Natural Low Energy Nuclear Fusion Reaction

Boris A. Andrianov*

— Abstract —

A hypothesis is put forward explaining a superpower flash, a shock wave and instant evaporation of most of the Chelyabinsk meteor by the emergence of conditions for a low energy fusion exothermic reaction between Mg and Si nuclei contained in olivine and pyroxene, which were found in the meteorite. The possible initiators of that reaction are considered. They are supposed as common for the known experiments of similar type.

The most mysterious feature of an airborne meteor is its sudden burst in atmosphere accompanied by a dazzling continuous flash and a power shock wave with estimated energy reaching several megatons of TNT equivalent. These events happened in the history of mankind several times.[1] Maximum values have Tunguska phenomenon (10-15 Mt) and Chelyabinsk bolide (0.44 Mt).[2] The actual data famine in the first case gave rise to assumption about a natural nuclear fusion reaction in the nucleus of a comet,[3,4] which is, however, inconsistent with our knowledge of the chemical composition of comets and of the temperature and pressure conditions necessary for initiating this reaction.[5] But the second case shows that the idea of a natural nuclear reaction is not devoid of sense by itself and deserves attention.

Meteorite fragments were a persuasive proof that on February 15, 2013 at an altitude of 23.3 km, a meteor of mass about 11,000 tons exploded, which was traveling at the moment of its burst at a velocity of 18.6 km/s.[2]

In accordance with Galimov,[6] the meteor lost 9/10 of its initial mass due to ablation in traveling time of 13 s in atmosphere, so that its mass was reduced to 1,100 tons, hence its kinetic energy was $1.9 \cdot 10^{14}$ J. Therefore the burst energy ($1.84 \cdot 10^{15}$ J) is in excess of kinetic energy by a factor of ten.

Along with such tremendous difference of these values it is also a striking fact that energy release was practically instant. The meteor of tremendous mass turned into vapor in a few seconds: about 1,100 tons of its substance (kept off ablation) instantly evaporated leaving a dense smoky trace in the air, which was absent before the burst.

The assertion that 1,000 tons of fragments fell down[6] looks rather doubtful and is obviously based on simple arithmetic. As is known, the total mass of fragments found to date does not exceed 700 kg. Usual heat engineering mechanism for the instant heating of such a massive object to melting and evaporating is not known.

Thus not for the first time Nature demonstrates to us an experiment in which there is a powerful burst and instant evaporation of a stone block containing no explosives. Among all known means only a nuclear explosion is capable of providing the energy required for that. There is ample evidence for that conclusion. Just the main features of a nuclear explosion characterize the behavior of the Chelyabinsk meteor.

First of all, there is superpower light radiation lasting 5 seconds as an extraordinarily increasing fireball. The radiation did not increase gradually but appeared suddenly and considerably exceeded heat radiation of burning gases attending the meteor flight. Approximate radiated energy of the fireball was $3.75 \cdot 10^{14}$ J,[7] *i.e.* 20% of the total burst energy. The flash brightness was so strong that a lot of eyewitnesses got a tan on their faces, even a man who was sitting in the back of a car. It is well known that light duration of nuclear explosion in seconds is equal to the cube root of its energy in kilotons.[8] From this correlation it is possible to make the rough estimate of energy as 125 kt, which is the same order of value with estimated by JPL.[2]

The second sign is a pulse of penetrating radiation. According to official information, the radiation environment after meteoric fall was normal, but it did not mean that pulse of background radiation was absent. It was not recorded because usual measuring means were not intended for pulse registration: they are based on gas discharge detectors which have an averaging time about several tens of seconds. Besides that, radiation monitoring posts make only 3 - 8 measurements per day.[9] Nevertheless, the gamma pulse really took place. Indirect but quite essential evidence is represented by many eyewitnesses in Chelyabinsk who felt the smell of spent gunpowder just after the flash.[10] As is generally known, such a smell is a distinctive feature of nitrogen oxides which can be formed in the air only under powerful gamma radiation at the moment of the burst as a result of radiochemical reaction. Products of that reaction could not instantly diffuse through the air from the burst area, but were formed just under a powerful gamma pulse.

There is no data about neutrons in this penetrating radiation. Also there is no valid data about a radio frequency pulse besides short-time disappearance of mobile communication, which could be caused by overloading of cellular networks.

The third sign is three shock waves, the first of which came to Chelyabinsk after 177 s , *i.e.* the explosion occurred at a distance (measured along an inclined straight line) about 60 km. Buildings were thoroughly shaken, a brick wall of a zinc factory was even crashed down, frames were pulled

out from windows, a lot of people were wounded by broken glass. If the explosion had happened at a lower height the shock wave force would have been much greater.

There has not been any radioactive contamination, possibly not only due to the high-altitude burst (the energy of gamma pulse was insufficient to induce residual activity), but mainly because of total absence of unstable reaction products.

