New Nuclear Reactions:
Anomalous neutron emission

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Several Italian teams have been working in the last decades on new types of nuclear reactions which do not possess the dangerous features of the nuclear reactions used nowadays for energy production purposes. The team of researchers, to which I belong, has been studying since more than 10 years nuclear reactions mainly starting from iron or other stable and hence safe chemical elements, rather than Uranium. These studies are very promising and have already shown that these reactions are very likely to become the future way to produce energy on a large scale.
In this short paper, I would like to present, mainly with the help of some figures, some of the results regarding the peculiar neutron emissions that have been detected and measured during the experiments that have been carried out so far.

Neutrons are chiefly associated with nuclear reactors where fission reactions of uranium take place. Of course, other types of reactions exist during which neutrons are emitted, for instance the nuclear fusion of deuterium and tritium, but the first thing, one is sure of, when neutrons are detected, is that there is some reactions going on involving the nuclei of atoms since it is from there that neutrons come from. Fission and Fusion reactions have their own quantum mechanical theory that predicts and describes how they work and the features of the emitted neutrons. As to the neutrons that we have detected, on the other hand, the theory that predicts them is called Deformed Space-Time (DST) theory [1,2]. Being newly formulated, it predicts new types of nuclear reactions starting form iron for instance, but it cannot predict yet the features of the emitted neutrons. This is the purpose of this short paper, to list these peculiar characteristics that have been found out during several experimental campaigns.

Neutrons emitted in beams

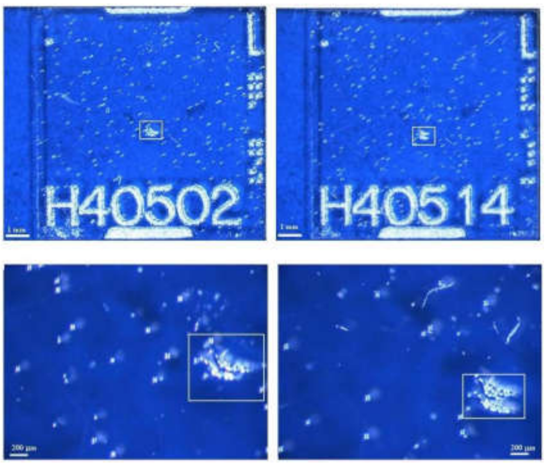

Fig. 1.Thick tracks at the centre of two CR39 detectors produced by neutrons converted into alpha particles by Boron (2006).

The neutrons emitted during the DST reactions are not emitted continuously along all the spatial directions as one might expect if one imagines that the emission should happen like in a fission reactor. On the contrary, neutrons are emitted in beams as shown in Fig.1 where two PADC detectors, known as CR39, show at the centre (first row) thick tracks due to the neutrons emitted by a water solution of iron subjected to ultrasonic cavitation [3]. During 90 minutes of ultrasonic treatment of the solution of iron, had the neutrons been emitted continuously along all the spatial directions, the appearance of the CR39 would be quite different.

On the first row, the little marker on the bottom left corner of each photo indicates 1mm, whereas, on the second column there is a magnification of the central tick track and the marker indicates 200μm. Another example that the emission of DST neutrons occurs in beams aligned along certain spatial directions can be seen in Fig.2. On the right it is shown the experimental equipment with the neutron bubble detectors placed around the solution of iron subjected to ultrasounds and on the right there is the photo of one of the bubble detectors showing the bubbles produced by the neutrons. The region where the bubbles are more concentrated was in correspondence of the centre of the cavitation chamber and since the bubbles did not appear all at once but their number increased gradually with time, it may signify that that direction is somehow privileged for DST neutron emission [4].

Fig.2 On the left the experimental apparatus with the sonotrode and the cavitation chamber at the centre, surrounded by the neutron bubble detectors. On the right the bubbles produced by the neutrons in one of the detectors. The position of the bubbles show some kind of tropism of the neutron emission (2006).

A further evidence of the emission of neutrons in beams along precise spatial directions is presented by Fig.3 which, with respect to the preceding two, is somehow more comprehensive.

