.80410E	06	.76669E	01	96 3	2	149
.81010E	06	.67715E	01	.81610E	06	.74691E	01	.82210E	06	.65497E	01	96 3	2	150
.83110E	06	.63561E	01	.83410E	06	.69899E	01	.84010E	06	.66975E	01	96 3	2	151
.84310E	06	.74213E	01	.84910E	06	.69159E	01	.85810E	06	.73123E	01	96 3	2	152
.86710E	06	.58127E	01	.87010E	06	.67645E	01	.88210E	06	.62367E	01	96 3	2	153
.89410E	06	.61359E	01	.90000E	06	.66832E	01	.90010E	06	.66928E	01	96 3	2	154
.90610E	06	.60348E	01	.92420E	06	.64766E	01	.93020E	06	.58876E	01	96 3	2	155
.93620E	06	.61246E	01	.94220E	06	.56166E	01	.95120E	06	.68726E	01	96 3	2	156
.96020E	06	.60286E	01	.96620E	06	.60716E	01	.97220E	06	.52106E	01	96 3	2	157
.97820E	06	.61106E	01	.98420E	06	.56046E	01	.99020E	06	.62926E	01	96 3	2	158
.99920E	06	.60216E	01	.10000E	07	.58986E	01	.10020E	07	.55942E	01	96 3	2	159
.10110E	07	.57746E	01	.10170E	07	.53972E	01	.10260E	07	.60336E	01	96 3	2	160
.10350E	07	.55700E	01	.10410E	07	.60366E	01	.10500E	07	.55210E	01	96 3	2	161
.10560E	07	.59566E	01	.10620E	07	.54502E	01	.10710E	07	.54526E	01	96 3	2	162
.10770E	07	.58032E	01	.10890E	07	.59994E	01	.10980E	07	.60048E	01	96 3	2	163
.11000E	07	.58582E	01	.11070E	07	.53466E	01	.11160E	07	.49278E	01	96 3	2	164
.11250E	07	.61300E	01	.11310E	07	.54288E	01	.11370E	07	.55806E	01	96 3	2	165
.11400E	07	.51080E	01	.11520E	07	.52397E	01	.11550E	07	.57871E	01	96 3	2	166
.11598E	07	.57553E	01	.11670E	07	.56862E	01	.11700E	07	.58856E	01	96 3	2	167
.11760E	07	.55955E	01	.11910E	07	.54518E	01	.12000E	07	.50301E	01	96 3	2	168
.12030E	07	.56511E	01	.12120E	07	.53041E	01	.12180E	07	.48171E	01	96 3	2	169
.12300E	07	.53941E	01	.12390E	07	.54701E	01	.12510E	07	.47471E	01	96 3	2	170
.12600E	07	.47401E	01	.12690E	07	.52701E	01	.12750E	07	.49051E	01	96 3	2	171
.12810E	07	.55391E	01	.12900E	07	.49021E	01	.13000E	07	.50854E	01	96 3	2	172
.13020E	07	.51237E	01	.13140E	07	.46343E	01	.13200E	07	.52021E	01	96 3	2	173
.13230E	07	.45835E	01	.13350E	07	.49641E	01	.13410E	07	.44729E	01	96 3	2	174
.13500E	07	.53881E	01	.13530E	07	.48625E	01	.13590E	07	.53873E	01	96 3	2	175
.13650E	07	.45931E	01	.13830E	07	.51205E	01	.13950E	07	.44161E	01	96 3	2	176
.14000E	07	.47351E	01	.14040E	07	.49915E	01	.14100E	07	.44351E	01	96 3	2	177
.14250E	07	.46786E	01	.14340E	07	.46945E	01	.14430E	07	.50414E	01	96 3	2	178
.14490E	07	.46640E	01	.14580E	07	.50068E	01	.14640E	07	.47804E	01	96 3	2	179

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.14700E 07 .51310E 01 .14760E 07 .47836E 01 .14970E 07 .48167E 01  96 3  2  180
.15000E 07 .48098E 01 .15133E 07 .47826E 01 .16000E 07 .44050E 01  96 3  2  181
.16428E 07 .43087E 01 .17000E 07 .39600E 01 .18000E 07 .36450E 01  96 3  2  182
.16889E 07 .35205E 01 .19000E 07 .34850E 01 .19988E 07 .35146E 01  96 3  2  183
.20000E 07 .35139E 01 .21000E 07 .32450E 01 .21174E 07 .32253E 01  96 3  2  184
.22000E 07 .30517E 01 .22481E 07 .30027E 01 .22500E 07 .29986E 01  96 3  2  185
.23000E 07 .29687E 01 .24000E 07 .27500E 01 .25000E 07 .26500E 01  96 3  2  186
.25260E 07 .26240E 01 .26000E 07 .25500E 01 .27000E 07 .24700E 01  96 3  2  187
.27280E 07 .24476E 01 .27500E 07 .24300E 01 .28000E 07 .23900E 01  96 3  2  188
.28500E 07 .23550E 01 .29000E 07 .23200E 01 .29301E 07 .22989E 01  96 3  2  189
.30000E 07 .22500E 01 .30500E 07 .22250E 01 .31000E 07 .22000E 01  96 3  2  190
.32000E 07 .21500E 01 .32500E 07 .21300E 01 .33000E 07 .21100E 01  96 3  2  191
.34000E 07 .20700E 01 .35000E 07 .20350E 01 .36000E 07 .20000E 01  96 3  2  192
.38000E 07 .19600E 01 .40000E 07 .19300E 01 .50000E 07 .18600E 01  96 3  2  193
.60000E 07 .20000E 01 .80000E 07 .24360E 01 .00000E 00 .00000E 00  96 3  2  194
                                                                   96 3  0  195
.42960E 05 .95078E 02          0         99          0          0  96 3  4  196
.00000E 00-.77826E 06          0          0          1         49  96 3  4  197
        49          2                                              96 3  4  198
.78635E 06 .00000E 00 .80000E 06 .20000E 00 .90000E 06 .74000E 00  96 3  4  199
.10000E 07 .94000E 00 .11000E 07 .98000E 00 .11598E 07 .99190E 00  96 3  4  200
.12000E 07 .11199E 01 .13000E 07 .12199E 01 .14000E 07 .12399E 01  96 3  4  201
.15000E 07 .12300E 01 .15133E 07 .12253E 01 .16000E 07 .13950E 01  96 3  4  202
.16428E 07 .13950E 01 .17000E 07 .16150E 01 .18000E 07 .17050E 01  96 3  4  203
.16889E 07 .17406E 01 .19000E 07 .17650E 01 .19988E 07 .17848E 01  96 3  4  204
.20000E 07 .17861E 01 .21000E 07 .18550E 01 .21174E 07 .18515E 01  96 3  4  205
.22000E 07 .19150E 01 .22481E 07 .18998E 01 .23000E 07 .19433E 01  96 3  4  206
.24000E 07 .20060E 01 .25000E 07 .20100E 01 .25260E 07 .20277E 01  96 3  4  207
.26000E 07 .20780E 01 .27000E 07 .21260E 01 .27280E 07 .21394E 01  96 3  4  208
.27500E 07 .21500E 01 .28000E 07 .21100E 01 .28500E 07 .20650E 01  96 3  4  209
.29000E 07 .20900E 01 .29301E 07 .21051E 01 .30000E 07 .21400E 01  96 3  4  210
.30500E 07 .21550E 01 .31000E 07 .21300E 01 .32000E 07 .20800E 01  96 3  4  211
.32500E 07 .20500E 01 .33000E 07 .20340E 01 .34000E 07 .20020E 01  96 3  4  212
.35000E 07 .19650E 01 .36000E 07 .19800E 01 .38000E 07 .19800E 01  96 3  4  213
.40000E 07 .19700E 01 .50000E 07 .21400E 01 .60000E 07 .21600E 01  96 3  4  214
.80000E 07 .20940E 01 .00000E 00 .00000E 00 .00000E 00 .00000E 00  96 3  4  215
                                                                   96 3  0  216
4.2096 + 4 9.5078 + 1          0          1          0          0  96 3 51  217
0.0    + 0-.77826E 06          0          0          1         15  96 3 51  218
        15          2                                              96 3 51  219
.78635E 06 .00000E 00 .80000E 06 .20000E 00 .90000E 06 .74000E 00  96 3 51  220
.10000E 07 .94000E 00 .11000E 07 .98000E 00 .12000E 07 .99990E 00  96 3 51  221
.13000E 07 .99990E 00 .16000E 07 .94000E 00 .18000E 07 .80000E 00  96 3 51  222
.20000E 07 .70000E 00 .25000E 07 .50000E 00 .30000E 07 .34000E 00  96 3 51  223
.35000E 07 .22000E 00 .40000E 07 .16000E 00 .80000E 07 .00000E 00  96 3 51  224
                                                                   96 3  0  225
4.2096 + 4 9.5078 + 1          0          2          0          0  96 3 52  226
0.0    + 0-.11479E 07          0          0          1         11  96 3 52  227
        11          2                                              96 3 52  228
.11598E 07 .00000E 00 .12000E 07 .12000E 00 .13000E 07 .22000E 00  96 3 52  229
.14000E 07 .26000E 00 .15000E 07 .27000E 00 .16000E 07 .25500E 00  96 3 52  230
.20000E 07 .21500E 00 .25000E 07 .14000E 00 .30000E 07 .10000E 00  96 3 52  231
.40000E 07 .60000E-01 .80000E 07 .00000E 00 .00000E 00 .00000E 00  96 3 52  232
                                                                   96 3  0  233
4.2096 + 4 9.5078 + 1          0          3          0          0  96 3 53  234
0.0    + 0-.14978E 07          0          0          1         14  96 3 53  235
        14          2                                              96 3 53  236
.15133E 07 .00000E 00 .16000E 07 .20000E 00 .17000E 07 .28000E 00  96 3 53  237
.18000E 07 .32000E 00 .19000E 07 .35000E 00 .20000E 07 .36000E 00  96 3 53  238
.21000E 07 .36000E 00 .22000E 07 .34200E 00 .25000E 07 .29500E 00  96 3 53  239