So the subject under consideration may appear as follows: at the input—a stone meteor (chondrite) of an estimated initial mass of 11,000 tons traveling at a velocity of 18.6 km/s; at the output—a "pure" nuclear explosion. What kind of effects and processes during the objects movement could bring this result? First of all, of course, there are huge aerodynamic loads due to strongly compressed and heated atmospheric air. For example, pressure difference between front and back sides of a body moving at 20 km/s varies from 10^7Pa at a height of 30 km to 10^8Pa at a height of 15 km.[11] This air disrupts and heats body surface up to melting and even to evaporation, whereas its interiors have no time to acquire heat, so that an effect of an overheated pressure cooker does not work here.

Thus, the first two actions are high surface pressure and temperature. The third action which is not usually taken into account in meteor behavior consideration is an acquirement of a negative charge by a cosmic body. This can cause the body's potential to rise up to 10 kV or more.[12] Similar potentials create high values of the electric field strength and of the current density on sharpened parts of the body's surface. In other words, we are dealing with an electromagnetic action.

These three actions, the main of which is the third one, are used in low energy nuclear reaction (LENR) experiments where mutual conversions of chemical elements are obtained at concentrations in excess of a possible error. Under these conditions an excess energy release and an absence of radioactivity were observed.[13-16] A common feature of all these experiments is high values of current density, *i.e.* the high electron concentration on some parts of the researched samples.

A new hypothesis has been proposed[17] that two electrons with opposing spin magnetic moments are capable of direct pairing by tunneling through the Coulomb barrier to the region of the dominant values of their negative spin-spin interaction energy. The most favorable conditions for this pairing are obtained at high surface densities of the negative charge, particularly on metallic points at high negative potentials. The pair dimension is determined by geometry of the potential well on the plot of electron-electron interaction energy versus distance and does not exceed $2{\cdot}10^{-13}$ m.

The response of the pair to an external permanent electric field is that the pair executes rotation in the plane which is orthogonal to the vector of the electric field strength. The factor of proportionality ("giroelectric ratio") between the pair rotation frequency and the electric field strength is estimated theoretically by Andrianov.[17] The rotation of the electron spin magnetic moments brings into existence the additional internal electric field, longitudinal component of which completely compensates the external field and transversal component is orthogonal to the external electric field and in full conformity with Coulomb law, causing the translational movement of the center-of-mass of the pair at right angles to the external electric field, so that the pair tends to be pushed out from this field along the equipotential surface. Such movement is an electrical analogy Meissner-Ochsenfeld effect and its indirect evidence was first observed by Prof. N.P. Myshkin in 1899.[18]

The strong evidence of the concept of directly paired electrons is the phenomenon of resonance absorption of alternating electric field energy by structural products of the corona discharge on the negative point.[19,20] It occurs at the frequency connected with the permanent electric field strength (at its low values) by the linear dependence. The factor of proportionality in this linear dependence was found to be almost equal to the theoretical one. Consequently, experimentally measured frequency of the resonance absorption of the alternating electric field energy is very close to the theoretical frequency of the electron pair rotation in the applied permanent electric field.

Owing to unexpected peculiarities of their behavior in the external electric field, paired electrons elude usual observation and remain in the shadow of researchers' attention. "Self-concealment" of directly paired electrons impedes estimation of their possible importance in a lot of natural processes and phenomena. With regard to considered properties of paired electrons it has been proposed they take part in "cold" nuclear reactions as a peculiar kind of a catalyst,[17] inasmuch as they move orthogonally to a vector of an electric field strength and are capable of penetrating between a nucleus and an electron shell possibly causing its disturbance and making nuclei approach each other.

The research has shown that the main minerals of Chelyabinsk meteorite fragments are olivine $(Fe, Mg)_2SiO_4$ and pyroxene $(Mg, Fe)_2Si_2O_6$.[6] There is also native iron, nickel and chromium. So that possible natural low energy nuclear fusion reactions can occur as follows:

$$^{24}_{12}\mathrm{Mg} + {}^{30}_{14}\mathrm{Si} \rightarrow {}^{54}_{26}\mathrm{Fe} + 17.886\ \mathrm{MeV}$$

$$^{26}_{12}\mathrm{Mg} + {}^{28}_{14}\mathrm{Si} \rightarrow {}^{54}_{26}\mathrm{Fe} + 18.544\ \mathrm{MeV}$$

$$^{25}_{12}\mathrm{Mg} + {}^{29}_{14}\mathrm{Si} \rightarrow {}^{54}_{26}\mathrm{Fe} + 21.164\ \mathrm{MeV}$$

$$^{26}_{12}\mathrm{Mg} + {}^{30}_{14}\mathrm{Si} \rightarrow {}^{56}_{26}\mathrm{Fe} + 19.957\ \mathrm{MeV}$$

$$2\ {}^{29}_{14}\mathrm{Si} \rightarrow {}^{58}_{28}\mathrm{Ni} + 16.437\ \mathrm{MeV}$$

$$2\ {}^{30}_{14}\mathrm{Si} \rightarrow {}^{60}_{28}\mathrm{Ni} + 15.606\ \mathrm{MeV}$$

$$2\ {}^{26}_{12}\mathrm{Mg} \rightarrow {}^{52}_{24}\mathrm{Cr} + 22.986\ \mathrm{MeV}$$

