account the branch cuts and other Regge trajectories.

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3) We note that the central constant g in Fig. 1 characterizes (for $(1/\sigma)(d\sigma/dy)$) precisely the density of the produced particles with respect to rapidity.

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STRUCTURE OF THE GIANT DIPOLE RESONANCE OF THE NUCLEI Er^{166} and Hf^{178}

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We measured the cross sections σ_γ for the absorption of γ quanta by the nuclei Er^{166} and Hf^{178}. These cross sections have an intermediate structure that can be interpreted in the spirit of the dynamic collective model of giant resonance.

The belatron of our Institute was used to measure the photoneutron yield curves for Er^{166} and Hf^{178}. The measurements were made by a method of automatic scanning [1] with respect to the energies E_0 of the accelerated electrons from the threshold of the (γ, n) reaction to 20 – 21 MeV. For each element we obtained two independent yield curves in steps $\Delta E_0 = 0.2$ MeV, shifted 0.1 MeV relative to each other. The statistical accuracy of the measurement was better than 0.1% at $E_0 \sim 20$ MeV. The photoneutrons were registered with a spherical detector with BF$_3$ counters [1]. The cross sections $\sigma(\gamma, Tn)$ for photoneutron production we calculated from the yield curves by the Penfold-Leiss method (with intervals $\Delta E = 0.2$ MeV) and were subsequently reduced by the method of [2], which suppresses the false fluctuation structure. This procedure ensures an energy resolution ~ 0.6 MeV. The absolute normalization of the cross section was carried out by comparing the photoneutron yields from the investigated samples and deuterium. To determine the multiplicity of the photoneutron emission, the yields of the reactions (γ, n) and $(\gamma, 2n)$ were separated by a statistical method [3, 4]. In these measurements we used a specialized computer [4] operating on line with the experimental apparatus, and a scintillation neutron detector [5] with efficiency $\sim 40\%$. The measured cross sections $\sigma(\gamma, 2n)$ do not contradicy the statistical theory of neutron emission. The level-density parameter a was found to equal 6.1 ± 2.5 MeV^{-1} and 17.7 ± 7.3 MeV^{-1} for Er^{166} and Hf^{178}, respectively. These values of a were used to calculate the total γ-quantum absorption cross sections σ_γ from $\sigma(\gamma, Tn)$ by means of the statistical-theory formulas. The cross sections σ_γ are shown in Figs. 1 and 2. For Er^{166} we determined σ_γ also from the cross section $\sigma(\gamma, Tn)$ calculated by the regularization method [6, 7]. The resultant

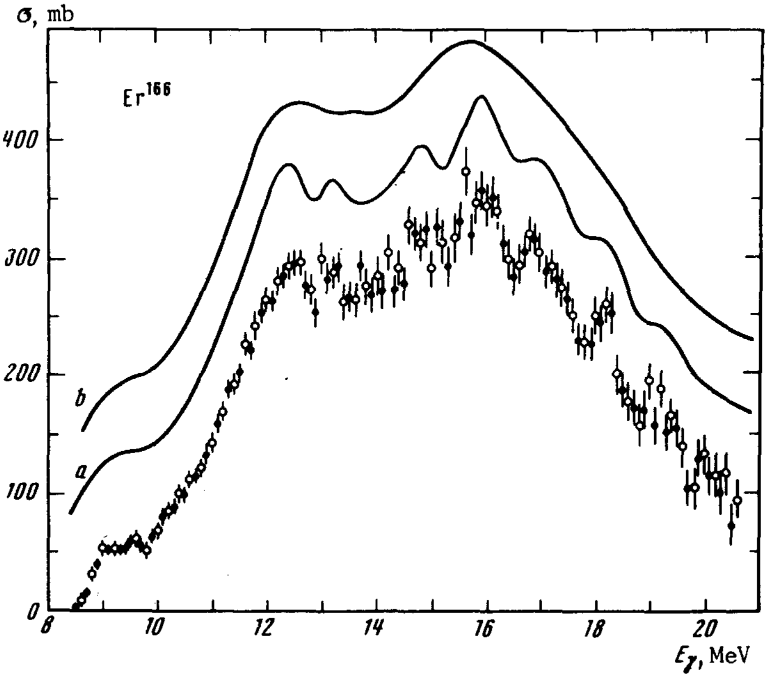

Fig. 1. Cross section σ_γ of Er^{166}; the light and dark circles correspond to two independent series of experimental data. Curves a and b were obtained by the regularization method (see the text) and are shown shifted relative to the ordinate axis.