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.30000E 07 .19000E 00 .35000E 07 .11000E 00 .40000E 07 .60000E-01   96 3 53   240
.60000E 07 .20000E-01 .80000E 07 .00000E 00 .00000E 00 .00000E 00   96 3 53   241
                                                                    96 3  0   242
4.2096 + 4 9.5078 + 1          0          4          0          0   96 3 54   243
0.0      + 0-.16259E 07        0          0          1         14   96 3 54   244
     14              2                                              96 3 54   245
.16428E 07 .00000E 00 .17000E 07 .22000E 00 .18000E 07 .35000E 00   96 3 54   246
.19000E 07 .42000E 00 .20000E 07 .45000E 00 .21000E 07 .46000E 00   96 3 54   247
.22000E 07 .45300E 00 .23000E 07 .43200E 00 .25000E 07 .38500E 00   96 3 54   248
.30000E 07 .28000E 00 .35000E 07 .18000E 00 .40000E 07 .11500E 00   96 3 54   249
.60000E 07 .40000E-01 .80000E 07 .00000E 00 .00000E 00 .00000E 00   96 3 54   250
                                                                    96 3  0   251
4.2096 + 4 9.5078 + 1          0          5          0          0   96 3 55   252
0.0      + 0-.18695E 07        0          0          1         10   96 3 55   253
     10              2                                              96 3 55   254
.18889E 07 .00000E 00 .19000E 07 .20000E-01 .20000E 07 .60000E-01   96 3 55   255
.21000E 07 .85000E-01 .22000E 07 .10500E 00 .23000E 07 .11000E 00   96 3 55   256
.25000E 07 .11000E 00 .30000E 07 .95000E-01 .40000E 07 .50000E-01   96 3 55   257
.60000E 07 .00000E 00 .00000E 00 .00000E 00 .00000E 00 .00000E 00   96 3 55   258
                                                                    96 3  0   259
4.2096 + 4 9.5078 + 1          0          6          0          0   96 3 56   260
0.0      + 0-.19763E 07        0          0          1         10   96 3 56   261
     10              2                                              96 3 56   262
.19988E 07 .00000E 00 .21000E 07 .90000E-01 .22000E 07 .13000E 00   96 3 56   263
.23000E 07 .15000E 00 .25000E 07 .16500E 00 .27500E 07 .16500E 00   96 3 56   264
.30000E 07 .15000E 00 .35000E 07 .10000E 00 .40000E 07 .70000E-01   96 3 56   265
.60000E 07 .00000E 00 .00000E 00 .00000E 00 .00000E 00 .00000E 00   96 3 56   266
                                                                    96 3  0   267
4.2096 + 4 9.5078 + 1          0          7          0          0   96 3 57   268
0.0      + 0-.20956E 07        0          0          1         11   96 3 57   269
     11              2                                              96 3 57   270
.21174E 07 .00000E 00 .22000E 07 .80000E-01 .23000E 07 .11500E 00   96 3 57   271
.24000E 07 .14000E 00 .25000E 07 .15000E 00 .26000E 07 .15500E 00   96 3 57   272
.27500E 07 .15000E 00 .35000E 07 .10000E 00 .40000E 07 .83000E-01   96 3 57   273
.60000E 07 .30000E-01 .80000E 07 .00000E 00 .00000E 00 .00000E 00   96 3 57   274
                                                                    96 3  0   275
4.2096 + 4 9.5078 + 1          0          8          0          0   96 3 58   276
0.0      + 0-.22250E 07        0          0          1         12   96 3 58   277
     12              2                                              96 3 58   278
.22481E 07 .00000E 00 .23000E 07 .60000E-01 .24000E 07 .12000E 00   96 3 58   279
.25000E 07 .15000E 00 .26000E 07 .17500E 00 .27000E 07 .18000E 00   96 3 58   280
.28000E 07 .18000E 00 .30000E 07 .17000E 00 .35000E 07 .14000E 00   96 3 58   281
.40000E 07 .12000E 00 .60000E 07 .40000E-01 .80000E 07 .00000E 00   96 3 58   282
                                                                    96 3  0   283
4.2096 + 4 9.5078 + 1          0          9          0          0   96 3 59   284
0.0      + 0-.25000E 07        0          0          1         14   96 3 59   285
     14              2                                              96 3 59   286
.25260E 07 .00000E 00 .26000E 07 .11000E 00 .27000E 07 .14000E 00   96 3 59   287
.28000E 07 .16500E 00 .29000E 07 .18000E 00 .30000E 07 .19500E 00   96 3 59   288
.31000E 07 .20000E 00 .32000E 07 .20000E 00 .33000E 07 .20000E 00   96 3 59   289
.34000E 07 .19500E 00 .35000E 07 .19000E 00 .40000E 07 .17000E 00   96 3 59   290
.60000E 07 .50000E-01 .80000E 07 .00000E 00 .00000E 00 .00000E 00   96 3 59   291
                                                                    96 3  0   292
4.2096 + 4 9.5078 + 1          0         10          0          0   96 3 60   293
0.0      + 0-.27000E 07        0          0          1         12   96 3 60   294
     12              2                                              96 3 60   295
.27280E 07 .00000E 00 .28000E 07 .10000E 00 .29000E 07 .14500E 00   96 3 60   296
.30000E 07 .17000E 00 .31000E 07 .18000E 00 .32000E 07 .19000E 00   96 3 60   297
.33000E 07 .19000E 00 .34000E 07 .19000E 00 .35000E 07 .18500E 00   96 3 60   298
.40000E 07 .17000E 00 .60000E 07 .50000E-01 .80000E 07 .00000E 00   96 3 60   299
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4.2096 + 4 9.5078 + 1              0            11             0             0  96 3  0  300
0.0    + 0-.29000E 07              0             0             1            10  96 3 61  301
      10          2                                                             96 3 61  302
.29301E 07 .00000E 00 .30000E 07 .10000E 00 .31000E 07 .12500E 00               96 3 61  303
.32000E 07 .14500E 00 .33000E 07 .16000E 00 .34000E 07 .16200E 00               96 3 61  304
.35000E 07 .16100E 00 .40000E 07 .14000E 00 .60000E 07 .30000E-01               96 3 61  305
.60000E 07 .00000E 00 .00000E 00 .00000E 00 .00000E 00 .00000E 00               96 3 61  306
                                                                                96 3 61  307
.42096E 05 .95078E 02              0            99             0             0  96 3  0  308
.00000E 00-.22760E 07              0             0             1            26  96 3 91  309
      26          2                                                             96 3 91  310
.23000E 07 .00000E 00 .24000E 07 .64300E-01 .25000E 07 .11500E 00               96 3 91  311
.25260E 07 .14700E 00 .26000E 07 .12800E 00 .27000E 07 .22930E 00               96 3 91  312
.27280E 07 .26050E 00 .27500E 07 .25440E 00 .28000E 07 .18130E 00               96 3 91  313
.28500E 07 .15765E 00 .29000E 07 .20400E 00 .29301E 07 .23800E 00               96 3 91  314
.30000E 07 .21670E 00 .30500E 07 .25725E 00 .31000E 07 .25780E 00               96 3 91  315
.32000E 07 .26900E 00 .32500E 07 .27710E 00 .33000E 07 .29920E 00               96 3 91  316
.34000E 07 .36130E 00 .35000E 07 .42650E 00 .36000E 07 .50960E 00               96 3 91  317
.38000E 07 .64560E 00 .40000E 07 .77200E 00 .50000E 07 .13260E 01               96 3 91  318
.60000E 07 .17300E 01 .80000E 07 .20940E 01 .00000E 00 .00000E 00               96 3 91  319
                                                                                96 3 91  320
.00000E 00 .00000E 00                                                           96 3  0  321
.42096E 05 .95078E 02                                                           96 0  0  322
.42096E 05 .95078E 02              0             1             0             0  96 4  2  323
