refractive index varies rapidly and in an irregular fashion about a mean value. A typical record of these fluctuations, obtained with one cavity open to the atmosphere and the other closed, is shown in Fig. 1b.[2] For comparison, Fig. 1a shows a record of the

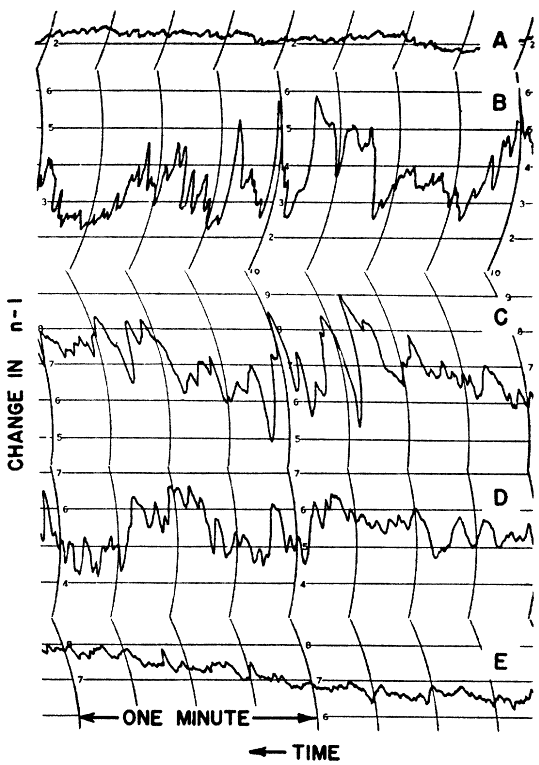


FIG. 1. The measurement of fluctuations in atmospheric refractive index with two cavity resonators: (a) both closed; (b) one open, the other closed; (c) both open, separated 1.8 m; (d) both open, separated 0.61 m; (e) both open, separated 7.6 cm. (Data taken on November 7, 1950; average wind speed was roughly 0.5 m/sec.)

stability of the instrument when both cavities were closed. In Fig. 1, ten small divisions are equal to nearly 0.8×10^{-6} in $n-1$.

Starting with an empirical expression for the radio (or microwave) refractive index of moist air,[3] and inserting mean values of temperature ($T=19.2°C$), water vapor pressure ($e=7.4$ millibars), and total pressure ($p=1011$ millibars) appropriate for the data of Fig. 1, the change in index Δn is found to be

$$10^6\Delta n=-1.1\Delta T+4.4\Delta e+0.27\Delta p. \quad (1)$$

The Δp term is unimportant, since fluctuations in pressure[4] are too small to have any significant effect on Δn. Thus, a simultaneous measurement of Δn and ΔT could determine Δe. It is sufficient to note here that an examination of a few records of simultaneous temperature and refractive index fluctuations did not reveal, in general, any marked correlation between these factors.

Some indication of a size for the random refractive index inhomogeneities[5] was obtained by observing the instantaneous difference in refractive index between two open cavities as their distance of separation was varied. Typical of several trials are the records shown in Fig. 1. When the cavity separation was less than 10 cm, fluctuations at one cavity were closely correlated with fluctuations at the other (Fig. 1e). For larger separations, the correlation began to disappear, as suggested by Figs. 1c and 1d.

To obtain a quantitative estimate of inhomogeneity size, a correlation coefficient ρ is defined as the correlation between simultaneous values of Δn and $\Delta n'$ distant x apart, thus

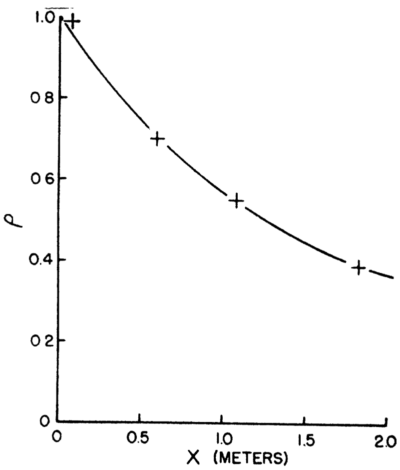
$$\rho=\langle(\Delta n)(\Delta n')\rangle_{\text{Av}}[\langle(\Delta n)^2\rangle_{\text{Av}}\langle(\Delta n')^2\rangle_{\text{Av}}]^{-\frac{1}{2}}. \quad (2)$$

