DOUBLE INTERNAL BREMSSTRAHLUNG IN THE DECAY OF ^{37}Ar

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This work reports the first experimental evidence of double internal bremsstrahlung (DIB) in an electron capture process. The measurement was performed using a radioactive gaseous 0.7 mCi ^{37}Ar source. This source has a convenient half-life (35 days), a high transition energy (810 keV) and no gamma-rays. No experimental complications due to the external bremsstrahlung are expected.

Two 5 cm × 5 cm NaI(Tl) crystals were shielded with lead and placed in the position that photons emitted from the source at a mean angle of 90^0 could be detected. A conventional fast-slow coincidence circuit was used to define coincidences between the two detectors. Pulses from the two detectors were recorded in a PDP-9 computer using a 64×64 dual parameter pulse height analysis program.

The possibility of Compton scattering between the two detectors was checked by blocking the entrance of one of the detectors by a tungsten plug. Cosmic and room background was also measured by removing the ^{37}Ar source. Random coincidence counting rate was measured by inserting a proper delay-line in the sistem.

After all necessary subtractions the final energy distribution of DIB is obtained. Data were summed along constant energy diagonals and the results are shown in Fig. 1, were W_{DIB} represents the probability for the DIB process and W_{IB} the probability for the single internal bremsstrahlung process. When a summation is made over the measured energy range from 210 keV to 810 keV the value of $(4.8\pm0.4)\times10^{-5}$ for the ratio $W_{DIB}(90^0)/W_{IB}$ is obtained.

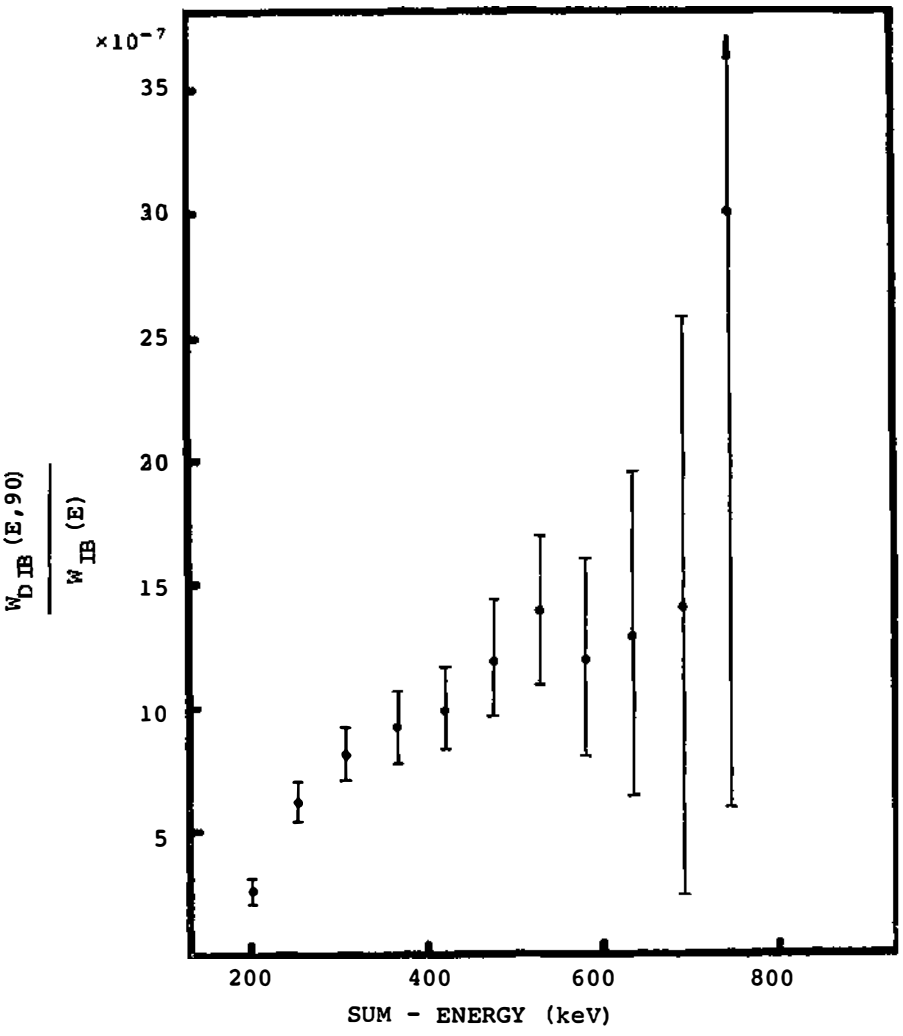

Fig. 1

The variation of the ratio $W_{DIB}(90)/W_{IB}$ with the value of the sum photon energy E.