.00000E 00 .00000E 00              0             1             0             0  96 4  2  323
      27          2                0             0             1            27  96 4  2  324
.00000E 00 .10000E 06                                                           96 4  2  325
.91633E-01 .69480E-01-.12556E-04-.53644E-06     0             4             0  96 4  2  326
                                          .00000E 00 .00000E 00                 96 4  2  327
.00000E 00 .20000E 06              0             0             4             0  96 4  2  328
.17443E 00 .91100E-01 .59886E-03 .33200E-03 .00000E 00 .00000E 00               96 4  2  329
.00000E 00 .30000E 06              0             0             4             0  96 4  2  330
.23623E 00 .10928E 00 .17343E-02 .81267E-03 .00000E 00 .00000E 00               96 4  2  331
.00000E 00 .40000E 06              0             0             4             0  96 4  2  332
.28113E 00 .12626E 00 .36171E-02 .16067E-02 .00000E 00 .00000E 00               96 4  2  333
.00000E 00 .50000E 06              0             0             4             0  96 4  2  334
.31377E 00 .14236E 00 .62243E-02 .27267E-02 .00000E 00 .00000E 00               96 4  2  335
.00000E 00 .60000E 06              0             0             4             0  96 4  2  336
.33733E 00 .15758E 00 .95971E-02 .43033E-02 .00000E 00 .00000E 00               96 4  2  337
.00000E 00 .70000E 06              0             0             4             0  96 4  2  338
.35433E 00 .17200E 00 .13653E-01 .63456E-02 .00000E 00 .00000E 00               96 4  2  339
.00000E 00 .80000E 06              0             0             4             0  96 4  2  340
.35633E 00 .17730E 00 .18000E-01 .83900E-02 .00000E 00 .00000E 00               96 4  2  341
.00000E 00 .90000E 06              0             0             4             0  96 4  2  342
.38833E 00 .19098E 00 .24729E-01 .10467E-01 .00000E 00 .00000E 00               96 4  2  343
.00000E 00 .10000E 07              0             0             6             0  96 4  2  344
.40800E 00 .20460E 00 .31257E-01 .13222E-01 .70264E-03 .97923E-03               96 4  2  345
.00000E 00 .12000E 07              0             0             6             0  96 4  2  346
.43100E 00 .23200E 00 .46029E-01 .22078E-01 .16791E-02 .15585E-02               96 4  2  347
.00000E 00 .14000E 07              0             0             6             0  96 4  2  348
.44500E 00 .25760E 00 .62143E-01 .34033E-01 .35527E-02 .25377E-02               96 4  2  349
.00000E 00 .18000E 07              0             0             8             0  96 4  2  350
.45433E 00 .30900E 00 .10089E 00 .63933E-01 .11391E-01 .44431E-02               96 4  2  351
.10067E-03-.15653E-05 .00000E 00 .00000E 00 .00000E 00 .00000E 00               96 4  2  352
.00000E 00 .20000E 07              0             0             6             0  96 4  2  353
.48300E 00 .33180E 00 .12327E 00 .94233E-01 .28409E-01 .76746E-02               96 4  2  354
.00000E 00 .22000E 07              0             0             6             0  96 4  2  355
.49567E 00 .35900E 00 .14471E 00 .11611E 00 .40000E-01 .14615E-01               96 4  2  356
.00000E 00 .24000E 07              0             0             6             0  96 4  2  357
.48900E 00 .37260E 00 .15357E 00 .13722E 00 .64064E-01 .24277E-01               96 4  2  358
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.50533E 00	.39240E 00	.17886E 00	.16644E 00	.84864E-01	.38377E-01	96	4	2	360
.00000E 00	.28000E 07	0	0	8	0	96	4	2	361
.52400E 00	.40560E 00	.19757E 00	.18367E 00	.78882E-01	.28569E-01	96	4	2	362
.14913E-01	.68412E-02	.00000E 00	.00000E 00	.00000E 00	.00000E 00	96	4	2	363
.00000E 00	.30000E 07	0	0	8	0	96	4	2	364
.51700E 00	.41580E 00	.20471E 00	.20522E 00	.10727E 00	.41823E-01	96	4	2	365
.21427E-01	.11094E-01	.00000E 00	.00000E 00	.00000E 00	.00000E 00	96	4	2	366
.00000E 00	.32000E 07	0	0	8	0	96	4	2	367
.54967E 00	.42720E 00	.22357E 00	.21778E 00	.11536E 00	.44377E-01	96	4	2	368
.96400E-02	.36412E-02	.00000E 00	.00000E 00	.00000E 00	.00000E 00	96	4	2	369
.00000E 00	.34000E 07	0	0	8	0	96	4	2	370
.57367E 00	.43800E 00	.25729E 00	.23878E 00	.12927E 00	.47669E-01	96	4	2	371
.59280E-02	.11335E-02	.00000E 00	.00000E 00	.00000E 00	.00000E 00	96	4	2	372
.00000E 00	.36000E 07	0	0	8	0	96	4	2	373
.56633E 00	.42940E 00	.26171E 00	.25522E 00	.15064E 00	.58285E-01	96	4	2	374
.75133E-02	.15571E-02	.00000E 00	.00000E 00	.00000E 00	.00000E 00	96	4	2	375
.00000E 00	.38000E 07	0	0	8	0	96	4	2	376
.59100E 00	.44560E 00	.28800E 00	.27178E 00	.17082E 00	.68285E-01	96	4	2	377
.10647E-01	.23794E-02	.00000E 00	.00000E 00	.00000E 00	.00000E 00	96	4	2	378
.00000E 00	.40000E 07	0	0	8	0	96	4	2	379
.61533E 00	.46320E 00	.31414E 00	.28689E 00	.18964E 00	.78615E-01	96	4	2	380
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.00000E 00	.50000E 07	0	0	10	0	96	4	2	382
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.00000E 00	.60000E 07	0	0	10	0	96	4	2	385
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.00000E 00	.80000E 07	0	0	10	0	96	4	2	388
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.16027E 00	.84176E-01	.42763E-01	.15257E-01	.00000E 00	.00000E 00	96	4	2	390
						96	4	0	391
						96	0	0	392
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4.20980+ 4 9.70620+ 1          1          0          0         18  98 1451
0.00000+ 0 0.00000+ 0          0          0          4          0  98 1451
---------------------- MØLYBDENUM-98 ----------------------        98 1451
PARTIAL EVALUATIØN BY A. SMITH, P. GUENTHER AND J. WHALEN, ANL.    98 1451
CØMPLETE DØCUEMENTATIØN IN ANL/NDM-7, 1974.                        98 1451
-------------------------------------------------------------      98 1451
                               1        451         24             98 1451
                               3          1         86             98 1451
                               3          2         86             98 1451
                               3          4         19             98 1451
                               3         51          8             98 1451
                               3         52          8             98 1451
                               3         53          7             98 1451
                               3         54          7             98 1451
                               3         55          7             98 1451
                               3         56          7             98 1451
                               3         57          7             98 1451
                               3         58          6             98 1451
                               3         59          6             98 1451
                               3         60          6             98 1451
                               3         61          6             98 1451
                               3         62          6             98 1451
                               3         91          8             98 1451
                               4          2         70             98 1451
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       247          2                                              98 3  1