If the inhomogeneities are isotropic, ρ may be regarded as independent of direction, and a measure of average size may be defined by[6]

$$L=\int_0^\infty \rho dx. \quad (3)$$

In the present instance, the quantities on the right side of Eq. (2) were determined from a periodic sampling of the recorded data, part of which are shown in Fig. 1. All the records were obtained within 50 minutes, during which time the weather remained practically unchanged. Figure 2 shows ρ fitted by the equation

FIG. 2. Correlation coefficient, ρ, of refractive index fluctuation as a function of distance, x.



$\rho=\exp(-x/1.9)$; inserting this in Eq. (3) gives a size of 1.9 m. The root-mean-square deviation of refractive index $\langle(\Delta n)^2\rangle_{\text{Av}}^{\frac{1}{2}}$ was nearly 0.3×10^{-6}. These results apply, of course, for a particular site and state of the atmosphere. Further investigations along these lines are now in progress.

The author wishes to thank Mr. S. J. Kryder and Mr. R. R. Larson for assistance with the experiments.

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On the Decay of $Xe^{125}\rightarrow I^{125}\rightarrow Te^{125}$

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RECENTLY, Anderson and Pool[1] reported a new isotope, Xe^{125}, with the half-life of 20 hr, produced in a $Te(\alpha, n)$ reaction. K x-rays of I and a weak γ-ray of the energy $\sim$0.6 Mev were reported.

We have produced Xe^{125} by neutron irradiation of Xe in the Harwell pile. After electromagnetic separation, a gas activity of the half-life 18±0.5 hr appeared on the collector foil (0.15 mg Al/cm^2) at mass number 125, confirming the existence of Xe^{125}. All odd mass numbers between 135 and 125 showed activities strong enough for β-spectrometer investigations. The activities at the mass numbers 133, 131, 129 (a new 9-day isomer, $E_\gamma=195$

kev), and 127 were investigated in a sample from an earlier irradiation.[2]

Figure 1 shows the β-spectrum of Xe^{125}. In Table I we have summarized the results obtained with the β-spectrometer and the NaI scintillation spectrometer. As can be seen from Fig. 1, the first K conversion line K_1 is overlapped by the Auger-line (A_1 in Fig. 1) $K-2L$. Knowing the intensity ratio $NA_1/NA_2=2$ from measurements on Xe^{131m}, it has been possible to give the intensity of the K_1 line in Table I. In Fig. 1 the half-width of the K_2+K_3 line shows that it is double. A separate investigation, not shown in the figure, indicates two conversion lines of the energies given in Table I. Because of intensity reasons it was not possible to get accurate information of these two lines.

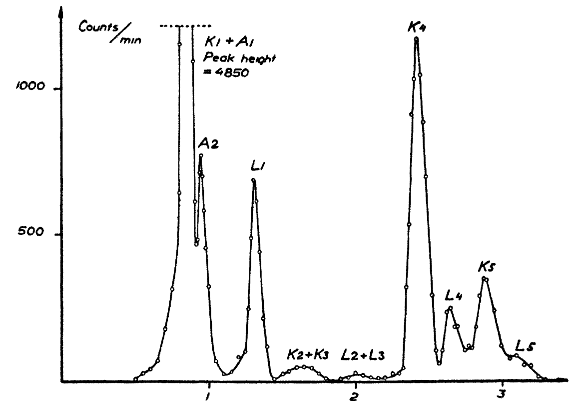

FIG. 1. β-spectrum of Xe^{125}.

It should be noticed that the 54-kev and the 187-kev γ-rays sum up to give the same energy as the 243-kev γ-ray. From intensity considerations it is also probable that the 54- and 187-kev γ-rays are emitted in cascade. Within the limits of error, the sum of the energies of the 96-, 106-, and 243-kev γ-rays are equal to the energy of the 460-kev γ-ray. The suggested level scheme must be considered as tentative, and coincidence measurements have to be performed before an unambiguous level scheme can be given.

