

## **Luminescence of Plasmoids of the optical Disruption of Air**

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Magnification of range of activity of laser systems in open atmospheric space relate to pinch of density of energy and orientation amplification (decrease in angular divergence) a bundle of laser radiation. At embodying of this solution by pinch of a power density of a laser bundle there can be an effect of ionization and an optical disruption (an example: a natural lightning) in volume of space of concentration of radiation of a laser bundle vortexes of turbulence or aerosols. These effects have threshold character; they are critical to physics of interaction of electromagnetic radiation and medium (the molecular both aerosol uptake and dispersion on the disperse particles and turbulent vortexes). To the greatest degree effects are critical to presence of particles of the aerosol serving by centre of formation of the plasma centre of a disruption in atmosphere.

In air surrounding the plasma centre, under the influence of natural radiation of the centre there is an ionization of molecules of builders of air, there are chemical responses which lead to formation of gas haloes with high concentration of oxides of nitrogen, ozone, oxygen ions. Radiation of the centre of an optical disruption of air is at the bottom of some observationally observable phenomena. On color pictures in a neighborhood of the formed plasma inhomogeneities intensive enough halo of a luminescence (blue-green field of a spectrum) as effect of action on medium of a hard radiation radiating from plasma formation in the field of a disruption [1] is observed.

Halo of ionization of air, formed round a laser-induced spark, relate to radiation of the multicharging ions and the vortex structures of fields in plasma [2]. Legitimacy of change an electron con-

centration at removal from plasma boundary - monotonous; slowly and linearly decreases on distances 1...10 cm to scornfully small values [3]. Restriction of duration of existence and occurrence of fluctuations of a power density of a luminescence of plasma of an optical disruption of air in a visible site of an optical spectrum with growth of power of laser radiation is caused by a plasma ionizing radiation [4, 5].

Found out on pictures of a disruption of air against a sky luminescence the dark localized plasma formations [6] can be explained occurrence of a gas halo with high concentration  $\text{NO}_2$  in a neighbourhood of space of an optical disruption of air surrounding the centre. The lifetime of gas halo  $\text{NO}_2$  round plasma formation makes quantity of the order of second [7]. In this time the gas halo  $\text{NO}_2$  formed as a shell of high-temperature "plasmoid", is capable to screen completely transiting visible radiation of atmosphere, creating on a picture the dark image of "plasmoid" – the localized centre of an optical disruption of air. In the present report observed data of none equilibrium dynamics of change of density of optical this sort of radiation of plasma formations in air are given at distribution of laser radiation with a wave length 10,6 microns of micro-second duration with medial on section of a bundle of density of intensity of laser radiation more than  $5 \cdot 10^8 \text{ W/cm}^2$ .

The spent experimental researches have shown that power of a luminescence in the field of a spectrum chosen for studying fluctuates in time damping. With magnification of energy of a laser impulse the continuance of fluctuations of power of a luminescence in this field of a spectrum decreases. The parent of restriction of duration and occurrence of fluctuations of signals of the receiver reflecting level of power of a luminescence of plasma of a disruption in different sites of a spectrum, with growth of power of laser radiation change of optical properties of air round plasma formations because of course of chemical responses under the influence of an ionizing radiation of plasma and a shock wave of high-temperature "plasmoid" - the centre of an optical disruption of air is. Occurrence and amplification of the regular perturbations behind front of the shock wave, shown as nonmonotonic behaviour of a lateral

view of uptake  $\text{NO}_2$  and occurrence осцилляций an issue signal in absorption band  $\text{NO}_2$  ( $\sim 400\text{nm}$ ), was revealed for the first time authors of operation [8] at luminescence measuring in a shock tunnel charged with dioxide of nitrogen. The oscillation frequency of values of parameters  $\text{NO}_2$ , gained analytically, in the core depends on the characteristic kinetic constants:

$$\omega = \sqrt{\frac{C_v g_{\text{дф}} D}{C_T \varepsilon_v^0}} \kappa_x \kappa_{\text{рст}}$$

Where  $\kappa_x$  - a constant of velocity of expenditure  $\text{NO}_2$  in chemical processes;  $\kappa_{\text{рст}}$  - a constant of relaxation rate  $\text{NO}_2$ ;  $g_{\text{дф}}$  - effective heat of disintegration  $\text{NO}_2$ ;  $D$  - an effective barrier of decomposition  $\text{NO}_2$ ;  $\varepsilon_v^0$  - equilibrium vibrational energy  $\text{NO}_2$  at the given temperature;  $C_v/C_T$  - the relation of heat capacities vibrational and thermalizations degrees of freedom of reacting system. Frequencies oscillations parameters change from 50 ... 100 ( $2600^0$ ) to 200 ... 500 kHz ( $4000^0$ ). In special experience lack of radiation in explored gases Ar,  $\text{N}_2$ ,  $\text{O}_2$ , CO,  $\text{CO}_2$  without additives  $\text{NO}_2$  [9] has been checked up.

Occurrence of fluctuations of signals reflecting power of a luminescence of plasma of an optical disruption in a dark blue site of a spectrum with growth of energy of laser radiation it is caused by issue of radiation of gas halo  $\text{NO}_2$  at distribution to it of a shock wave of the centre of an optical disruption of air [5], instead of contortion of an optical signal by a photodetector.

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