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.15800E 06 .95530E 01 .16800E 06 .74820E 01 .17200E 06 .79950E 01  98 3  1
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.38000E 07	.39000E 01	.40000E 07	.38000E 01	.45000E 07	.38500E 01	98	3	1	110
.50000E 07	.39000E 01	.55000E 07	.39583E 01	.60000E 07	.40167E 01	98	3	1	111
.80000E 07	.42500E 01	.00000E 00	.00000E 00	.00000E 00	.00000E 00	98	3	1	112
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0.00000+ 0	0.00000+ 0	0	0	0	0	98	3	2	114
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						98	3	2	119

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.21400E	06	.75250E	01	.21600E	06	.87040E	01	.22000E	06	.89800E	01	98	3	2	123
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.87960E	06	.72301E	01	.88560E	06	.63269E	01	.89060E	06	.65559E	01	98	3	2	164
.89960E	06	.56711E	01	.90000E	06	.57055E	01	.90860E	06	.64635E	01	98	3	2	165
.92660E	06	.58589E	01	.93860E	06	.61775E	01	.95970E	06	.63520E	01	98	3	2	166
.96570E	06	.57818E	01	.97170E	06	.61416E	01	.98070E	06	.53798E	01	98	3	2	167
.98970E	06	.56290E	01	.99270E	06	.49724E	01	.99570E	06	.63188E	01	98	3	2	168
.10000E	07	.61871E	01	.10050E	07	.60422E	01	.10170E	07	.51006E	01	98	3	2	169
.10320E	07	.61204E	01	.10440E	07	.53138E	01	.10590E	07	.59215E	01	98	3	2	170
.10650E	07	.53392E	01	.10770E	07	.60246E	01	.10890E	07	.53050E	01	98	3	2	171
.11000E	07	.60378E	01	.11010E	07	.61053E	01	.11130E	07	.52014E	01	98	3	2	172
.11190E	07	.56295E	01	.11280E	07	.50575E	01	.11310E	07	.57245E	01	98	3	2	173
.11370E	07	.47916E	01	.11460E	07	.56286E	01	.11550E	07	.56297E	01	98	3	2	174
.11640E	07	.49778E	01	.11760E	07	.53978E	01	.11940E	07	.48360E	01	98	3	2	175
.12000E	07	.50750E	01	.12180E	07	.53607E	01	.12390E	07	.51656E	01	98	3	2	176
.12480E	07	.44785E	01	.12570E	07	.50343E	01	.12780E	07	.53203E	01	98	3	2	177
.12900E	07	.49654E	01	.13000E	07	.49580E	01	.13020E	07	.49575E	01	98	3	2	178
.13080E	07	.45420E	01	.13110E	07	.51277E	01	.13350E	07	.49377E	01	98	3	2	179

.13440E 07	.47230E 01	.13560E 07	.47450E 01	.13620E 07	.51225E 01	98	3	2	180
.13710E 07	.46177E 01	.13770E 07	.52262E 01	.13860E 07	.46685E 01	98	3	2	181
.13890E 07	.50042E 01	.14000E 07	.47750E 01	.14100E 07	.45745E 01	98	3	2	182
.14160E 07	.51636E 01	.14250E 07	.49092E 01	.14280E 07	.53808E 01	98	3	2	183
.14340E 07	.44949E 01	.14430E 07	.48115E 01	.14460E 07	.48001E 01	98	3	2	184
.14670E 07	.46790E 01	.14730E 07	.48604E 01	.14760E 07	.43662E 01	98	3	2	185
.14820E 07	.48536E 01	.14910E 07	.43377E 01	.14970E 07	.45651E 01	98	3	2	186
.15000E 07	.45608E 01	.15250E 07	.45289E 01	.16000E 07	.43983E 01	98	3	2	187
.17000E 07	.41267E 01	.17750E 07	.40016E 01	.18000E 07	.39000E 01	98	3	2	188
.19000E 07	.37700E 01	.20000E 07	.37050E 01	.20450E 07	.36555E 01	98	3	2	189
.21000E 07	.34950E 01	.21260E 07	.34495E 01	.22000E 07	.32400E 01	98	3	2	190
.22380E 07	.32096E 01	.23000E 07	.31120E 01	.23630E 07	.30550E 01	98	3	2	191
.24000E 07	.29817E 01	.25000E 07	.28892E 01	.25250E 07	.28872E 01	98	3	2	192
.26000E 07	.27217E 01	.27000E 07	.25955E 01	.27270E 07	.25888E 01	98	3	2	193
.28000E 07	.24110E 01	.29000E 07	.24015E 01	.29290E 07	.24258E 01	98	3	2	194
.30000E 07	.23453E 01	.31000E 07	.22900E 01	.32000E 07	.21800E 01	98	3	2	195
.34000E 07	.20600E 01	.35000E 07	.20100E 01	.36000E 07	.19600E 01	98	3	2	196
.38000E 07	.18700E 01	.40000E 07	.17700E 01	.45000E 07	.16501E 01	98	3	2	197
.50000E 07	.19300E 01	.55000E 07	.19784E 01	.60000E 07	.20267E 01	98	3	2	198
.80000E 07	.24000E 01	.00000E 00	.00000E 00	.00000E 00	.00000E 00	98	3	2	199
						98	3	0	200
.42098E 05	.97062E 02	0	99	0	0	98	3	4	201
.00000E 00	-.73490E 06	0	0	1	47	98	3	4	202
47	2					98	3	4	203
.74220E 06	.00000E 00	.79520E 06	.18339E 00	.80000E 06	.28000E 00	98	3	4	204
.90000E 06	.80000E 00	.10000E 07	.11200E 01	.11000E 07	.12750E 01	98	3	4	205
.12000E 07	.13410E 01	.13000E 07	.13650E 01	.14000E 07	.13400E 01	98	3	4	206
.14460E 07	.13009E 01	.15000E 07	.13602E 01	.15250E 07	.13868E 01	98	3	4	207
.16000E 07	.15017E 01	.17000E 07	.15963E 01	.17750E 07	.15921E 01	98	3	4	208
.18000E 07	.16500E 01	.19000E 07	.17300E 01	.20000E 07	.17450E 01	98	3	4	209
.20450E 07	.17157E 01	.21000E 07	.17800E 01	.21260E 07	.17800E 01	98	3	4	210
.22000E 07	.18600E 01	.22380E 07	.18429E 01	.23000E 07	.18630E 01	98	3	4	211
.23630E 07	.18412E 01	.24000E 07	.18683E 01	.25000E 07	.18858E 01	98	3	4	212
.25250E 07	.18690E 01	.26000E 07	.19753E 01	.27000E 07	.19795E 01	98	3	4	213
.27270E 07	.19524E 01	.28000E 07	.20390E 01	.29000E 07	.19985E 01	98	3	4	214
.29290E 07	.19597E 01	.30000E 07	.20047E 01	.31000E 07	.19850E 01	98	3	4	215
.32000E 07	.20200E 01	.34000E 07	.20100E 01	.35000E 07	.20250E 01	98	3	4	216
.36000E 07	.20400E 01	.38000E 07	.20300E 01	.40000E 07	.20300E 01	98	3	4	217
.45000E 07	.19999E 01	.50000E 07	.19700E 01	.55000E 07	.19799E 01	98	3	4	218
.60000E 07	.19900E 01	.80000E 07	.18500E 01	.00000E 00	.00000E 00	98	3	4	219
						98	3	0	220
4.2098 + 4	9.7062 + 1	0	1	0	0	98	3	51	221
0.0 + 0	-0.73490+ 6	0	0	1	14	98	3	51	222
14	2					98	3	51	223
.74220E 06	.00000E 00	.80000E 06	.20000E 00	.90000E 06	.32000E 00	98	3	51	224
.10000E 07	.36000E 00	.11000E 07	.38500E 00	.12000E 07	.38050E 00	98	3	51	225
.13000E 07	.37000E 00	.14000E 07	.36000E 00	.15000E 07	.32500E 00	98	3	51	226
.18000E 07	.26000E 00	.24000E 07	.15500E 00	.30000E 07	.80000E-01	98	3	51	227
.40000E 07	.40000E-01	.80000E 07	.00000E 00			98	3	51	228
						98	3	0	229
4.2098 + 4	9.7062 + 1	0	2	0	0	98	3	52	230
0.0 + 0	-0.7874 + 6	0	0	1	14	98	3	52	231
14	2					98	3	52	232
.79520E 06	.00000E 00	.80000E 06	.80000E-01	.90000E 06	.48000E 00	98	3	52	233
.10000E 07	.76000E 00	.11000E 07	.89000E 00	.12000E 07	.96050E 00	98	3	52	234
.13000E 07	.99500E 00	.14000E 07	.98000E 00	.15000E 07	.93000E 00	98	3	52	235
.18000E 07	.73000E 00	.24000E 07	.47500E 00	.30000E 07	.25500E 00	98	3	52	236
.40000E 07	.12000E 00	.80000E 07	.00000E 00	.00000E 00	.00000E 00	98	3	52	237
						98	3	0	238
4.2098 + 4	9.7062 + 1	0	3	0	0	98	3	53	239

```
0.0      + 0-1.4320 + 6            0            0            1           11   98 3 53   240
       11           2                                                         98 3 53   241
.14460E 07 .00000E 00 .16000E 07 .30000E 00 .17000E 07 .40000E 00   98 3 53   242
.18000E 07 .44000E 00 .19000E 07 .44500E 00 .20000E 07 .44000E 00   98 3 53   243
.22000E 07 .40000E 00 .24000E 07 .32000E 00 .30000E 07 .18000E 00   98 3 53   244
.40000E 07 .40000E-01 .80000E 07 .00000E 00                         98 3 53   245
                                                                    98 3  0   246
4.2098 + 4 9.7062 + 1              0            4            0            0   98 3 54   247
0.0      + 0-1.5100 + 6            0            0            1           11   98 3 54   248
       11           2                                                         98 3 54   249
.15250E 07 .00000E 00 .16000E 07 .35000E-01 .17000E 07 .12000E 00   98 3 54   250
.18000E 07 .16000E 00 .19000E 07 .19500E 00 .20000E 07 .20000E 00   98 3 54   251
.22000E 07 .20000E 00 .24000E 07 .18000E 00 .30000E 07 .10000E 00   98 3 54   252
.40000E 07 .40000E-01 .80000E 07 .00000E 00 .00000E 00 .00000E 00   98 3 54   253
