$$\langle i \mid U_1(\infty) \mid f\rangle \approx -\frac{i}{\hbar}\int d^3r' V_1(\vec{r}')\int_0^\infty dt \exp\left[-i(\hbar\lambda_K - E_i)\,t/\hbar\right. \cdot$$

$$\cdot \langle i \mid \Phi_K\rangle\langle\Phi_K \mid \varrho(\vec{r}-\vec{r}', 0) \mid f\rangle \sim \frac{\text{const}}{\hbar\lambda_K - E_i} \qquad (13)$$

is the usual Breit-Wigner expression[4,5,6].

The used number density function in (13) has been obtained by solving the Louville type equation

$$\frac{\partial\varrho}{\partial t} = \frac{i}{\hbar}\left[\varrho, H_0\right] = -iL\varrho,$$

where $\hbar\lambda_K = E_0 - i\Gamma/2$ and Φ_K are the eigenvalue and eigenfunction of the non-hermitian operator L.

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2.5. Gamma-ray planar Si(Li) polarimeter

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Linear polarization is defined by the ratio

$$P = \frac{N_1 - N_2}{N_1 + N_2},$$

where N_1 and N_2 are the numbers of photons polarized in two mutually perpendicular directions.

Following the measurements of Honzatko and Kajfosz[1] and of Ewan et al.[2], a planar Si(Li) detector was applied as a polarimeter and its sensitivity determined. The beam of linearly polarized gamma rays was achieved by Compton scattering of 122 keV gamma rays from a 2 mCi source of ^{57}Co in graphite at 90°. Linearly polarized gamma rays undergo a second Compton scattering in the detector, preferentially in the plane perpendicular to the direction of polarization[3]. The number of pulses in the total energy peak for the two orientations of the detector (parallel and perpendicular to the polarization plane) were determined. From these results an asymmetry ratio $A = (3.0 \pm 0.6)\%$ was obtained[4].

A systematic investigation of planar Si(Li) polarization analyzers of different geometry and dimensions has been undertaken, and a new apparatus was built (Fig.) to improve the method of measurement. In this system the positioning of the detector and the scatterer on the axis of rotation can be accomplished to a better accuracy. A further improvement is the measurement of the number of pulses in four positions (two and two opposite positions for »parallel« and »perpendicular« measurement), which is expected to yield a practical elimination of systematic

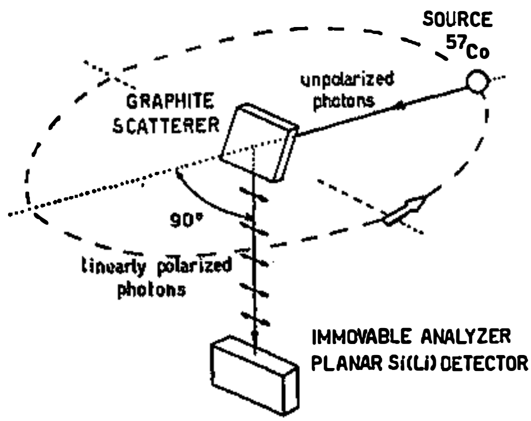

Fig. Schematic illustration of the polarimeter.

errors. The number of counts in the detector N, due to the variation of the scattering cross section in the graphite scatterer, is a function of the deviation x of the detector from the symmetry axis. The sum of numbers of counts in two opposite positions will be

$$N(x_1) + N(-x_1) = N(0) + N(0) + x_1 \frac{dN}{dx} - x_1 \frac{dN}{dx} + \frac{1}{2} x_1^2 \frac{d^2N}{dx^2} + \\ + \frac{1}{2} x_1^2 \frac{d^2N}{dx^2} + \dots .$$

The linear terms practically cancel and the quadratic and higher order terms are negligible.

In the new arrangement it is also easy to check whether the detector or the scatterer are in the proper position by comparing the number of pulses in the opposite positions. From this asymmetry one may draw conclusions about the eccentricity and the necessary correction of the position.

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