HIGH ENERGY *K* CONVERSION COEFFICIENTS

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High energy *K* conversion coefficients are calculated using relativistic Hartree-Fock-Slater wave functions. We show that above about 1.5 MeV there is serious disagreement between the theoretical and recent experimental results.

Smither et al. [1,2] have recently measured internal conversion coefficients in the heretofore neglected region of 1-9 MeV. In general, their work indicates the likelihood that there is a marked difference between predictions from theory and experiment in this energy domain. The purpose of this calculation is to present internal conversion coefficient values, calculated as accurately as possible within the framework of existing theory, for $Z = 48$, multipolarities E1, M1 and M2 and for gammay-ray transition energies from 1-17 MeV (existing tabulations [3-5] do not go beyond 2.5 MeV).

Our calculation of internal conversion coefficients is based on the use of relativistic Hartree-Fock-Slater wave functions* for both the bound and continuum state electrons. We included finite nuclear size effects and used the no-penetration model [3] as well as experimental electron binding energies [7]. We have used a ninth-order Adams-Moulton method to integrate the Dirac equation for both the bound and continuum wave functions. The radial integrals were evaluated by use of an 11th order closed-type Newton-Cotes formula [8].

Our results are presented in fig. 1 and we have also reproduced the experimental curves [1]. We see that there is considerable disagreement between theory and experiment, particularly for higher energies. Our low-energy results (up to 2.5 MeV) are in excellent agreement with other theoretical results [7,8]. Note that the theoretical internal conversion coefficient results can *not* be represented by a curve of the form $\omega^{-\alpha}$ (ω is the transition energy and α is some positive constant) in contrast to the experimental data [1,2].

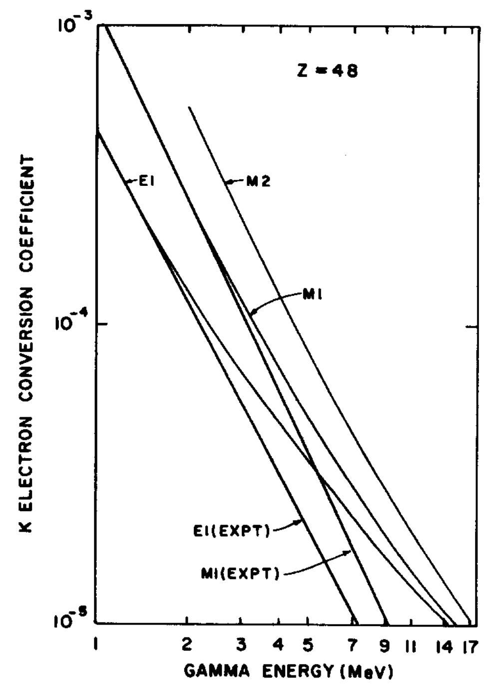

Fig. 1. Theoretical values for *K* conversion coefficients for $Z = 48$, gamma-ray transition energies 1-17 MeV and multipolarities E1, M1 and M2. The experimental results [1,2] are also indicated.

In summary, we have calculated internal conversion coefficients from 1 MeV to 17 MeV and

* The improved version due to Kohn and Sham [6] was used instead of the original Slater prescription.

shown that there is serious disagreement between theory and experiment. As a final remark, we strongly urge experimentalists to acquire more data in this potentially rich high-energy domain.

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PRESSURE SHIFT OF THE HYDROGEN HYPERFINE FREQUENCY BY KRYPTON AND XENON *

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Hyperfine pressure shifts for hydrogen atoms in krypton and xenon were measured by optical pumping. Expressed as fractions of the hyperfine frequency, the shifts are $(-10.4 \pm 0.2) \times 10^{-9}$/Torr(0°C) and $(-20 \pm 2) \times 10^{-9}$/Torr(0°C). *These shifts are not consistent with theory.*

The hyperfine pressure shifts for hydrogen atoms in krypton and xenon, where long range forces between atoms should account for nearly all of the shift [1-3], have not been measured previously because of the relatively short spin disorientation times in those gases. In our experiment, as in Pipkin's experiments [4], hydrogen atoms are polarized and detected by spin-exchange collisons with optically pumped Rb atoms in a closed pyrex absorption cell containing a fixed and accurately measured density of buffer gas. Our technique differs from previous measurements mainly in the homogeneity of the earth's magnetic field available in our magnetically "clean" laboratory and in the means of dissociation of molecular hydrogen.

Table 1

Inert gas	Density Torr (0°C)	Fractional shift $\times 10^9$ Torr (0°C)
Krypton	225.51	-10.26 ± 0.2
Krypton	138.00	-10.44 ± 0.03
Krypton	46.19	-10.38 ± 0.1
Xenon	13.87	-19.0 ± 1.2
Xenon	8.95	-21.8 ± 2.4
Xenon	4.88	-19.9 ± 1.2

Since only 10^{-6} Torr or less of atomic hydrogen is required in the sample, the surface of a tungsten wire 0.05 mm in diameter and 1 cm long at 1600°K (formed into a quadrupolar array to cancel the field of the r.f. heating current to first order [5]) produces enough atoms for our experiment. At low buffer gas pressures, the best evidence of satisfactory hydrogen density is the disorienting effect of H-Rb spin-exchange collisions on Rb magnetic resonance signals. At high pres-

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