                                                                    98 3  0   254
4.2098 + 4 9.70620+ 1              0            5            0            0   98 3 55   255
0.0      + 0-1.7580 + 6            0            0            1           12   98 3 55   256
       12           2                                                         98 3 55   257
.17750E 07 .00000E 00 .18000E 07 .60000E-01 .19000E 07 .16000E 00   98 3 55   258
.20000E 07 .23500E 00 .21000E 07 .25000E 00 .22000E 07 .26000E 00   98 3 55   259
.23000E 07 .24500E 00 .26000E 07 .19500E 00 .30000E 07 .12800E 00   98 3 55   260
.35000E 07 .80000E-01 .40000E 07 .50000E-01 .80000E 07 .00000E 00   98 3 55   261
                                                                    98 3  0   262
4.2098 + 4 9.7062 + 1              0            6            0            0   98 3 56   263
0.0      + 0-2.0250 + 6            0            0            1           10   98 3 56   264
       10           2                                                         98 3 56   265
.20450E 07 .00000E 00 .21000E 07 .10000E 00 .22000E 07 .17000E 00   98 3 56   266
.23000E 07 .20500E 00 .24000E 07 .21000E 00 .25000E 07 .20500E 00   98 3 56   267
.26000E 07 .19500E 00 .30000E 07 .15000E 00 .40000E 07 .40000E-01   98 3 56   268
.80000E 07 .00000E 00 .00000E 00 .00000E 00 .00000E 00 .00000E 00   98 3 56   269
                                                                    98 3  0   270
4.2098 + 4 9.7062 + 1              0            7            0            0   98 3 57   271
0.0      + 0-2.1050 + 6            0            0            1           10   98 3 57   272
       10           2                                                         98 3 57   273
.21260E 07 .00000E 00 .21000E 07 .00000E 00 .22000E 07 .80000E-01   98 3 57   274
.23000E 07 .12500E 00 .24000E 07 .16000E 00 .25000E 07 .16500E 00   98 3 57   275
.26000E 07 .17000E 00 .30000E 07 .15000E 00 .40000E 07 .55000E-01   98 3 57   276
.80000E 07 .00000E 00 .00000E 00 .00000E 00 .00000E 00 .00000E 00   98 3 57   277
                                                                    98 3  0   278
4.2098 + 4 9.7062 + 1              0            8            0            0   98 3 58   279
0.0      + 0-2.216  + 6            0            0            1            9   98 3 58   280
        9           2                                                         98 3 58   281
.22380E 07 .00000E 00 .23000E 07 .48000E-01 .24000E 07 .10000E 00   98 3 58   282
.25000E 07 .13000E 00 .26000E 07 .14000E 00 .27000E 07 .14000E 00   98 3 58   283
.30000E 07 .12000E 00 .40000E 07 .55000E-01 .80000E 07 .00000E 00   98 3 58   284
                                                                    98 3  0   285
4.2098 + 4 9.7062 + 1              0            9            0            0   98 3 59   286
0.0      + 0-2.3400 + 6            0            0            1            8   98 3 59   287
        8           2                                                         98 3 59   288
.23630E 07 .00000E 00 .24000E 07 .40000E-01 .25000E 07 .13000E 00   98 3 59   289
.26000E 07 .16000E 00 .27000E 07 .18000E 00 .30000E 07 .16500E 00   98 3 59   290
.40000E 07 .10000E 00 .80000E 07 .00000E 00 .00000E 00 .00000E 00   98 3 59   291
                                                                    98 3  0   292
4.2098 + 4 9.7062 + 1              0           10            0            0   98 3 60   293
0.0      + 0-2.5000 + 6            0            0            1            8   98 3 60   294
        8           2                                                         98 3 60   295
.25250E 07 .00000E 00 .26000E 07 .16000E 00 .27000E 07 .26000E 00   98 3 60   296
.28000E 07 .29000E 00 .29000E 07 .30000E 00 .35000E 07 .22000E 00   98 3 60   297
.40000E 07 .16000E 00 .80000E 07 .00000E 00 .00000E 00 .00000E 00   98 3 60   298
                                                                    98 3  0   299
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4.2098 + 4 9.7062 + 1            0           11           0            0   98 3 61   300
0.0    + 0-2.7000 + 6            0            0           1            7   98 3 61   301
     7           2                                                         98 3 61   302
.27270E 07 .00000E 00 .28000E 07 .16000E 00 .29000E 07 .24000E 00   98 3 61   303
.30000E 07 .25000E 00 .34000E 07 .24000E 00 .40000E 07 .15000E 00   98 3 61   304
.80000E 07 .00000E 00 .00000E 00 .00000E 00 .00000E 00 .00000E 00   98 3 61   305
                                                                           98 3  0   306
4.2098 + 4 9.7062 + 1            0           12           0            0   98 3 62   307
0.0    + 0-2.9000 + 6            0            0           1            7   98 3 62   308
     7           2                                                         98 3 62   309
.29290E 07 .00000E 00 .30000E 07 .14000E 00 .31000E 07 .20000E 00   98 3 62   310
.32000E 07 .24000E 00 .34000E 07 .24000E 00 .40000E 07 .16000E 00   98 3 62   311
.80000E 07 .00000E 00 .00000E 00 .00000E 00 .00000E 00 .00000E 00   98 3 62   312
                                                                           98 3  0   313
.42098E 05 .97062E 02            0           99           0            0   98 3 91   314
.00000E 00-.29697E 07            0            0           1           13   98 3 91   315
    13           2                                                         98 3 91   316
.30000E 07 .00000E 00 .31000E 07 .16767E-01 .32000E 07 .10820E 00   98 3 91   317
.34000E 07 .29107E 00 .35000E 07 .42833E 00 .36000E 07 .56067E 00   98 3 91   318
.38000E 07 .78533E 00 .40000E 07 .10200E 01 .45000E 07 .11162E 01   98 3 91   319
.50000E 07 .12125E 01 .55000E 07 .13487E 01 .60000E 07 .14850E 01   98 3 91   320
.80000E 07 .18500E 01                                                      98 3 91   321
                                                                           98 3  0   322
.00000E 00 .00000E 00                                                      98 0  0   323
4.2098 + 4 9.7062 + 1            0            1           0            0   98 4  2   324
4.2098 + 4 9.7062 + 1            0            1           0            0   98 4  2   324
0.0    + 0 0.0    + 0            0            0           1           28   98 4  2   325
    28           2                                                         98 4  2   326
.00000E 00 .10000E 06            0            0           4            0   98 4  2   327
.72253E-01 .66060E-01 .86100E-04 .71511E-04 .00000E 00 .00000E 00   98 4  2   328
.00000E 00 .20000E 06            0            0           4            0   98 4  2   329
.14977E 00 .87640E-01 .54600E-03 .33939E-03 .00000E 00 .00000E 00   98 4  2   330
.00000E 00 .30000E 06            0            0           4            0   98 4  2   331
.21160E 00 .10506E 00 .16171E-02 .81233E-03 .00000E 00 .00000E 00   98 4  2   332
.00000E 00 .40000E 06            0            0           4            0   98 4  2   333
.25830E 00 .12108E 00 .34614E-02 .16467E-02 .00000E 00 .00000E 00   98 4  2   334
.00000E 00 .50000E 06            0            0           4            0   98 4  2   335
.29297E 00 .13628E 00 .59900E-02 .27878E-02 .00000E 00 .00000E 00   98 4  2   336