No positrons or electrons in addition to the conversion electrons were found. In most cases the Auger-lines are not overlapped by conversion lines, and it is possible to find the Z-value to which a certain decay takes place from the energy of the Auger-lines. Knowing the x-ray fluorescence yield, it is also possible to prove K-capture from comparison of the intensities of the Auger-lines and the conversion lines. In this case

$$(NA_1+NA_2)/(NK_1+NK_2+NK_3+NK_4+NK_5)=0.44.$$

If no K-capture were present, this ratio would have been ~ 0.11.[3]

TABLE I. Summary of results.

Energy of the electron line (kev)	Interpretation	Corresponding γ-ray energy (kev)	Relative intensity
20.7	K_1+A_1		100
26.2	A_2		16
	A_1		32
	K_1	54.0	68
49.5	L_1	54.7	16
63	K_2	96	1
73	K_3	106	1
107	L_2+L_3		0.4
153	K_4	187	24
183	L_4	188	5.2
208	K_5	243	7.2
238	L_5	243	
	Scintillation spectrometer	460	Weak

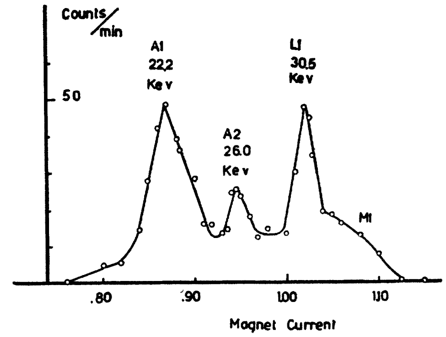

FIG. 2. β-spectrum of I^{125}.

We therefore conclude that Xe^{125} decays predominantly by K-capture to several excited states in I^{125}.

It is also of interest to point out the similarities in the decay of Xe^{125} and Xe^{127}. Earlier we have reported[2] that Xe^{127} decays by K-capture to I^{127}. γ-rays of the energies 57, 145, 170, and 200 kev are emitted. The energies of the first two γ-rays sum up to give the energy of the 200-kev γ-ray. Using the NaI scintillation spectrometer we later found a weak γ-ray of the energy 365 kev, indicating that the 170- and the 200-kev γ-rays probably are emitted in cascade, since their γ-energy sum is the same as the energy of the 365-kev γ-ray.

Reid and Keston[4] discovered a 56-day I activity which they assigned to the mass number 125. X-rays and weak electrons of energy 100 kev were observed. In our aged Xe^{125} sample we should be able to find this activity.

Figure 2 shows the β-spectrum of the Xe^{125} sample about one month after the electromagnetic separation. In addition to the Auger-lines $K-2L$ and $K-L-M$ characteristic for Te, we observe two conversion lines of energies 30.5 and 34 kev, which are consistent with the L and M conversion lines of a 35.5-kev γ-ray. G. Friedlander *et al.*[5] have investigated the Te fraction of the sample used by Reid and Keston and found weak electrons of the energy $\sim$120 kev. In investigations by K. Siegbahn and W. Forsling[6] and R. D. Hill,[7] it is definitely concluded that Te^{125m} decays by emission of two γ-rays in cascade (35 and 109 kev). The low energy γ-rays found by these investigators and that found by us are certainly emitted from the same level in Te^{125}.

This fact and the results of Friedlander *et al.* support the assumption that I^{125} decays by K-capture to both the levels in Te^{125}. The branching ratio, however, would then be small, since we have not found the conversion lines of the 109-kev γ-ray. The spin of I^{127} is 5/2, and the nuclear shell theories suggest 5/2 also for I^{125}. The spins 3/2 and 11/2 for the excited states in Te^{125} are consistent with the measurements.[7] K-capture to the upper level of Te^{125} would then be more forbidden than to the lower level in agreement with the measurements.

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β-Spectrometer Investigations on Electromagnetically Separated Xe^{135} and Kr^{79}

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Xe^{135}.—Xe^{135} has been investigated in the β-spectrometer by Peacock *et al.*,[1] who report a β-spectrum of the upper limit 0.93 Mev and a 0.247-Mev γ-ray. In an investigation on Xe^{133m} [2]