and M is the mass of the lump in grams. The constants A and μ depend on the total scattering cross sections associated with each uranium atom. They are, therefore, different for uranium metal or oxide lumps. In fact, A is proportional to the 0.415 power of the scattering cross section associated with each uranium atom up to the scattering cross section of 1000 barns. For uranium metal, $A = 9.25$ barns and $\mu = 2.67$ gm/cm^2. For U_3O_8, $\mu = 1.67$ gm/cm^2. The limiting value of the integral at great dilution is 240 barns.

The approximate temperature dependence of the integral is given by

$$\int \sigma_c(E)\, dE/E = A\ [1 + \alpha T + \mu\ (S/M)]$$

where $\alpha \simeq 10^{-4}$ per centigrade degree, the temperature T is in degrees centigrade and A and μ are as given above.

The logarithmic width of the resonance energy band $\log_e (E_0/E_1)$ is about 5.6 for uranium metal and 7.3 for U_3O_8 or UO_2.

The inverse diffusion length K_0 for resonance neutrons in uranium metal of density ρ gms per cm^3 is

$$K_0 = 0.022\ \rho\text{cm}^{-1}.$$

5. Plutonium Cross Sections

Average values for the fission and capture cross sections of plutonium-239 for an approximately Maxwellian neutron spectrum with a most probable neutron velocity of 2200 meters per second are 664 barns and 361 barns, respectively. Neutrons per thermal neutron fission of $Pu^{239} = 3.0 \pm 0.1$.

6. Thermal neutron absorption cross section of $Xe^{135} = 3.5 \times 10^6$ barns.

Isotron Declassified

Isotope Separator Data Declassified by AEC

Details of experimental and theoretical work with the isotron isotope separator, developed at Princeton University during the early intensive search for a feasible electromagnetic method for separating uranium-235 from uranium-238, have also been declassified by the Atomic Energy Commission. Preliminary work with an experimental model of the isotron in 1942 indicated that the isotopes of lithium could be separated by the method, and it was later demonstrated that partially separated uranium isotopes could be collected. Further work with the isotron was abandoned early in the following year in view of the development of other and more promising isotope separation methods. While more recent investigations have apparently confirmed the wisdom of that decision, the AEC has nevertheless stated that the method may prove valuable in other types of nuclear physics research and has therefore released various early reports on the isotron project.

The isotron, essentially an electromagnetic mass separator which uses an extended source of ions rather than the slit source of the mass spectrograph, was developed as a result of suggestions advanced by R. R. Wilson, now of Cornell University. A constant electric field of high intensity is employed to accelerate ions down a tube with uniform kinetic energy until they are further accelerated by a low intensity field varying at radio frequency. The resulting periodic variation in velocity has the effect of bunching ions at a certain distance down the tube. Groups of ions of different mass travel with different velocity, and the isotopic separation process is accomplished by means of an analyser which focuses the desired beam of ions on a collector.

Usefulness of the isotron is not limited to the separation of isotopes, the AEC points out, for the instrument may also be employed as a mass spectrometer to measure the masses of ions, using the time of flight principle.

Cosmic-Ray Altimeter

Developed at Johns Hopkins

Aircraft altimeters operating on barometric principles provide relatively precise measurements of altitude for normal flying conditions and have long proved satisfactory. At altitudes of more than three miles, however, the atmospheric pressure drops to a low and nearly constant level, and in this region and above the barometric types are unreliable. A new type of altimeter employing two sets of Geiger-Müller tubes has recently been developed to determine altitudes higher than three miles by cosmic-ray count and, according to information from the Applied Physics Laboratory at Johns Hopkins University, where the instrument was developed, the cosmic-ray altimeter is estimated to be accurate to within one part in one hundred and sixty at an altitude of thirty miles above the earth. As an aircraft climbs into higher altitudes the intensity of the cosmic radiation increases at a known rate. The rays register upon the altimeter by penetrating its first row of Geiger-Müller tubes, passing through a lead shield, then contacting the second layer of tubes. The altimeter is sensitive to the rays only when both sets of tubes are activated; then the impulse is passed through an electric circuit to a voltmeter which records them. If the cosmic-ray pulse is not sufficiently strong to penetrate the lead shield, the voltmeter will not count it. This automatically eliminates the low intensity cosmic rays which are not as reliable as the stronger particles. Unlike the barometric types, the cosmic-ray altimeter obviates the need for constant calibration. It is always ready for operation, no matter what the altitude of the airfield. Barometric altimeters, on the other hand, must be adjusted according to the altitude of the take-off field.

The altimeter, developed at the Applied Physics Laboratory and tested by high-flying aircraft, has recently been patented by John W. B. Barghausen, electronics engineer in the APL Research Center, and James A. Van Allen, who prior to 1950 was in charge of high-altitude research at Johns Hopkins. Dr. Van Allen is at present chairman of the physics department of the State University of Iowa.