POSSIBLE TRACES OF A NATURAL LASER EMISSION OF THE EARTH'S ATMOSPHERE

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To explain some cases of spontaneous holes in window panes a hypothesis of generation of narrow pulses of laser radiation in the upper atmospheric layers is discussed. Some approaches to verification of this hypothesis are suggested.

The review[1] presents the results of studying the possibilities of direct transformation of solar energy into laser radiation in molecular gas media and analyzing the natural laser effects in planetary atmospheres Illuminated by the Sun. Surface measurements of the nonequilibrium IR radiation from the Martian and Venusian atmospheres performed with the help of heterodyne spectrometers made it possible to classify these planetary atmospheres as first known cosmic IR laser objects.[1] However, laser radiation has not yet been discovered in the earth's atmosphere.

Nevertheless, both theoretical and experimental studies demonstrate the possibility of generation of active media in the Earth's atmosphere as well.[2,3] Consider the studies on the discovery of IR radiation in the upper atmosphere and of the processes of radiative energy transformation into IR emissions.[4] The intensity of IR radiation increases significantly during magnetic storms due to the effect of particles entering certain zones in the upper atmosphere. It was also found that almost all the external energy entering terrestrial space is ultimately transformed into IR radiation.

One of the possibilities in searching for laser radiation is to look for available traces left by laser beams on physical surfaces and for their manifestations in various natural phenomena in particular, there are cases when unusual traces appear in window panes, resembling an imprint from high-intensity beams.[5] For example, such a phenomenon was observed on April 16, 1984 around 16:00 LT in one of the buildings in the city of Chita. A hole suddenly appeared in the third floor outer window pane. The window looks out into open space toward the northwest. The appearance of that hole was accompanied by an explosive noise, typical for a laser beam hitting glass.[5] A photo of the hole is shown in Fig. 1. The glass from the hole fell in between the panes. The inside glass, opening into the room, was not visibly affected. No foreign objects (stones, bullets, etc.) were found near the window.

Similar accounts are described in the literature. In particular, a phenomenon closely resembling the Chita case was recorded in 1977 in Fryazino. For five seconds witnesses of that event observed a bright ball at the window glass, followed by the appearance of a hole, 3–4 cm in diameter. Disappearance of luminescence at the window was accompanied by a loud sound. Estimates made from the data published in Ref. 5 produced exceptionally high levels of power and power density fed to the glass: 4 kW and 400 W/cm^2, respectively. The authors of that study related this phenomenon to ball lightning. Note that the hole which appeared in Fryazino differed from that in Chita by its cross-sectional profile: in Chita it had a slight exit widening, while in Fryazino it was the opposite. In addition, no thunder-storm phenomena were recorded in Chita during the period in question.

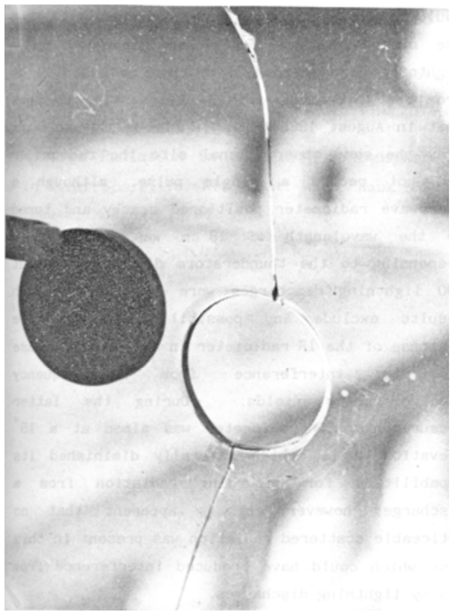

FIG. 1. Photo of hole in window pane (from the inner side); which appeared on April 16, 1984 in Chita.

As a result of further studies, we found several other strange holes in outer window panes in Chita. A peculiar feature of one of them is an imprint of

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the hole area on the untouched inner pane. The imprint looks like white powder (see photo in Fig. 2). it is somewhat below the hole, so that the trace cam be regarded as an almost exact projection of the hole from the position of the Sun upon the inner pane (we were able to date the hole appearance to November; it was impossible to pinpoint the exact day of the event). The imprinted white material is quite strongly attached to the glass surface and it is practically impossible to scratch it off with any metal object. Such a character of the destruction completely excludes any simple mechanical effect upon the outside glass, and points to a high energy potential of the destructive agent. If the hypothesis of beam irradiation is accepted, its electromagnetic wavelength band must obviously occur where the window glass is opaque; what is more, it should at the same time fall within the atmospheric transparency window. Radiation satisfying these conditions most probably comes from one of the IR atmospheric transparency windows.