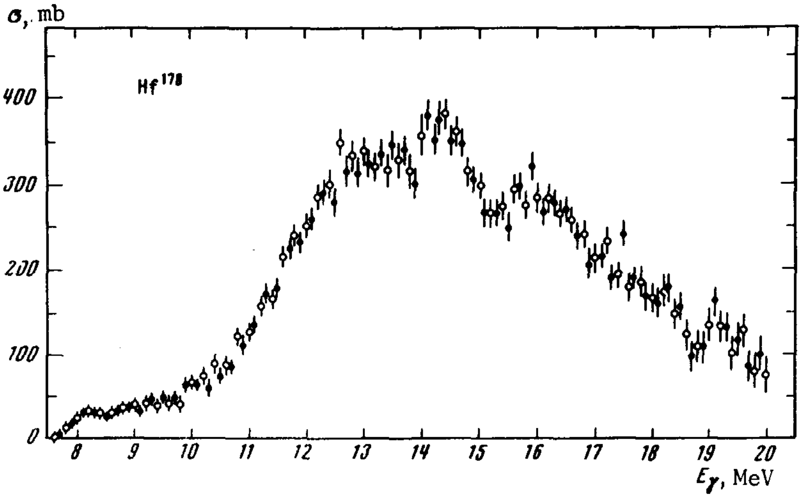

Fig. 2. Cross section σ_γ of Hf^{178}.

curves a and b, which correspond to the total volume of the experimental information and to half this volume, are shown in Fig. 1. As seen from the figure, the "resolution" of the experiment is critically sensitive to the statistical accuracy.

The cross sections σ_γ of the investigated even-even nuclei show an intermediate structure, which appears in both independent experimental series. This structure correlates with the predictions of the calculations [8 - 10] performed within the framework of the collective dynamic model of giant resonance. It is interesting to note that the widths of the experimental peaks, which can be interpreted as satellites of the main dipole resonances, are appreciably lower than the widths of these resonances. Thus, in the case of Hf^{178}, the width of the vibrational satellite at an excitation energy 14.3 MeV does not exceed 1.2 MeV.

An approximation of the cross sections σ_γ by means of two Lorentz lines shows that the gross structure of σ_γ of Er^{166} cannot be described by the Danos-Okamoto model. In addition to the effects of interaction of dipole and quadrupole oscillations, this may be due to the fact that Er^{166} is statically non-axial. Approximation of σ_γ by three (lorentzian) resonances of equal dipole strength yields for Er^{166} a non-axiality parameter $\gamma = 20 \pm 3°$.

Nucleus	σ_{int}, MeV-b	β	Q_0, b
Er^{166}	3.05 ± 0.3	0.33	7.76
Hf^{178}	3.16 ± 0.3	0.26	6.72

The table lists the values of the integral cross sections σ_{int} calculated from σ_γ and the deformation parameters β, as well as the values Q_0 of the intrinsic quadrupole moments of the nuclei, corresponding to the obtained values of β.

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RADIATIVE DECAY OF Σ^+ HYPERON

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A low-energy theorem connecting the weak processes $\Sigma^+ \to p\gamma$ and $\Sigma^+ \to p\pi^0\gamma$ is derived by using the PCAC hypotehsis in standard fashion. Using this theorem, the amplitudes of the first transition are expressed in terms of the S-wave of the nonleptonic decay $\Sigma^+ \to p\pi^0$. The probability and asymmetry parameter of the $\Sigma^+ \to p\gamma$ decay are obtained. The results agree well with the experimental data. The difference between the presented analysis and the analogous approach in [2] is also explained.

In the present aritcle, using the PCAC hypothesis in the standard manner (see, e.g., [1]), we establish a low-energy theorem that connects the two decays $\Sigma^+ \to p\gamma$ and $\Sigma^+ \to p\pi^0\gamma$. This theorem allows us to express the amplitudes of the $\Sigma^+ \to p\gamma$ transition in terms of the amplitude of the S-wave of the $\Sigma^+ \to p\pi^0$ decay. The first approach of this type to radiative hyperon decay was used in [2]. However, the theoretical probability value obtained there for the only decay measured to date, $\Sigma^+ \to p\gamma$, turned out to be half the presently known experimental value. This discrepancy is due to the fact that the diagrams shown in Fig. 3 were not considered in [2][1]. Allowance for these diagrams leads to results that agree well with experiment.

The Lorentz and gauge invariance of the amplitude of the $\Sigma^+ \to p\gamma$ decay lead to the general expression

$$M_{\Sigma^+ \to p\gamma} = < p\gamma | H_w | \Sigma^+ > = e\bar{U}_p (a + b\gamma_5)\, \gamma_\mu \gamma_\nu k_\mu \epsilon_\nu U_\Sigma \, . \tag{1}$$

We represent the parity-conserving part a of the transition in the form of a sum of a pole term which turns out to be determined by the diagram of Fig. 2 (see formulas (7a) and (6), and a contact part $\tilde{a}$:

$$a = a_{\text{pol}} + \tilde{a}.$$