NATURAL URANIUM REACTORS WITH AN EXTERNAL SOURCE OF FAST NEUTRONS ARE THE FUTURE OF ENERGY AND COSMONAUTICS

A. G. Mozgovoy, I. N. Tilikin

P. N. Lebedev Physical Institute of the Russian Academy of Sciences, Moscow, Russia

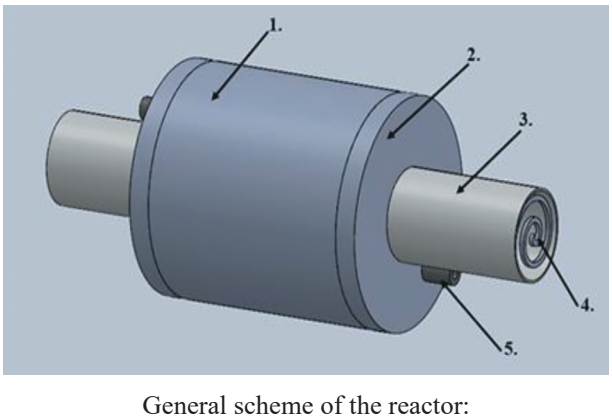
The operation of conventional nuclear reactors is based on the ability to chain react when uranium 235 is fissioned by slow neutrons, which sometimes led to known disasters. The use of U 235 leads to the need to enrich natural uranium 238 (its content of U 235 is 0.7%). Natural U 238 shares fast neutrons (in particular, 2.4 MeV – megaelectronvolt or 4.10^{-13} J, which arise during thermonuclear fusion of deuterium) with the release of another 200 MeV of energy, but **without a chain, self-sustaining reaction and without the possibility of any accidents**, the thermonuclear reaction itself has a gain of the order of hundreds (10 KeV of deuterium nuclei during fusion give 2.45 MeV), i. e. the total gain of the energy output scheme is about 10,000 (at 100 percent efficiency). Therefore, private companies in the USA have already attracted more than $7 billion. https://www.fusionindustryassociation.org/.

The most promising direction is compact torus colliders (**CT**) or **FRC-field Reversed Configuration** – a plasmoid with a closed current loop with the required composition and mass (micrograms) is accelerated by external magnetic fields and collided with another one flying towards it. With the same current directions, CTs are attracted and all the kinetic energy goes to heating the plasma with the implementation of a thermonuclear reaction. We accelerate compact tori with hundreds of micrograms of lithium deuteride 6 to hundreds of km / sec, the energy is kilojoules. We collide, we get $10^{16–17}$ neutrons or hundreds of kJ. The resulting neutrons go to uranium, thorium, spent nuclear fuel, we increase the output energy by another 100 times and get the desired megajoules and megawatts in the frequency mode (1–100 Hz).

American companies **Helion Energy** and **Tri Alpha Energy** have attracted about $2 billion (including $50 million from Rusnano). Helion (the main investor is **Sam Altman**, former partner of **Elon Musk** in Open AI – artificial intelligence is becoming the main consumer of electricity) even signed contracts with Microsoft and the largest steel company in America, Nucor, to supply reactors with a total capacity of up to 500 MW from 2028.

Experiments were conducted at the Lebedev Physical Institute [1] that confirmed the possibility of achieving “breakeven” at compact torus colliders: – two CTs, formed using a patented method in inductive energy storage devices and accelerated towards each other, gave a plasma temperature of more than 1 keV at the collision site and a soft X-ray duration of about one microsecond (these are two key parameters), which is similar to the duration of a nuclear explosion.

Acceleration of compact tori is a new type of electric rocket engines – To Mars in a month [2].



General scheme of the reactor:

1 – body of the molten salt reactor, *2* – its covers, *3* – collider of compact tori with a neutron yield of 10^{16} per pulse, *4* – inductive storage unit of the compact tori formation section, *5* – inlet and outlet pipes of uranium-238 molten salts. In the molten salt reactor, the fuel is also a coolant

References

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