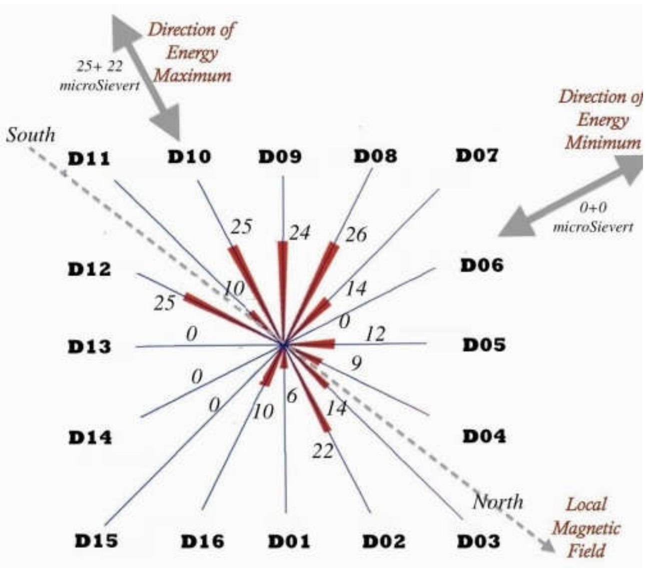

Fig.3. Neutron energy distribution. The length of the central lines is proportional to the reported dose (μSv) registered in the corresponding detector. The directions of maximum intensity (detectors number 2 and 10) and minimum intensity (detectors 6 and 14) are mutually perpendicular. (2012)

In this experiment [5] the ultrasounds were conveyed into a steel bar placed, in Fig.3, at the intersection of the lines. All around the bar there was a circular array of 16 CR39 detectors screened by boron. At the end of the 3 minutes of ultrasonic application, each of them presented several tracks. The length of the red tapered segments is proportional to the estimated dose of neutrons received by each detector and the number next to each segments (from 0 to 26) represents the micro Sievert (μSv). It is clear from the distribution of the doses, that the emission of neutrons in space is anisotropic and asymmetric and that there exist also certain directions along which no neutrons were emitted.

From the evidences presented in Fig. 1,2 and 3, it becomes clear straight away that, because of the emission of neutrons in beams and along certain spatial directions, the detection of these emissions is far from being easily achieved. Let's move now to another feature of the DST neutrons concerning their behaviour with the time.

Neutrons emitted in temporal bursts

The emission of the DST neutrons along precise spatial directions made us suspect that it was not continuous but that it happened in single bursts. In order to verify this idea, we began to work with active detectors capable of recording second after second the received level of neutrons. However we did not completely give up the passive detectors (bubble detectors) that had been so successful in catching the DST neutrons up to then. Besides, not being affected by electronic noise, the bubble detectors, used together with the active ones, could give also some kind of veto on the pulses seen by the active detectors which, conversely, are sensitive to this type of noise. The pulses are reported in Fig.4 [3].

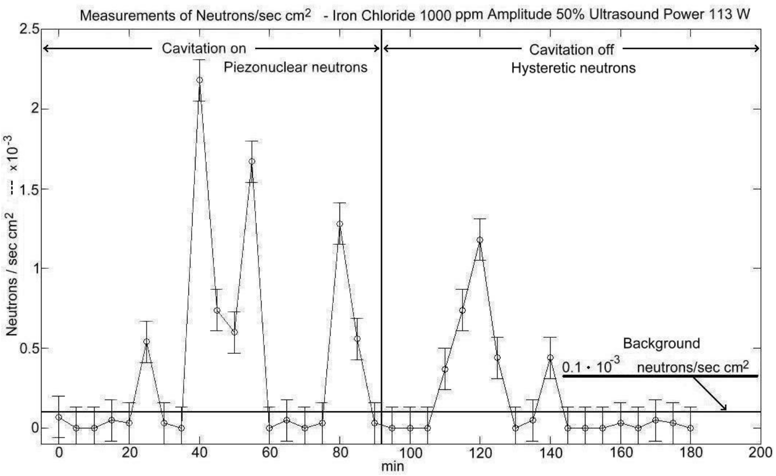

Fig.4. Neutrons measured by BF_3 (Boron Tri-fluoride) counter, place near the cavitation chamber that contained 1000 ppm of iron chloride. The ultrasonic power released into the solution was 113 W. (2007)

Not much needs to be added to the eloquence of this graph. The emission does take place with temporal bursts. These bursts do not show up as soon as one turns on the ultrasounds, rather it takes some tens of minutes for the neutrons to be emitted. This indicates the existence of some kind of energy threshold to be overtaken, just as predicted by the DST theory. Besides and more interestingly, the measurement of the gamma emission around the cavitation chamber did not show any pulse above the gamma background, which conversely is always present after neutron emission as predicted by the quantum electrodynamics.