.00000E 00 .60000E 06            0            0           4            0   98 4  2   337
.31853E 00 .15078E 00 .93486E-02 .44500E-02 .00000E 00 .00000E 00   98 4  2   338
.00000E 00 .70000E 06            0            0           4            0   98 4  2   339
.33700E 00 .16464E 00 .13436E-01 .66544E-02 .00000E 00 .00000E 00   98 4  2   340
.00000E 00 .80000E 06            0            0           4            0   98 4  2   341
.36133E 00 .17904E 00 .18686E-01 .91911E-02 .00000E 00 .00000E 00   98 4  2   342
.00000E 00 .90000E 06            0            0           4            0   98 4  2   343
.40133E 00 .19406E 00 .26071E-01 .11167E-01 .00000E 00 .00000E 00   98 4  2   344
.00000E 00 .10000E 07            0            0           6            0   98 4  2   345
.42400E 00 .20900E 00 .33186E-01 .14133E-01 .76900E-03 .10608E-02   98 4  2   346
.00000E 00 .12000E 07            0            0           6            0   98 4  2   347
.44567E 00 .23680E 00 .48571E-01 .23400E-01 .18800E-02 .16900E-02   98 4  2   348
.00000E 00 .14000E 07            0            0           6            0   98 4  2   349
.45267E 00 .26140E 00 .64186E-01 .35000E-01 .37573E-02 .25377E-02   98 4  2   350
.00000E 00 .16000E 07            0            0           6            0   98 4  2   351
.47033E 00 .28700E 00 .82586E-01 .48211E-01 .69645E-02 .30215E-02   98 4  2   352
.00000E 00 .18000E 07            0            0           6            0   98 4  2   353
.47767E 00 .33680E 00 .10436E 00 .76211E-01 .16582E-01-.66823E-02   98 4  2   354
.00000E 00 .20000E 07            0            0           6            0   98 4  2   355
.47833E 00 .35460E 00 .12860E 00 .98900E-01 .35018E-01 .71162E-02   98 4  2   356
.00000E 00 .22000E 07            0            0           6            0   98 4  2   357
.50000E 00 .37800E 00 .15243E 00 .12478E 00 .48609E-01 .15031E-01   98 4  2   358
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.51300E 00	.39920E 00	.16700E 00	.14469E 00	.66491E-01	.23815E-01	98	4	2	360
.00000E 00	.26000E 07	0	0	8	0	98	4	2	361
.54400E 00	.40100E 00	.18443E 00	.15433E 00	.55518E-01	.17623E-01	98	4	2	362
.13107E-02	.17700E-03	.00000E 00	.00000E 00	.00000E 00	.00000E 00	98	4	2	363
.00000E 00	.28000E 07	0	0	6	0	98	4	2	364
.53367E 00	.41900E 00	.19186E 00	.18089E 00	.92636E-01	.34638E-01	98	4	2	365
.00000E 00	.30000E 07	0	0	8	0	98	4	2	366
.53633E 00	.40680E 00	.20200E 00	.20278E 00	.92909E-01	.31900E-01	98	4	2	367
.26307E-02	.44041E-03	.00000E 00	.00000E 00	.00000E 00	.00000E 00	98	4	2	368
.00000E 00	.32000E 07	0	0	8	0	98	4	2	369
.55667E 00	.43780E 00	.21743E 00	.20933E 00	.11591E 00	.48715E-01	98	4	2	370
.15593E-01	.65176E-02	.00000E 00	.00000E 00	.00000E 00	.00000E 00	98	4	2	371
.00000E 00	.34000E 07	0	0	8	0	98	4	2	372
.58333E 00	.42700E 00	.24014E 00	.22900E 00	.12464E 00	.51492E-01	98	4	2	373
.10087E-01	.80588E-02	.00000E 00	.00000E 00	.00000E 00	.00000E 00	98	4	2	374
.00000E 00	.36000E 07	0	0	8	0	98	4	2	375
.58233E 00	.43700E 00	.26829E 00	.25878E 00	.15618E 00	.60854E-01	98	4	2	376
.79600E-02	.17306E-02	.00000E 00	.00000E 00	.00000E 00	.00000E 00	98	4	2	377
.00000E 00	.38000E 07	0	0	8	0	98	4	2	378
.59200E 00	.44600E 00	.28814E 00	.27033E 00	.17255E 00	.69815E-01	98	4	2	379
.11040E-01	.25700E-02	.00000E 00	.00000E 00	.00000E 00	.00000E 00	98	4	2	380
.00000E 00	.40000E 07	0	0	8	0	98	4	2	381
.61000E 00	.46060E 00	.31171E 00	.28367E 00	.18982E 00	.79769E-01	98	4	2	382
.15173E-01	.37182E-02	.00000E 00	.00000E 00	.00000E 00	.00000E 00	98	4	2	383
.00000E 00	.50000E 07	0	0	10	0	98	4	2	384
.58200E 00	.42980E 00	.33114E 00	.30700E 00	.24918E 00	.12908E 00	98	4	2	385
.36393E-01	.11912E-01	.35758E-02	.57190E-03	.00000E 00	.00000E 00	98	4	2	386
.00000E 00	.60000E 07	0	0	10	0	98	4	2	387
.65300E 00	.49400E 00	.39071E 00	.34200E 00	.28873E 00	.17746E 00	98	4	2	388
.71800E-01	.26341E-01	.82316E-02	.15600E-02	.00000E 00	.00000E 00	98	4	2	389
.00000E 00	.80000E 07	0	0	10	0	98	4	2	390
.76200E 00	.61220E 00	.48257E 00	.40133E 00	.32718E 00	.23862E 00	98	4	2	391
.13340E 00	.61294E-01	.24626E-01	.61381E-02	.00000E 00	.00000E 00	98	4	2	392
						98	4	0	393
0.0 + 0	0.0 + 0					98	0	0	394
0.0 + 0	0.0 + 0					98	0	0	395

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PARTIAL EVALUATIØN BY A. SMITH, P. GUENTHER AND J. WHALEN, ANL.     100 1451    4
CØMPLETE DØCUEMENTATIØN IN ANL/NDM-7, 1974.                         100 1451    5
------------------------------------------------------------------- 100 1451    6
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                               3          1         87              100 1451    8
                               3          2         87              100 1451    9
                               3          4         17              100 1451   10
                               3         51          8              100 1451   11
                               3         52          8              100 1451   12
                               3         53          7              100 1451   13
                               3         54          7              100 1451   14
                               3         55          7              100 1451   15
                               3         56          6              100 1451   16
                               3         57          7              100 1451   17
                               3         58          6              100 1451   18
                               3         59          7              100 1451   19
                               3         60          6              100 1451   20
                               3         61          6              100 1451   21
                               3         91          5              100 1451   22
                               4          2         73              100 1451   23
                                                                    100 1    0   24
                                                                    100 0    0   25
4.2100 + 4 .99046E 02          0         99          0          0 100 3    1   26
0.0    + 0 0.0    + 0          0          0          1        251 100 3    1   27
       251          2                                             100 3    1   28
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                                                                  100 3  0  113
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      251          2                                              100 3  2  116
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.15230E 06 .77040E 01 .16440E 06 .69580E 01 .17240E 06 .75590E 01 100 3  2  119
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.23250E	06	.79170E	01	.24650E	06	.80780E	01	.25050E	06	.88450E	01	100	3	2	124
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.36470E	06	.90060E	01	.36870E	06	.81710E	01	.37270E	06	.91330E	01	100	3	2	131
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.41250E	06	.82730E	01	.41650E	06	.93670E	01	.42250E	06	.68180E	01	100	3	2	134
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.94530E	06	.62448E	01	.94830E	06	.58060E	01	.96630E	06	.56402E	01	100	3	2	164
