A radio interview with Sergio Focardi, the father of “Ni-H Cold-Fusion".

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The Story

Fleischmann recently — on some journal, a month or two ago — related the episode once again. He’d gone home in the evening from the lab where he was conducting an electrolysis experiment, a common enough experiment in Chemistry. In the morning, when he came back, his found that his experimental apparatus was gone. He looked around and he saw a hole in the ceiling: it had flown upstairs.

At this point he says: “I understood that it must have been a nuclear phenomenon”. I’d like to raise some objections here, it’s as if Chemistry experiments never blew up … and he was a Chemist, on top of it!

In any case, he thought is was nuclear, he believed to have discovered a nuclear reaction; and since he was using palladium as a metal, and compounds in which instead of hydrogen he had used deuterium (deuterium is “heavy” hydrogen, hydrogen with twice the mass), he thought that hydrogen and palladium were involved, and announced this in a Press conference.

He was imitated by many research groups -- even in Italy -- who went on carrying out similar electrolysis experiments for twenty years: they never got any results, just minor effects which are in fact fluctuations. The last thesis I assigned to an undergraduate before I retired was to look up the relevant results; and I was able to verify that this was exactly the case: nobody had got any results, except minor effects which are fluctuations.

We might say that this is the main line taken up by Fleischmann’s followers.

As for myself, however, two or three years after this discovery, I was at a conference in Trento, in the company of two friends, one from Cagliari, Habel, and one from Siena, Piantelli. Piantelli told us he had seen similar phenomena with hydrogen; we talked and decided to check out these effects again. The three of us all worked in Siena, as Piantelli had a lot of support there (At the time, the President of the University was [Luigi] Berlinguer, who is now an MP in the European Parliament, and he had given him a lot of help and support). We carried out the first experiments and saw the first effects.

So there were two parallel lines of research: on one side, the deuterium and palladium people, who never got anything: there’s a quite a few of them, and they believe they are the guys with results. [On the other side] we, using hydrogen and nickel, did get, at a certain point, some small effects ... not important ones. For instance, we built several devices .. we input some (electrical) energy in them, and in the end the system put out twice that amount of thermal energy. We had therefore doubled our energy. However, if we reconverted that thermal energy into electrical energy, we were right back were we started from. So this was ... a game, not a system. But this is the result we got in Siena .. and there were physical effects as well … we published them, etc. …

After that, at a certain point ... I was running the risk of dying of a tumor. I was lucky, I found a good doctor who saved my life, and so I retired, I stopped working (as a professor, obviously), but kept on … then I did quit for a while … until Rossi looked me up.

Rossi had gotten this notion to use fusion … this process is called cold fusion. The "hot fusionists", the ones who are supposed to get fusion at high temperatures (and haven't gotten there yet), are the ones who labeled it with this nickname, cold fusion -- it's slightly disparaging, of course. So this is what Rossi had made up his mind to work on, had asked around, then he phoned a colleague of mine in Bologna who had written a report on cold fusion, and asked him who the leading expert in Italy was. My colleague named me, because he knew I had gone ahead. So Rossi calls me and tells me he's interested in the subject. We met, talked things over, and I could see that he had some innovative ideas; for instance, he immediately thought of using powder. Powder increases the surfaces involved and thereby increases the hydrogen which gets into the metal. We came to an agreement and began conducting experiments -- this happened about two and a half /three years ago -- in Bondeno, where he had an assembly plant, he was running a business there.

With these experiments came the first important results, the ones which led to the current result. Let's say that I was lucky to meet Rossi, and maybe Rossi was lucky to meet me, because I immediately told him: "We must watch out for neutrons, neutrons are dangerous! Buy a neutron detector immediately, never work without one, because if neutrons escape, you're done for, you're dead". And he took my advice on this.

There are no neutrons. This a fortunate fact; as this is a nuclear phenomenon, you would expect them. Luckily, there are none, because the nickel nucleus has a "pretty deep hole": if it weren't so deep, there would be neutrons as well. In fact, in the Siena experiments at one point I, we, did find some neutrons, and measured them; but there were different materials there, no nickel. In short: the experiment is nickel and hydrogen; these are very simple things.

[Female interviewer] So this has nothing to do with our idea of what's nuclear — I mean gamma rays, that kind of danger, those things?

There's a little bit of gamma rays, I'll explain presently. But these can be shielded with lead.

So, there are no neutrons. This is very important: you can protect yourself from neutrons as well, but you need boron, water, you need ... whereas for gamma rays you can use lead. Besides, these are not high energy gamma rays, they're easy to shield.

After this, we began to build our first devices, extremely simple ones: a container, with a small cylinder inside, a tray for the nickel, which is the component we were using (we experimented with other metals too, we did all sorts of things), hydrogen — obviously, you can get it out of a gas bottle or produce it with electrolysis, depending on the application. You heat the system with a resistor, an (electric) current; at a certain point the system begins to produce energy. And the energy that comes out is more than the energy given at input. But there's a difference: input energy is electrical, output is thermal, and therefore less valuable. Granted, if you want heat, it's what you need.