Three interesting points can be made here about the absence of gamma pulses. No gamma after neutron emission might be considered as the first signature of the presence of new phenomena or more boldly of a new physics. No gamma means that, were these DST reactions used as energy production sources, there would be a huge improvement with respect to the safety of the future power plants since the screening of gamma emission is one of the major and serious issues during the normal exercise or accidents. No gamma during neutron emission and after turning off the ultrasounds means also that, although these DST reactions are indeed nuclear reactions, they do not produce radionuclides, i.e. the nuclear waste continuously generated by every uranium fission power plant all around the world.

It goes without saying that the emission in temporal bursts is certainly a further fact which, along with the anisotropy of emission, makes the detection of the DST neutrons not an easy thing.

Neutrons spectra of the DST neutrons

A further feature of the DST neutrons contributes to make them not easily detectable. Their spectrum. By the active detector MicroSpec 2 Neutron Probe produced by the BTI Industries, we managed to record the spectrum of the neutrons emitted during the DST reactions induced into a steel bar by ultrasounds. The attempt to determine the spectrum of DST neutrons was planned in order to try and characterise them as comprehensively as possible. After the space and time features, their energy was the next step [6].

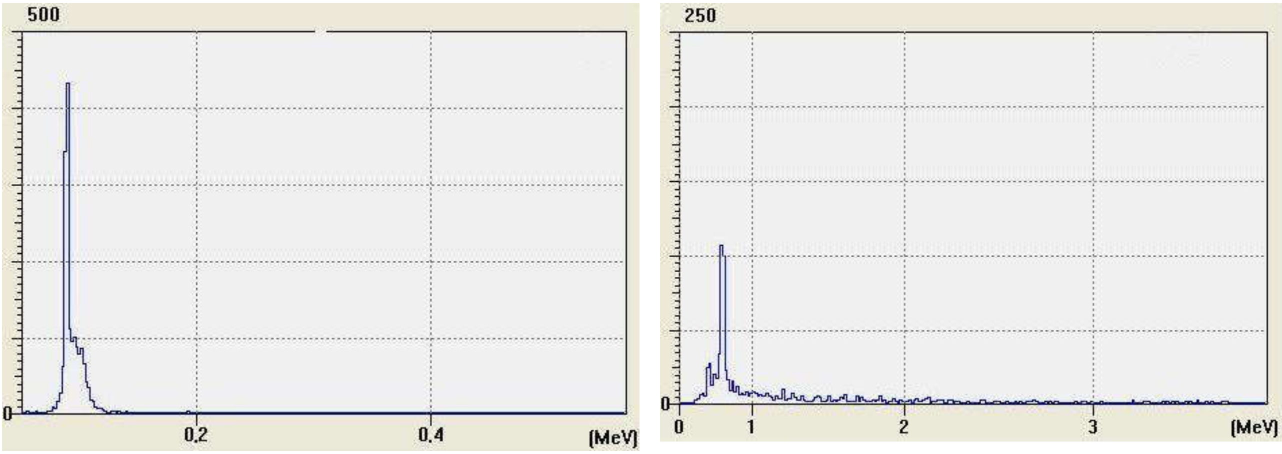

Fig.5. The N-Probe uses two separate detectors to cover the neutron energy range from thermal to 20 MeV. A NE213-type liquid scintillator is used from 800 keV to 20 MeV while a ^{3}He proportional counter based on the $^{3}He(n,p)T$ reaction is used to cover the energy region from thermal to 800 keV.

The DST neutrons appear to have two components at different energy which have to be both considered, along with the space anisotropy and asymmetry and the time asynchrony, when one decides to detect these peculiar emissions. For instance these neutrons can be detected neither by the activation of Indium foils nor by Uranium fission chambers, as it has been suggested, since the cross-section that these elements offer to neutrons is very low in the energy ranges where DST neutrons are emitted.

The aim of this short paper is to briefly mention the peculiar features of the DST neutrons, i.e. neutrons emitted during Deformed Space-Time reactions. These features have been found out by several experimental campaigns in which also other peculiarities of these new phenomena of physics were discovered. It may be interesting to know that other research teams in Italy and around the world have found out similar results. This indicates that these phenomena are real and not due to some kind of errors or misunderstanding of the results. For a comparison between our results and those of other teams' you may refer to [7]. All the papers about the theory and experiments can be found in [8].

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