

## Energy from nuclear fusion within a few years

Nuclear fusion means merging of small atomic nuclei like hydrogen nuclei resulting in strong energy release. This energy generation method will be under development for the next 20-30 years in large international research facilities like ITER in France. If this development will be successful remains to be seen. There are also large problems with the fuel tritium which will be used in such future fusion reactors, since it is radioactive and is not found in nature but has to be produced for example in uranium fission reactors.

Other possibilities for fusion energy however exist. One method which has been known since the 1950-ies is called **muon catalyzed fusion**. Advanced research in many countries shows that this method works.

The fuel in this method is heavy hydrogen, also called deuterium. This form of hydrogen exists in ordinary water and in all living organisms. Deuterium is not radioactive. The reason why this method has not been useful so far is that a source is needed to generate the muons which initiate the fusion reactions. Muons are also called heavy electrons.

At the Department of Chemistry and Molecular Biology, University of Gothenburg, an intense laser-driven source for muons has been developed during the last ten years. During Autumn 2017, a patent was granted for this muon generator with Leif Holmlid as inventor. This patent is owned by a company Ultrafusion which is owned by him together with GU Ventures, the holding company of University of Gothenburg. During 2018, this Ultrafusion company was merged with a Norwegian company Norrønt Fusion Energy AS which works with research in the same scientific area. **It is intended to combine the resources of the two companies to promote and speed up the product development of the fusion reactor which uses the patented muon generator.**

A detailed description of this type of fusion reactor has recently been published in a scientific journal in USA with calculations of how much energy is formed. The journal Fusion Science and Technology is owned by the American Nuclear Society. This article is authored by Leif Holmlid and published with Open Access, which means that everyone can read it for free at this link <https://doi.org/10.1080/15361055.2018.1546090>. It is shown there that it is easy to build fusion reactors with 1 MW heating power, thus with the energy out as hot water or heat in other forms. This type of relatively small heat generator is needed in large numbers in all cold regions of the world to replace heating stations which use fossil or other not renewable fuels. In this way, the emissions of greenhouse gases and of air pollutants be strongly reduced.

This type of fusion reactor generates weak radiation of muons and like other fusion reactors also neutrons. These particles can be stopped quite easily by concrete walls. No dangerous products or rest products are formed. The fuel is very cheap and the running costs for the laser needed for the muon generator are low. There is no risk for uncontrolled nuclear processes which could give explosions or emissions: such risks can exist with other fusion methods. The method with muon catalysis cannot be used for weapons since no chain reaction or explosive ignition of the fuel takes place.

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