

**DETERMINATION OF CHANGES IN ION CONCENTRATION
IN A GAS MEDIUM**

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Let us determine how the total ion concentration in a gas medium changes with time t under irradiation by an ionizing radiation source, if at the initial moment of time at $t=0$ the concentration is $x=0$.

Let's rewrite the equation $\frac{dx}{v_r - k_p \frac{x^2}{4}} = dt$, in the form of $\frac{dx}{\alpha(a^2 - x^2)} = dt$,

where $\alpha ::= \frac{k_p}{4} > 0, a^2 ::= \frac{v_r}{\alpha} > 0$,

or after integration $t = \frac{1}{\alpha} \int_0^x \frac{dz}{a^2 - z^2}$.

By decomposing the integrand function $\frac{1}{a^2 - z^2}$ on the sum of simplest rational functions

$$\frac{1}{a^2 - z^2} = \frac{1}{2a(a+z)} + \frac{1}{2a(a-z)}$$

and finding the first variables, we obtain $t = \frac{1}{2\alpha a} \ln \frac{a-z}{a+z} \Big|_0^x = \frac{1}{2\alpha a} \ln \frac{a-x}{a+x}$.

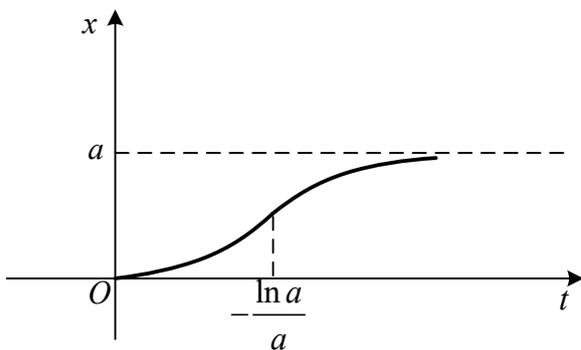


Fig. 1

So, $\frac{a+x}{a-x} = e^{2\alpha at}$,

whence (see Fig. 1) $x = a \frac{e^{2\alpha at} - 1}{e^{2\alpha at} + 1}$.

From the obtained relation we can see that after some time a constant concentration of ionized particles is established in the system, since

$$\lim_{x \rightarrow +\infty} a \frac{e^{2\alpha at} - 1}{e^{2\alpha at} + 1} = a = 2\sqrt{v_r/k_p}$$