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.10050E	07	.57723E	01	.10110E	07	.52585E	01	.10140E	07	.55630E	01	100	3	2	167
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,22000E 07 .18540E 01 ,23000E 07 ,18355E 01 ,23634E 07 .17984E 01 100 3  4  213
,24000E 07 .18170E 01 ,25000E 07 .17643E 01 ,25250E 07 .17605E 01 100 3  4  214
,26000E 07 ,18491E 01 ,27000E 07 ,18388E 01 ,28000E 07 ,18228E 01 100 3  4  215
,28280E 07 .18106E 01 ,30000E 07 ,19107E 01 ,32000E 07 .19776E 01 100 3  4  216
,34000E 07 .19944E 01 ,37000E 07 ,20097E 01 ,40000E 07 .20150E 01 100 3  4  217
,60000E 07 .19700E 01 ,80000E 07 ,20000E 01 ,00000E 00 .00000E 00 100 3  4  218
                                                                  100 3  0  219
4.2100 + 4 .99046E 02          0           1          0         0 100 3 51  220
0.0    + 0-,53560E 06          0           0          1        15 100 3 51  221
      15          2                                               100 3 51  222
,54095E 06 .00000E 00 ,60000E 06 .48000E 00 ,70000E 06 .76000E 00 100 3 51  223
,80000E 06 .88000E 00 ,90000E 06 .92000E 00 .10000E 07 .94000E 00 100 3 51  224
,11000E 07 .92200E 00 .12000E 07 ,86300E 00 ,15000E 07 ,72000E 00 100 3 51  225
,20000E 07 .56800E 00 ,25000E 07 ,44800E 00 ,30000E 07 .33800E 00 100 3 51  226
,40000E 07 .16500E 00 .60000E 07 ,70000E-01 .80000E 07 ,00000E 00 100 3 51  227
                                                                  100 3  0  228
4.2100 + 4 ,99046E 02          0           2          0         0 100 3 52  229
0.0    + 0-,69440E 06          0           0          1        14 100 3 52  230
      14          2                                               100 3 52  231
,70134E 06 .00000E 00 .70000E 06 ,40000E-01 ,80000E 06 .24000E 00 100 3 52  232
.90000E 06 .34000E 00 .10000E 07 ,38000E 00 ,11000E 07 .41200E 00 100 3 52  233
,12000E 07 .42000E 00 .15000E 07 .36000E 00 ,20000E 07 .26800E 00 100 3 52  234
.25000E 07 ,16800E 00 .30000E 07 .10000E 00 .40000E 07 .50000E-01 100 3 52  235
,60000E 07 .20000E-01 .80000E 07 ,00000E 00 ,00000E 00 .00000E 00 100 3 52  236
                                                                  100 3  0  237
4.2100 + 4 .99046E 02          0           3          0         0 100 3 53  238
0.0    + 0-.10637E 07          0           0          1        12 100 3 53  239
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      12              2                                                          100 3 53   240
.10743E 07 .00000E 00 .11000E 07 .10000E 00 .12000E 07 .34000E 00 100 3 53   241
.13000E 07 .44000E 00 .14000E 07 .47000E 00 .15000E 07 .49000E 00 100 3 53   242
.17000E 07 .48000E 00 .20000E 07 .40000E 00 .25000E 07 .25000E 00 100 3 53   243
.30000E 07 .17000E 00 .40000E 07 .80000E-01 .80000E 07 .00000E 00 100 3 53   244
                                                                  100 3  0   245
4.2100 + 4 .99046E 02          0          4          0          0 100 3 54   246
0.0    + 0-.11361E 07          0          0          1         11 100 3 54   247
      11              2                                           100 3 54   248
.11474E 07 .00000E 00 .12000E 07 .10000E 00 .13000E 07 .16000E 00 100 3 54   249
.14000E 07 .20000E 00 .15000E 07 .22000E 00 .17000E 07 .22000E 00 100 3 54   250
.20000E 07 .21000E 00 .25000E 07 .15000E 00 .30000E 07 .90000E-01 100 3 54   251
.40000E 07 .60000E-01 .80000E 07 .00000E 00 .00000E 00 .00000E 00 100 3 54   252
                                                                  100 3  0   253
4.2100 + 4 .99046E 02          0          5          0          0 100 3 55   254
0.0    + 0-.14633E 07          0          0          1         12 100 3 55   255
      12              2                                           100 3 55   256
.14779E 07 .00000E 00 .15000E 07 .65000E-01 .16000E 07 .17000E 00 100 3 55   257
.17000E 07 .24000E 00 .18000E 07 .27000E 00 .19000E 07 .29000E 00 100 3 55   258
.20000E 07 .29000E 00 .22000E 07 .28000E 00 .24000E 07 .25500E 00 100 3 55   259
.30000E 07 .17000E 00 .40000E 07 .80000E-01 .80000E 07 .00000E 00 100 3 55   260
                                                                  100 3  0   261
4.2100 + 4 .99046E 02          0          6          0          0 100 3 56   262
0.0    + 0-.17 04E 07          0          0          1          8 100 3 56   263
       8              2                                           100 3 56   264
.17881E 07 .00000E 00 .19000E 07 .30000E-01 .20000E 07 .50000E-01 100 3 56   265
.22000E 07 .90000E-01 .24000E 07 .10000E 00 .30000E 07 .85000E-01 100 3 56   266
.40000E 07 .60000E-01 .80000E 07 .00000E 00 .00000E 00 .00000E 00 100 3 56   267
                                                                  100 3  0   268
4.2100 + 4 .99046E 02          0          7          0          0 100 3 57   269
0.0    + 0-.19081E 07          0          0          1         11 100 3 57   270
      11              2                                           100 3 57   271
.19272E 07 .00000E 00 .20000E 07 .60000E-01 .21000E 07 .10000E 00 100 3 57   272
.22000E 07 .13000E 00 .23000E 07 .15500E 00 .24000E 07 .16000E 00 100 3 57   273
.25000E 07 .16000E 00 .27000E 07 .15500E 00 .40000E 07 .80000E-01 100 3 57   274
.50000E 07 .20000E-01 .80000E 07 .00000E 00 .00000E 00 .00000E 00 100 3 57   275
                                                                  100 3  0   276
4.2100 + 4 .99046E 02          0          8          0          0 100 3 58   277
0.0    + 0-.21014E 07          0          0          1          9 100 3 58   278
       9              2                                           100 3 58   279
.21224E 07 .00000E 00 .22000E 0  .80000E-01 .23000E 07 .13000E 00 100 3 58   280
.24000E 07 .16000E 00 .25000E 0  .17000E 00 .27000E 07 .16500E 00 100 3 58   281
.40000E 07 .10000E 00 .60000E 07 .30000E-01 .80000E 07 .00000E 00 100 3 58   282
                                                                  100 3  0   283
4.2100 + 4 .99046E 02          0          9          0          0 100 3 59   284
0.0    + 0-.23400E 07          0          0          1         11 100 3 59   285
      11              2                                           100 3 59   286
.23634E 07 .00000E 00 .24000E 07 .40000E-01 .25000E 07 .80000E-01 100 3 59   287
.26000E 07 .12000E 00 .28000E 07 .15000E 00 .30000E 07 .16500E 00 100 3 59   288
.32000E 07 .16500E 00 .34000E 07 .16000E 00 .40000E 07 .15000E 00 100 3 59   289
.60000E 07 .40000E-01 .80000E 07 .00000E 00 .00000E 00 .00000E 00 100 3 59   290
                                                                  100 3  0   291
4.2100 + 4 .99046E 02          0         10          0          0 100 3 60   292
0.0    + 0-.25000E 07          0          0          1          9 100 3 60   293
       9              2                                           100 3 60   294
.25250E 07 .00000E 00 .26000E 07 .10000E 00 .28000E 07 .16000E 00 100 3 60   295
.30000E 07 .18000E 00 .32000E 07 .18500E 00 .34000E 07 .18000E 00 100 3 60   296
.40000E 07 .17000E 00 .60000E 07 .60000E-01 .80000E 07 .00000E 00 100 3 60   297
                                                                  100 3  0   298
