Neutrons fromPiezonuclear reaction induced by cavitation

Brief note

The purpose of this report is to illustrate the various stages of research on piezonuclear reactions from the first experimental evidence.
The results (approximately up to 2010) have been published in the main international scientific journals (slide1).

Of course the research is going on but now we want to have a moment of reflection and conduct simple but general considerations.

It is important to note, however, the spirit that animated the work group, all along the various stages of its formation, even before one could even think about an actual experimental activity.

This is the sense of knowing well to involve ourselves and put to question conjectures that often we also take for established and granted.

The debate about our research is open and sometimes heated. For these discussions we also refer to in the brief explanatory note on "piezonuclear cavitation" shown in slide 2.
We can see, in passing, how assent to our researches is rapidly growing, maybe owing to the precise correspondence between experimental results and theoretical predictions.

In slide 3 we can see the title page of a booklet that can be considered a summary of the theoretical basis of our research.
Of course in a few pages are packed full years of study.

As for the experimental work, we report in the images that follow the key stages of the experimental activities conducted in various locations and in different years (slides 4-7)

Now some experimental results are briefly presented. These results can be obtained on liquids (solutions of iron compounds) and on solid samples (steel bars), both subjected to ultrasonic stress.

The front pages of some publications and texts of some patent having as object the results of experiments on liquid matrices are listed in followed slides.

It's clear that the interest for our research goes over and above the even important basic theoretical implications, and certainly there is much attention for their practical applications

Going back to the experimental aspects we want to emphasize two remarks that make it particularly appropriate to use great caution in our circumstance:
1. we know well that our statements will touch on topics of fundamental importance
2. certainly we must be very careful when the experimental results can be considered at the limit of sensitivity of the instruments used.

Then we address ourselves to our research with a critical sense and only after a thorough analysis our results are presented formally.

The first criticism was referred to the type of neutron detectors used: passive bubble detectors.
In part, this criticism has returned as this type of detectors are now widely used in research (slides 14-15)

However, it was our duty to make use in the experiments also of most common detectors (slide 16)

So compatible results have been obtained using different methods:
- active Boron trifluoride detectors
- Passive detectors CR39 type (polycarbonate) shielded with boron
- Passive bubble detectors

We want to emphasize that since the first measures that were formally submitted (Physics letters "Piezonuclear Neutrons" - 2009) we adopted three different methods of measurement completely independent of each other

Of course we are also engaged in a continuous refinement of techniques for an ever better characterization of the emissions.
As an example, the recent availability of neutron spectrometry systems will allow better characterization of the emitted radiation as to energy.

It should however be noted that not always the commercially available instrumentation (often designed for purposes of sanitary protection) corresponds to the need for a new experimentation.

In some cases it is useful, even necessary, to develop detection systems specially designed.

The following slides show some examples of images obtained by microscopy on traces of passive dosimeters specially treated.
(CR39 - polycarbonate treated with boron)

In slides from S17 to S20 are presented images obtained with the same optical technique both as a result of our experiments and as obtained by neutron emission in nuclear research reactors of the ENEA Casaccia.

Slides 22-26 show some results obtained with application of ultrasound to steel bars.
A first analysis excludes already surface corrosion phenomena.
The analysis by use of SEM (electron microscope) gave results consistent with those observed in liquid solutions subjected to ultrasound.

Recent studies have shown the presence of micro-cavities in the metal bars subjected to ultrasound (slides 27-29)

It 's hardly necessary to mention that the materials we have considered are steels, ie, alloys, solid solutions, and above all polycrystalline materials.
This obviously entails the presence not only of the typical lattice defects but also the natural disorder typical of grain boundaries as compared with the regularity of a crystal lattice.

Some components of our research group, considering the analogy of cavitation in liquids, have expressed this simple fact: it seems obvious that the effects of an anisotropic and inhomogeneous space-time are well highlighted in anisotropic and inhomogeneous materials.
This seems to be an obvious theoretical consideration.

Certainly it is important for us to have as a basis of our research a well defined theory, as we have already said. A theory is a great help and it allows to move forward without proceeding blindly without any reference and only by attempts, in a tipical heuristic way or rather by chance.
The theory prevent us from any random results.

But a model is still a model and our role is mainly that of observers.

We just alter (or inflect, or "deform") space-time conditions and wait for what happens.
Observers who may have done a crack in a wall and are now trying to see beyond.

But beyond the applications that the research may have (and we all hope they will be many), we already have reached an important goal: to have laid the foundations for a new observation point (let say a vantage point).
A new way of being in front of phenomena that seem to be new.

I would like to conclude with the words that often told me my first Teacher of Physics Giorgio Salvini

- *the present Honorary President of the National Accademy of Italy " Accademia dei Lincei"*
- *and former father founder of the Nuclear National Laboratories in Rome-Frascati.*

I approximate the sentence, as I remember, and is written in the last slide.

I think these words really summarize the spirit of our research.