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Neutrino Emission and the Safety of Nuclear Objects

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In 1979, there was a serious accident in the U.S. at the Three Mile Island nuclear power plant which involved two power-generating units. In 1986, the world witnessed a large-scale disaster in the USSR at the Chernobyl nuclear power plant that operated four power reactors. The last major accident occurred in March of 2011 in Japan. That accident involved six reactors. It is known that during the nuclear reactions in the reactors the torrents of anti-neutrino are released. At first, the neutrino emission was postulated as extremely high-penetrating, practically non-reactive to the matter. However, the capture cross sections of neutrinos, although really having very low values, are being measured at the extremely rough criteria. The situation here is somewhat similar to what happened to the neutron. Neutron, too, has high penetrating capacity, and often low capture cross sections, but, nevertheless, its cases of resonant interaction processes, that have sections many orders larger than normal, are well studied. From the very beginning of the discoveries of the neutrino, the "pervasive bias" has been adopted in the description of its properties, and little is known about its possible resonant interactions with matter and the research on these interactions. Resonant interactions are widespread in the microcosm and the physics of elementary particles, and it is not prudent to deny their presence for neutrinos, even with a very small probability. It must be said that for the relic neutrinos, the high level of interaction with matter is already widely discussed, but with the caveat that it is not typical for nuclear neutrinos. It is obvious for the greater part of the neutrino energy spectrum, but not for resonance. This is the first point. But there is another point: the interaction of neutrinos with matter is among the weak interactions, but, as pointed out by Academician B.M.Pontecorvo in 1970 [1,2], and discussed even earlier –¬¬ in 1964 –in the works of E.Bialynicka –Birula [3], the interaction between the particles them selves can proceed according to the mechanism of the strong interaction. This radically changes the situation; the presence of two or more neutrino fields close to each other can lead to a strong interaction between them, precisely: 1) to a sharp acceleration of the inverse beta process, which will lead to a large release of additional energy, and 2) to an increase in the fraction of excited nuclei in fissile material, which will lead to a decrease in its critical mass, and to an uncontrolled change of regimein the reactor to a supercritical state. Therefore, the work of two or more reactors located near each other is extremely worrying. The tendency to a greater increase in the number of cooperating power units (up to 7-8) is clearly showing. The conception of independence of the adjacent units, which is the prevailing conception at present, may appear misleading. At present, the most dangerous situations exist in Japan, Canada and India (NPPs with 7-8 power units); Ukraine has a nuclear power plant with 6 units (Zaporozhye); in Russia there are stations with 4-5 units. In addition to the mutual influence of nuclear power units, the question of the effect of natural neutrino torrents on their work also requires a systematic study. The methods of detecting the interactions of nuclear power units according to the neutrino mechanism are being discussed.

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