[Male interviewer] You must reconvert it.

You must reconvert it. And you lose by a factor of 2; but that too can be done.

We would put measured energy in the system ... In the first experiments we would boil water... we would measure the steam … we would boil and let off the steam … we would take water from the waterworks … and so by simply measuring input energy with an electric meter … and then, with a water meter, the water we had used … we were able to calculate the energy which had been produced. We came to perform experiments in which the energy produced was in the order of two hundred times the input energy -- and that's quite a factor. The only weak point is that this is thermal energy. If you want to convert it into electrical, you must divide it by two; on the other hand, well, you still have a factor of one hundred!

In Bondeno we ran the experiments for months, using different devices. Rossi works in the USA as well, and he conducted similar experiments there too. Both with Naval Research and with the DOE ... Rossi has a firm in the US, let's say that he expanded the horizon, up to the more recent demos: the one on Jan 14th, which was held in Bologna... we conducted another one a few days ago [the one with Essén and Kullander] … in which one shows what's going on, and one can invite the public.

Now, the public's reaction is not all that positive. That time, many of the public were professors from this Institute [the Faculty of Physical, Mathematical and Natural Sciences of the University of Bologna], and they're also bit envious. You see, these phenomena don't exist for official Physics — of which I myself am part of, though I have a different idea, I know these phenomena. But take theoretical physicists, especially: Physics states that these things don't exist, are not possible, may not be, because they occur inside stars — which is true — and we do not have stellar temperatures. What we do have, however, is experimental data: energy gets produced!

So things are not all that easy. I'm not under attack, maybe because they know that if they attack me I will answer right back … I'm not going to stir them up; however, I believe ... I don't know the opinion of every individual, but I would be willing to bet on who the unbelievers are. I'm an experimental physicist, not a theoretical one -- but theoretical physicists think they know it all, they say "these things occur inside stars, therefore they cannot occur at 100, 200 K". They don't tell me so much, but I know that's what they're thinking.

The Technology.

How are gamma rays produced? Well, at a certain point we wrote a paper, Rossi and myself, which may be found in the Journal of Nuclear Physics. I had originally sent it to ArXiv, which is usually open-minded in accepting contributions, they accept everything. They didn't accept it. And why not? Because I was a heretic -- wasn't I stating things that cannot exist? They also told me that that was no way to write a paper! What they didn't know is that, in all this chaos, I have a letter from Physical Review, the most important journal of all, which not only accepted one of my last papers, a few years back, but went so far as mentioning that the reviewers were soliciting acceptance of such an elegant paper...they were actually praising me for it. These other folks tell me that I don't know

how to write a paper? So Rossi, what does he do? "Very well, we'll put up a website and put it on line". He doesn't want me to relate this, but I don't know why he doesn't want me to...
In this paper we also give an explanation of the phenomenon. Here's what's going on: there, in the container, we have nickel and hydrogen, then we heat up the system. Then, let's say, the hydrogen nuclei, which are protons, move inside the system and these protons are able to come into contact with the nickel, with the atom, penetrate into the atom and even into its nucleus.

This is where things get difficult. How can they penetrate the nucleus? Because the opposing force is huge. I don't have an answer for this. All the same, it happens. We can see that from what goes on afterwards. The interpretation is that they penetrate... Others have contributed to the Journal with their interpretations of the phenomena, explanations, and so on.
So, when the proton penetrates into the nickel nucleus, nickel is turned into copper, because everything has changed. It becomes copper in an excited energy state, not in its fundamental state, and thus, so as to speak, a sort of boiling occurs within the nucleus; at this point, the nucleus gets de-excited, by undergoing decays from the excited levels towards its fundamental state. Gamma rays are emitted here ... of a certain energy, it depends on the levels, we haven't thoroughly measured them yet.

So, if gamma [radiation] is emitted in one direction, the nickel goes in the opposite direction, like a cannon recoiling when it is fired. Therefore nickel releases energy into the medium. And so does gamma — I mean that gamma, when it interacts, gives off its energy. But nickel does this in its immediate surroundings, so it does not travel very far. Thus, the excess energy in the copper -- copper, I'm speaking about copper -- is distributed to the medium, and the temperature of the medium rises, and this facilitates further problems, to the point that, once the process is primed, it keeps on going in like manner, and what happens is that nickel is turned into copper. In fact, we analyzed the material after it had been working for a long time and found copper in it. We went to Padova, where they have the appropriate instrument: we found copper. Copper has two isotopes, the ratio between the two is not in the concentration found in Nature, so we are not dealing with junk copper which has been added, it was produced by us in this manner. Therefore, we produced energy, we produced copper, and got to...

[Male interviewer] But can this reaction be controlled? I mean, if we, let's say, interrupt the inflow of outside energy, is the reaction interrupted as well?

From a certain point on, the system runs by itself. I mean, the problem is starting it, priming it; but one it's primed, it can actually run by itself and we can reduce its energy. The important thing is that it must have a certain amount of energy, because every phenomenon produces thermal energy and thereby locally heats up the system. This is the way it works. In one case we made it run for months, and we heated Rossi's offices, in this way.

