The Oil Drum
DISCUSSIONS ABOUT ENERGY AND OUR FUTURE

The return of cold fusion?

Posted by Ugo Bardi on May 20, 2011 - 10:40am

Back in 1989, during the craze of the "cold fusion" announcement by Martin Fleischmann and Stanley Pons, a colleague of mine told me about the theory he had developed. It was based on quantum mechanics, he said, and it would explain everything that had been observed in cold fusion on the basis of an adjustable parameter.

Alas, in the real universe parameters cannot be adjusted at will as in the memory of a computer. Cold fusion proved elusive; I myself spent some months at that time with a home-made contraption that should have produced it; looking for the helium atoms that should have been created. I found none and I was not the only one who was disappointed. At that time, practically everyone who had a physics or chemistry lab available tried. But nobody could reproduce the claims about fusion taking place in an electrochemical cell, not even the authors of the claims themselves. So, the idea of cold fusion died out rapidly; surviving mostly in the dreams of crackpots and conspiracy theorists. A few serious scientists kept working on it; there were more claims scattered over the years and a whole new term "LENR" (low energy nuclear reactions) was coined to describe the field. However, after more than 20 years it seems clear that it is not possible to obtain useful energy by cramming deuterium atoms into palladium, as Fleischmann and Pons had tried to do.

So, it would seem that cold fusion as a way of producing energy is something made of the same stuff dreams are made of. That was my conclusion after having worked on it and the reason of my initial reaction of total disbelief when I first heard of the claims of having attained just that dream by two Italian researchers, Andrea Rossi and Sergio Focardi. Yet, in physics there are no absolutes: everything known can be disproved and, in the end, it is the experimental reality that counts. So, I noted that Rossi and Focardi, unlike Pons and Fleischmann, seem to be able to reproduce their result according to several reports that appear reliable. Then, a friend and colleague of mine went to visit Focardi. My friend is not an easily duped person and he went there ready to debunk the hoax. He came back rather perplexed, saying something like, "well, there may be something in this story."

So, what is happening? Have we really made a giant step forward in our quest for a clean and abundant form of energy? Nuclear fusion, after all, is a common physical reality – it can be made to occur in the laboratory in a variety of ways and not just with the giant machine of the "ITER" project which attempts to reproduce the reaction that takes place in the sun. Another kind of fusion is well known and almost commercial: it is the version where a nucleus of boron and one of hydrogen react to form three helium nuclei in a high energy plasma. This system goes under the name of "plasma focus" fusion. It could be used to generate soft x-rays, or neutrons when deuterium is used in the place of hydrogen. But can it be used to generate energy? Some people claim that it can; but surely it has to be difficult because the technology was invented in the 1960s and so far no energy producing prototype seems to be around.

Still, the "plasma focus" technology may be the prototype of a different class of fusion machines which don't try to fuse hydrogen isotopes together. They, rather, try to fuse protons (hydrogen nuclei) with heavier nuclei. Boron is the choice in plasma focus, but there are other possibilities.

What Rossi and Focardi have claimed is that they have been able to fuse a proton with a nickel nucleus. It is a reaction that could, indeed, produce large amounts of energy. The problem with this idea is that there is a tremendous electrostatic barrier that prevents the positively charged proton from entering the positively charged nickel (or other) nucleus. Overcoming these electrostatic barriers in a practical device, usually, requires the use of high energy plasmas which need much more energy to be created and sustained than it can be obtained from fusion. Yet, if it were possible to reduce this potential using some kind of "nuclear catalyst," then one could tap fusion as an energy source. It can be done and it has been done using exotic particles known as "muons," which act as catalysts, indeed. It is an extremely complicated process which takes a lot of energy to create and maintain. Yet, at least it shows that "nuclear catalysis" is possible.

This is what Rossi and Focardi have claimed to have been able to do with their device that they called "Energy Catalyser". They don't claim to be using muons but, somehow, they claim to have been able to activate and maintain the nuclear reaction of hydrogen with nickel by providing much less energy than the reaction then generates. They claim that the EROEI of the device could be around 30 or even larger once the thermal energy generated by the reaction is converted into electrical energy.

So, have we found the magic trick to get abundant and clean energy? Could people go back to speak of electric power "too cheap to meter" as in the heyday of nuclear energy? Perhaps, but it is too early to tell. There are several details that just don't click together in Rossi and Focardi's claims (see, e.g., the article by Kjell Aleklett cited below). If we have to reconcile the energy catalyser concept with what we know of nuclear physics, we have to think of some truly exotic phenomenon that takes place in the reaction chamber. In physics, the experiment reigns, but the possibility of the experimental error is always present. That's why no claim can be considered as validated until the relative experiment is independently reproduced. That will take some time, you can't do physics in a hurry, but in the end we will know.

Some references on the "Energy Catalyser"

Kjell Aleklett's article. http://aleklett.wordpress.com/2011/04/11/rossi-energy-catalyst-a-big-hoa...

Wikipedia has a good page on the story: http://en.wikipedia.org/wiki/Energy_Catalyzer

More info

http://www.physorg.com/news/2011-01-italian-scientists-cold-fusion-video...

http://peswiki.com/index.php/Directory:Andrea_A._Rossi_Cold_Fusion_Gener...

http://www.nyteknik.se/nyheter/energi_miljo/energi/article3111124.ece

http://www.journal-of-nuclear-physics.com/

http://www.express.gr/news/business/434458oz_20110316434458.php3