Mg and Si nuclei flow together forming a stable isotope Fe, or two Si nuclei turn into Ni nucleus, or two Mg nuclei turn into Cr nucleus. An oxygen nucleus does not take part in this process since it is double-magic and has a greater stability. All these reactions obey the conservation laws of charge, nucleon-number and isotopic spin. Energy yield of the reaction is calculated as the difference in rest energies of initial and ultimate products.[21] As mentioned above, paired electrons may act as an initiator of these reactions. As the heat release thereafter increases, the reaction may become self-sustained, which seemingly has happened in Chelyabinsk. Reaction products instantly evaporated and left a dense smoky trace in the air which disappeared little by little and

did not cause radioactive fallout since there were not any radioactive materials. For 440 kt ($1.841 \cdot 10^{15}$ J) of explosion energy $6.43 \cdot 10^{26}$ is required for nuclear fusions in accordance with the first mentioned reaction, *i.e.* 32 kg of silicon and 25.6 kg of magnesium, the amount of which in that meteor was excessive.

From this point of view the 1908 Tunguska phenomenon becomes understandable. It is obvious that a similar but considerably more powerful burst of meteor happened there and its fragments (if any remained) flew far. Reasonable explanation can also be made for the problem of tektite origin,[22] particularly the absence of meteoric substance in them. The natural nuclear explosion happened at a low altitude and can explain the Mohenjo-daro mystery without fantastic ideas about ancient nuclear warfare.[23]

Process history must depend on aggregative state, temperature, pressure and density of initial components as well as on characteristic of the electrical action on them. It is not inconceivable and even more probable that within certain conditions these reactions can occur calmly, without burst, therefore their research is of specific interest for the purpose of obtaining cheap and pure nuclear energy.

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About the Author

Boris Andrianov is an Associate Professor of General and Experimental Physics at South Ural State University in Chelyabinsk, Russia.

*Email: borisandr47@gmail.com

So that possible natural low energy nuclear fusion reactions can occur as follows: 24 12. Mg.Â The natural nuclear explosion happened at a low altitude and can explain the Mohenjo-daro mystery without fantastic ideas about ancient nuclear warfare.23. Process history must depend on aggregative state, temper-ature, pressure and density of initial components as well as on characteristic of the electrical action on them. It is not inconceivable and even more probable that within certain conditions these reactions can occur calmly, without burst, therefore their research is of specific interest for the purpose of obtaining cheap and pure nuclear energy. Nucleus Â· Nucleons (p, n) Â· Nuclear matter Â· Nuclear force Â· Nuclear structure Â· Nuclear reaction. v. t. e. Nuclear fusion is a reaction in which two or more atomic nuclei are combined to form one or more different atomic nuclei and subatomic particles (neutrons or protons). The difference in mass between the reactants and products is manifested as either the release or the absorption of energy. This difference in mass arises due to the difference in atomic binding energy between the nuclei before and Nuclear fusion works by having two atoms join together and release excess neutrons and energy. What stands in the way of atoms doing this in everyday situations is the electrostatic barrier (the repulsive force between atoms) a.k.a. Coulomb barrier: http://en.wikipedia.org/wiki/Coulomb_barrier. To overcome this barrier the atoms have to be pressed together by gravity and heat (the sun) or magnets and heat (current fusion experiments such as tokamak fusion reactor). The reason heat is necessary is the added energy it gives into the reaction. Temperature is a measure of the average amount of ato Cold Fusion is now called Low Energy Nuclear Reaction (LENR) among other terms. This is because instead of fusing two items (which is reported to occur mildly), several atoms give off parts which then fuse into a third unstab...Â Hi. I am new to this Forum, but have followed this and similar stories. Cold Fusion is now called Low Energy Nuclear Reaction (LENR) among other terms. This is because instead of fusing two items (which is reported to occur mildly), several atoms give off parts which then fuse into a third unstable atom which then Beta Decays into IR heat. I know it will take a ruler upside most of the heads here before anyone will look at this seriously but this thread was started in 2011 and a lot more information is now available. Nuclear Fusion. If light nuclei are forced together, they will fuse with a yield of energy because the mass of the combination will be less than the sum of the masses of the individual nuclei. If the combined nuclear mass is less than that of iron at the peak of the binding energy curve, then the nuclear particles will be more tightly bound than they were in the lighter nuclei, and that decrease in mass comes off in the form of energy according to the Einstein relationship. For elements heavier than iron, fission will yield energy. For potential nuclear energy sources for the Earth, the deuter