The Energy Catalyzer

Right now, there are two possibilities. The household version is an object of this size (it fits between two hands ~20cm apart). You can install it, for example, in the place where

you have your gas heater and you won't be needing gas anymore, you would use this [household version], and it works for months...

[Female interviewer] And then how do you turn it off in hot weather?

(Laughs) At some point in the past, as the device kept working on and on, I started thinking of a hammer. "Let's hit it with a hammer!" (Laughs). Well, what you do is you shut off ... the latest application has nickel inside it, then the hydrogen is supplied by electrolysis, so that … because you cannot keep a hydrogen tank at home, of course, it's dangerous. Instead we generated it from water by electrolysis.

So, the device kept on working, and I thought to myself: "I guess I'm going to have to use a hammer to stop it". Until one day Rossi told me "I stopped it!". "And how did you do that?". He said: "I cut the power to the electrolysis, obviously". Right! All you have to do is run the electrolysis from a separate power source. You cut the power off there, and once the hydrogen is used up, the device stops by itself.

For this we have already carried out the essential tests, the device works, works for months. There is no radioactivity, obviously because there is a lead shield, and we ran some measurements. We also measured the water flowing through the device: we found the same radioactivity as in the water from the waterworks. So there are no radioactive phenomena. Well, clearly the world must pass through all these tests … and after all is said and done, the object already exists. Clearly, in our case, our involvement is over, because we needed the experimental phase to demonstrate its characteristics, but did not go beyond. The next part begins now, it is already beginning now: right now, in Greece they are already building them. The question of Greece came about because Professor Stremmenos — who was a professor at Bologna, whom we've known for years because he too worked in the field of cold fusion (from a more chemical point of view) — when he learned of these results of mine, of ours, he was extremely interested. He contacted Rossi, and since he had been Ambassador of Greece to Italy and knows all the top Greek officials and therefore has no difficulty talking with the government, he took the initiative to start a venture in Greece, and a contract was drawn up. I do not know the details, but for him it was easy to convince the Greek President, the minister... Consequently Greece has signed a contract with Rossi and can build these devices. I do not know the limitations [of the agreement], do not know the details.

[Male interviewer] I understood from that meeting that there was a sort of memorandum of understanding …There is an agreement between Rossi and the University [of Bologna]. Rossi also met the President [of the University], because Rossi is funding research in this field which will be carried out here at the Department of Physics. There is already a relationship, in other words. The President knows him somehow, because in recent days we had the visit of two Swedish professors, which then ...

[Male interviewer] They were in contact with yourself, with Levi, Rossi...

Yes, and with Rossi, they were his guests, and they saw it work, an the experiment was arranged for them. They have seen the device, and also made suggestions and so on.

[Male interviewer] May I ask you something? Now, you probably can not answer, because it's a trade secret. However, Rossi likewise said that there's

nickel, hydrogen, energy is produced. Very well. But even at the presentation of [Jan.] 14th he said "of course, you are allowed to use measuring instruments only to a certain point, because [referring to the secret catalyst] there is something which may not be mentioned.

...something which may not be mentioned.

[Male interviewer] Now, these may well be urban legends, but I have heard people, read things on the Internet, suggesting, among the various ingredients, some amount of natural uranium. These are urban legends, and they are spreading through the Internet.

They have taken this episode as a way of hiding the existence of uranium. No, no, there is no uranium. There is a compound that I do not know (nor want to know) that is meant to facilitate the reaction.

[Male interviewer] Isn't that the famous powder mentioned earlier?

Yes, there is the nickel powder, then there's hydrogen and then there's this chemical compound. The issue came up during that demonstration because, when some people tried to measure the gamma rays, Rossi objected, because by measuring the gamma rays they would have also measured the gamma rays emitted by this secret compound, and so they would have understood what it was, what was in it.

[Male interviewer] What was in the compound...

Yes, and it's part of the patent.

And the purpose of this secret compound is, I believe, to facilitate the formation of atomic hydrogen instead of molecular hydrogen, because hydrogen typically settles down in molecules, but if one has a molecule, it can not penetrate into the nucleus. So I think the additive is used to this purpose: it forms atomic hydrogen, which penetrates into the nucleus.

[Male interviewer] It penetrates into the nucleus...

This is my interpretation, because Rossi did not tell me, nor have I asked him.Of course, looking at the [gamma] rays one can recognize it (and it will be a chemical compound, not just an element) and find out its components ... this perhaps is still not enough ... there may be more than two ... perhaps in different proportions.

[Male interviewer] The question is, if the tube were to break while the machine is running... this an outsider's objection, but ... well. Internally, there are gamma rays shielded by lead. If this shielding fails, would there be any radiation?

Yes, but I think -- we didn't use this -- but I imagine that an application would have an external radiation counter, so if radiation leaks out - for example in case of rupture – the detector counts it, and can issue a warning signal.

[Male interviewer] Or interrupt the catalytic process, as you said earlier, so no radiation is emitted.

Yes, or a circuit which effectively cuts everything off and interrupts it; or a whistle goes off, a warning signal so that the device can be manually shut down.