4.2100 + 4 .99046E 02          0         11          0          0 100 3 61   299
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0.0      + 0-.28000E 07              0            0            1               8 100 3 61   300
        8          2                                                             100 3 61   301
.28280E 07 .00000E 00 .30000E 07 .17500E 00 .32000E 07 .22000E 00 100 3 61   302
.34000E 07 .23000E 00 .37000E 07 .23000E 00 .40000E 07 .22000E 00 100 3 61   303
.60000E 07 .90000E-01 .80000E 07 .00000E 00 .00000E 00 .00000E 00 100 3 61   304
                                                                                 100 3  0   305
.42100E 05 .99046E 02             0           99            0               0 100 3 91   306
.00000E 00-.24750E 07             0            0            1               5 100 3 91   307
        5          2                                                             100 3 91   308
.25000E 07 .00000E 00 .30000E 07 .15000E 00 .40000E 07 .80000E 00 100 3 91   309
.60000E 07 .15000E 01 .80000E 07 .20000E 01 .00000E 00 .00000E 00 100 3 91   310
                                                                                 100 3  0   311
                                                                                 100 0  0   312
.42100E 05 .99046E 02             0            1            0               0 100 4  2   313
.42100E 05 .99046E 02             0            1            0               0 100 4  2   313
.00000E 00 .00000E 00             0            0            1              27 100 4  2   314
       27          2                                                             100 4  2   315
.00000E 00 .10000E 06             0            0            4               0 100 4  2   316
.76633E-01 .66780E-01 .86486E-04 .75844E-04 .00000E 00 .00000E 00 100 4  2   317
.00000E 00 .20000E 06             0            0            4               0 100 4  2   318
.15573E 00 .88420E-01 .56286E-03 .33656E-03 .00000E 00 .00000E 00 100 4  2   319
.00000E 00 .30000E 06             0            0            4               0 100 4  2   320
.21773E 00 .10602E 00 .16986E-02 .84567E-03 .00000E 00 .00000E 00 100 4  2   321
.00000E 00 .40000E 06             0            0            4               0 100 4  2   322
.26410E 00 .12232E 00 .35600E-02 .16533E-02 .00000E 00 .00000E 00 100 4  2   323
.00000E 00 .50000E 06             0            0            4               0 100 4  2   324
.29630E 00 .13780E 00 .62786E-02 .28944E-02 .00000E 00 .00000E 00 100 4  2   325
.00000E 00 .60000E 06             0            0            4               0 100 4  2   326
.33933E 00 .15138E 00 .10186E-01 .33956E-02 .00000E 00 .00000E 00 100 4  2   327
.00000E 00 .80000E 06             0            0            4               0 100 4  2   328
.40833E 00 .18302E 00 .21543E-01 .76  0E-02 .00000E 00 .00000E 00 100 4  2   329
.00000E 00 .90000E 06             0            0            4               0 100 4  2   330
.42933E 00 .19876E 00 .28443E-01 .10866E-01 .00000E 00 .00000E 00 100 4  2   331
.00000E 00 .10000E 07             0            0            6               0 100 4  2   332
.44300E 00 .21360E 00 .35214E-01 .14100E-01 .82618E-03 .88923E-03 100 4  2   333
.00000E 00 .12000E 07             0            0            6               0 100 4  2   334
.47133E 00 .24280E 00 .51971E-01 .22756E-01 .20518E-02 .11569E-02 100 4  2   335
.00000E 00 .14000E 07             0            0            6               0 100 4  2   336
.48867E 00 .27060E 00 .69900E-01 .34289E-01 .41691E-02 .15277E-02 100 4  2   337
.00000E 00 .16000E 07             0            0            6               0 100 4  2   338
.50600E 00 .30320E 00 .96186E-01 .55000E-01 .14182E-01 .65023E-02 100 4  2   339
.00000E 00 .18000E 07             0            0            8               0 100 4  2   340
.51067E 00 .34940E 00 .12630E 00 .87567E-01 .17809E-01 .12915E-02 100 4  2   341
.19867E-02-.12194E-02 .00000E 00 .00000E 00 .00000E 00 .00000E 00 100 4  2   342
.00000E 00 .20000E 07             0            0            8               0 100 4  2   343
.52633E 00 .34740E 00 .12863E 00 .85744E-01 .20000E-01 .56592E-02 100 4  2   344
.27967E-03 .26029E-04 .00000E 00 .00000E 00 .00000E 00 .00000E 00 100 4  2   345
.00000E 00 .22000E 07             0            0            8               0 100 4  2   346
.52467E 00 .36020E 00 .14771E 00 .10813E 00 .27373E-01 .79692E-02 100 4  2   347
.12793E-02 .38159E-04 .00000E 00 .00000E 00 .00000E 00 .00000E 00 100 4  2   348
.00000E 00 .24000E 07             0            0            8               0 100 4  2   349
.54867E 00 .39300E 00 .17371E 00 .13067E 00 .42136E-01 .12615E-01 100 4  2   350
.90400E-03 .13294E-03 .00000E 00 .00000E 00 .00000E 00 .00000E 00 100 4  2   351
.00000E 00 .26000E 07             0            0            8               0 100 4  2   352
.55800E 00 .41000E 00 .19300E 00 .15422E 00 .56909E-01 .17762E-01 100 4  2   353
.13993E-02 .19388E-03 .00000E 00 .00000E 00 .00000E 00 .00000E 00 100 4  2   354
.00000E 00 .28000E 07             0            0            8               0 100 4  2   355
.55533E 00 .41600E 00 .20300E 00 .17722E 00 .73818E-01 .24346E-01 100 4  2   356
.20480E-02 .34282E-03 .00000E 00 .00000E 00 .00000E 00 .00000E 00 100 4  2   357
.00000E 00 .30000E 07             0            0            8               0 100 4  2   358
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.58833E 00	.44300E 00	.23857E 00	.19989E 00	.93273E-01	.31531E-01	100	4	2	359
.33640E-02	.59118E-03	.00000E 00	.00000E 00	.00000E 00	.00000E 00	100	4	2	360
.00000E 00	.32000E 07	0	0	8	0	100	4	2	361
.58467E 00	.44220E 00	.24686E 00	.22100E 00	.11400E 00	.40777E-01	100	4	2	362
.45567E-02	.87882E-03	.00000E 00	.00000E 00	.00000E 00	.00000E 00	100	4	2	363
.00000E 00	.34000E 07	0	0	8	0	100	4	2	364
.59967E 00	.45480E 00	.27114E 00	.23944E 00	.13382E 00	.49623E-01	100	4	2	365
.67933E-02	.14435E-02	.00000E 00	.00000E 00	.00000E 00	.00000E 00	100	4	2	366
.00000E 00	.36000E 07	0	0	8	0	100	4	2	367
.60567E 00	.45860E 00	.28629E 00	.25578E 00	.15409E 00	.59846E-01	100	4	2	368
.92200E-02	.20812E-02	.00000E 00	.00000E 00	.00000E 00	.00000E 00	100	4	2	369
.00000E 00	.38000E 07	0	0	8	0	100	4	2	370
.61133E 00	.46120E 00	.30129E 00	.27100E 00	.17436E 00	.70800E-01	100	4	2	371
.12253E-01	.28865E-02	.00000E 00	.00000E 00	.00000E 00	.00000E 00	100	4	2	372
.00000E 00	.40000E 07	0	0	8	0	100	4	2	373
.63100E 00	.48220E 00	.32886E 00	.28233E 00	.18809E 00	.79769E-01	100	4	2	374
.17153E-01	.42912E-02	.00000E 00	.00000E 00	.00000E 00	.00000E 00	100	4	2	375
.00000E 00	.50000E 07	0	0	8	0	100	4	2	376
.58567E 00	.43220E 00	.33900E 00	.31233E 00	.25427E 00	.13262E 00	100	4	2	377
.43567E-01	.15718E-01	.00000E 00	.00000E 00	.00000E 00	.00000E 00	100	4	2	378
.00000E 00	.60000E 07	0	0	10	0	100	4	2	379
.65467E 00	.49680E 00	.39400E 00	.34389E 00	.29245E 00	.18262E 00	100	4	2	380
.75533E-01	.28500E-01	.89421E-02	.14848E-02	.00000E 00	.00000E 00	100	4	2	381
.00000E 00	.80000E 07	0	0	10	0	100	4	2	382
.78000E 00	.63680E 00	.51086E 00	.42800E 00	.35118E 00	.26192E 00	100	4	2	383
.15580E 00	.78000E-01	.36232E-01	.11562E-01	.00000E 00	.00000E 00	100	4	2	384
						100	4	0	385
						100	0	0	386
						100	0	0	387