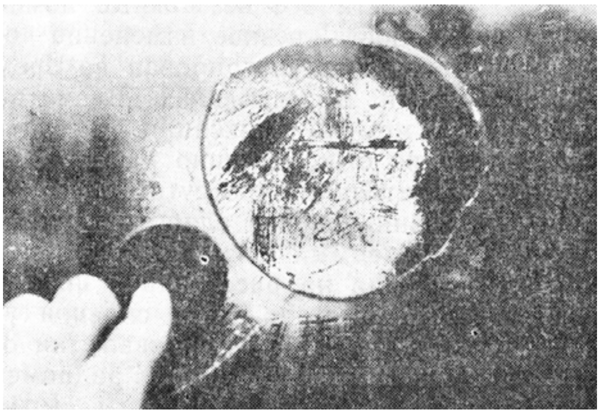

FIG. 2. Photo of the hole in the window pane, with residue of evaporated material on the intact inner glass pane

Note that from 1984 to 1989 we recorded no new holes appearing in window panes. Such cases were reported in Ref. 6, which included photos of such holes and of the glass shreds falling from them. Similar phenomena were also observed at much earlier dates, e.g., in 1904 during a tornado.[7]

Summarizing the known facts, one can suggest that narrow beams of laser radiation are sometimes generated in the earth's atmosphere. The hypothetical mechanism for the generation of such beams might generally look as follows. If an extended gas cloud suddenly appears, e.g., a bolide [meteor] blows up in the upper atmosphere, and the density of excited molecules in it happens to be sufficiently high, laser radiation can be generated. The dominant propagation direction must correspond to the direction of maximum cloud extension because, lacking a resonator, a quite extended medium is needed to accumulate enough radiative energy. In the absence of rigid system geometry and resonators the radiation would be of pulsed in nature and propagate in various directions. In the case of flat structures (or layers), typical for the atmosphere, radiation beams would most probably propagate along horizontal directions. At sufficient radiation power levels beams might be formed as the result of self-focusing. The phenomenon of self-focusing in the atmosphere has been discussed quite often (see, e.g.. Ref. 8), and it was assumed that thin waveguides might appear in those cases, along which the beams might have travelled for long distances.

Obviously, to assess the feasibility of these assumptions direct evidence of the existence of laser beams should be obtained. While traces of destruction (such as in window panes) can be observed only rarely, weak signals generated by pulses scattered in the medium could be recorded quite often by sensitive instrumentation. In addition, such radiation cannot always be powerful enough to produce destruction in various objects or be focused into beams of small divergence. Hence, specially organized observations to identify narrowly directed pulsed radiation in the earth's atmosphere could be regarded as another direction for these studies.

We attempted to identify such radiation using a wideband radiometer operating at 7–14 μm. The first measurements were conducted in July 1987 in the area of Preobrazhenka village of the Chita province. Observations were taken at approximately 1 km above sea level. The instrument had an angle of view of about 0.1 rad and was aimed at 45° to the horizon toward the south. On July 14 the instrument identified a pulse of radiation, exceeding in its power all the possible interferences (such as produced by birds entering the instrument field of vision, abrupt changes in cloud conditions, etc.). The pulse was recorded during a weak thunderstorm. A few kilometers to the north of the site a thunderstorm was observed. However, at the instant the pulse was recorded no thunder could be heard at the site. This is no proof that ball lightning or a weak discharge, not heard by the observers, could not have occurred. Calculations show that the observed signal could be generated by a lightning discharge at a distance of about 1 km from the instrument. It is interesting to note that in August 1989 during a strong thunderstorm over the same observational site the radiometer did not record a single pulse, although a microwave radiometer positioned nearby and tuned to the wavelength of 18 cm was continuously responding to the thunderstorm discharges (about 100 lightning discharges were recorded). Such results exclude any possibility of a false response of the IR radiometer in the previous case due to interference from low-frequency electromagnetic fields. During the latter measurements the radiometer was aimed at a 15° elevation angle, which naturally diminished its capabilities for recording radiation from a discharge; however, it is apparent that no noticeable scattered radiation was present in this case which could have produced interference from nearby lightning discharges.

The results presented can hardly be considered a final proof of the existence of laser radiation beams in the Earth's atmosphere. However, one can state that the above facts suggest that the laser pulses with power sufficient for self-focusing can be generated under natural atmospheric conditions. To prove such a suggestion, a wider search for radiation from laser atmospheric pulses should be instigated. The general direction of such studies can be formulated in the following manner: spectral measurements in the IR atmospheric transparency windows and with the UV, millimeter, and decimillimeter bands also possibly considered. Such measurements should be undertaken during magnetic storms and periods when the earth's crossing the boundaries between cosmic magnetic field sectors; in the regions of bolide bursts, of geomagnetic and radiation anomalies, in regions of frequent thunderstorm activity, and also during periods and in areas of other significant energy perturbations in the upper atmosphere.

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