the gaseous ammonia in the molecular beam source; the measurement setup was the same as employed by us earlier [5] in the investigation of the characteristics of ordinary masers. A complicated dependence of the radiation power in the second cavity on these parameters was observed. The power W_2 radiated in the second cavity goes through three minima as the frequency ν_1 of the first cavity is varied over a wide range, and the character of its variation depends on the voltage V on the sorting system and on the pressure p in the molecular beam source. These variations are plotted in Figs. 1 and 2. The value $V = V_k$ at which the radiation power in the second cavity drops to zero, $W_2 = W_2(V)_p = 0$, depends on the pressure of the ammonia in the beam source. This dependence is shown in Fig. 3.

When $W_2 = 0$, the molecule beam no longer radiates as it goes through the third cavity, and the radio spectroscope shows a strong absorption line.

It is quite interesting that at certain values of V and p the beam leaving the first cavity also absorbs energy even in the second cavity. In this case, as the beam travels along the cavity in the usual generation mode, the population of the energy levels is a periodic function of the time and depends on the number of active molecules in the beam.

As the first cavity is detuned by an amount $\Delta\nu_1 = \pm 4$ Mc, when the microwave field in the cavity decreases, beats are observed in the second cavity between the frequency set in the "molecular bell" by the first cavity and the natural frequency of the second cavity. The frequency of these beats is 3—4 kcs. Further detuning of the first cavity stops generation in the first cavity and the "molecular bell" disappears from the second cavity, leaving only the natural oscillations. More complete experimental and theoretical results will be published in the future.

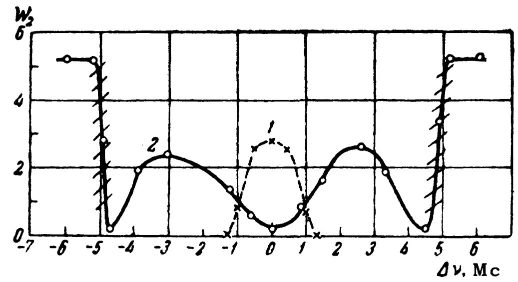

FIG. 1. Dependence of the radiation power W_2 in the second cavity as the detuning $\Delta\nu_1 = \nu_1 - \nu_{21}$ of the first cavity is varied, for two values of the sorting-system voltage: 1 – V = 4.5 kV, 2 – V = 8 kV.

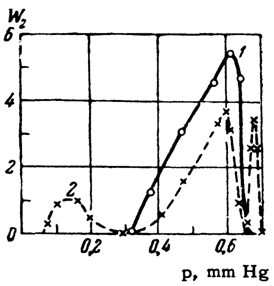

FIG. 2. Dependence of the power W_2 radiated in the second cavity on the voltage V on the sorting system and on the ammonia pressure p in the beam source: curve 1 – V = 4.5 kV, 2 – V = 8 kV

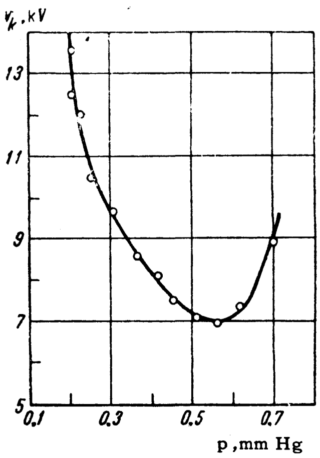

FIG. 3. Dependence of the voltage V_k, at which $W_2 = W_2(V) = 0$, on the pressure p in the molecular-beam source.

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CROSS SECTION FOR THE INTERACTION BETWEEN NEUTRONS AND NUCLEI AT 8.3 BeV

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Submitted to JETP editor January 11, 1962

J. Exptl. Theoret. Phys. (U.S.S.R.) **42**, 909-910 (March, 1962)

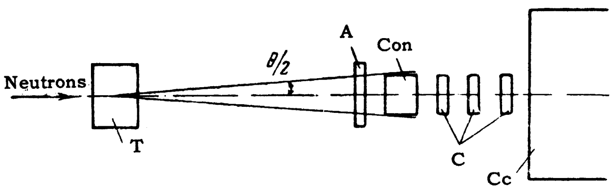
THE total and inelastic cross sections for the interaction between neutrons of effective energy 8.3 BeV and nuclei of C, Al, Cu, Sn, and Pb were

Table I. Cross sections (mb) for neutron-nucleus interaction as a function of the angle

θ, deg	Pb	Sn	Cu	Al	C
0.111	2257 ± 156				
0.164	2581 ± 126				307 ± 13
0.228	2556 ± 100	1805 ± 57	1217 ± 48	600 ± 23	345 ± 15
0.34	2142 ± 50				
0.5	1919 ± 46				
0.57	1757 ± 43				280 ± 8
1.0					238 ± 4
2.0	1766 ± 125				218 ± 8
3.0	1636 ± 81		626 ± 29		
5.0	1713 ± 66	1218 ± 50		380 ± 13	

Table II. Energy dependence of the total and inelastic cross sections (mb) for the interaction between neutrons and nuclei

Energy BeV	σ_a	σ_t	σ_a	σ_t	σ_a	σ_t
	Pb		Sn		Cu	
1.4	1727 ± 45	3209 ± 55	1158 ± 63	2202 ± 62	674 ± 34	1388 ± 39
4.5	1660 ± 90	2320 ± 130			638 ± 24	1088 ± 22
8.3	1713 ± 66	2556 ± 100	1218 ± 50	1805 ± 57	626 ± 29	1217 ± 48
	Al		C			
1.4	414 ± 23	703 ± 18	201 ± 13	378 ± 10		
4.5			218 ± 8	354 ± 11		
8.3	380 ± 13	600 ± 23	218 ± 8	345 ± 15		



Geometry of the experiment: T – target, A – anticoincidence counter, Con – aluminium converter, C – scintillation counters, Cc – Cerenkov counter.

measured in the proton synchrotron of the Joint Institute for Nuclear Research by knocking the particles out of the beam.

The measurements were carried under conditions of "good" and "poor" geometry,[1] by measuring the distances between the target specimens and the detector. For the C and Pb nuclei, the cross sections were also measured at intermediate values of the angle θ (see Fig. 1). To reduce the effect of the fluctuations in the apparatus, the measurements were made alternately with and without the target. The positions "with target" and "without target" were automatically alternated every 10–12 cycles of accelerator operation. The carbon, copper, and lead targets were 20.33, 53.47, and 60.50 g/cm^2 thick, respectively. The results are listed in Table I. Comparison of the cross sections at 8.3 BeV effective energy with the corresponding cross sections at other energies[2-4] (see Table II) shows that the cross sections for the inelastic interaction between the neutrons and the nuclei are constant over a wide energy range. At the same time, a certain decrease in the cross section with increasing energy is observed, owing to the reduction in the diffraction scattering.

A theoretical analysis of the experimental results will be given in a separate paper.

The authors are grateful to V. I. Veksler for interest in the work and to I. V. Chuvilo for collaboration and useful discussions. We are also grateful to L. P. Zinov'eva and to the entire proton synchrotron crew for stable operation of the accelerator during the entire experiment.

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