## **Thorium Energy Status**

# The ThorEA organisation



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A brief account of the ThorEA organisation, a loosely based UK group promoting the cause of Thorium ADSR systems. The groups current activities are described, and an invitation extended to take part.

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## ThorEA



## The Thorium Energy Amplifier Association



A research association -A Learned Society -

A not-for-profit organisation -

to promote the use of thorium-fuelled energy amplifier systems as a safe, sustainable and publicly-acceptable of nuclear power.

Goal: the construction of a thorium-fuelled ADSR in the United Kingdom.

### Methods:

- Publicity
- Meetings
- Research
- Website



## **Publicity**





### Thorium: Time for a Change in Perception?

Gareth Hatch

Published 7/16/2010

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In discussions and presentations on rare earths and their extraction and processing, junior mining and exploration companies are frequently asked to discuss how they plan to handle and "dispose" of any thorium present in the deposit [especially if the deposit contains monazite]. The presence of thorium in such deposits is usually perceived to be at best a nuisance and at worse, a potentially costly regulatory problem, because of its slightly radioactive nature.

And yet, it wasn't always the case that thorium was perceived to be a problem. Many of the rare earth deposits known today, were discovered by geologists and others looking for either uranium or thoriumbearing minerals. Former thorium-producing mines are now being re-examined and re-vamped as rare earth

Thorium was at one time the subject of significant research as part of the development of nuclear fuel cycles. It ultimately lost out to uranium as the metal of choice for such processes, primarily because the uranium fuel cycle was particularly suited to the production of materials for use in weapons manufacture. Thus the decline in interest was a result of political, not technical reasons.

In recent years, however, there has been a resurgence of interest in the use of thorium for a modernized version of the nuclear fuel cycle. According to the Tho nergy Amplifier Association [ThorEA], there are a number of reasons for this:

. Thorium is over three times more plentiful than uranium and the process of extracting it from minerals is relatively straightforward;



**NOVEMBER** 

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# **Beyond the envelope**

### Accelerator-driven sub-critical reactor

### How it works

Conventional fission involves a self-sustaining nuclear chain reaction, with the neutrons produced in one reaction going on to split more nuclei, and so on. Once a chain reaction is established, then the reactor is said to be "critical" and must be carefully controlled to ensure that the number of neutrons does not escalate and result in "super-criticality". If, on average, fewer than one neutron goes on to split more nuclei, then the reaction is "sub-critical" and the fission will eventually die away. Accelerator-driven sub-critical reactors (ADSRs) are purposely kept sub-critical. The reaction is sustained by actively supplementing the reactor core with extra neutrons using an external accelerator. It fires beams of protons at a heavymetal target within the reactor, where neutrons are chipped off to maintain fission. The chain reaction keeps going as long as the accelerat is still firing protons; to put an end to the reaction, the proton beams are simply turned off. It is proposed that the reactor could burn thorium as a fuel and use lead as the coolant.

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Round and round The EMMA proof-of-principle prototype accelerator can now store a particle beam.

including the Belgian Nuclear Research Centre SCK+CEN, which has funding for a test reactor. The Thorium Energy Amplifier Association (ThorEA) in the UK has called for a public-private partnership in which a public investment of £300m would finance a five-year period of research and development, which it says would stimulate £1.5-2bn of commercial support.

The design is inherently safe, and thorium has many advantages over uranium as a nuclear fuel physicist Carlo Rubbia, the idea has since been (see "Enter the thorium tiger" on p40). Thorium is three times as abundant as uranium and,

moreover, breeder reactors such as ADSRs use all the fuel, meaning supplies will last thousands, rather than hundreds, of years. As a sideline, excess neutrons from the heavy-metal target could be used to convert waste from conventional reactors into isotopes that are much less radioactive.

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Nuclear powe

At present, existing accelerators are just too expensive - each accelerator costs in the region of a billion dollars. Also, accelerators with sufficient reliability - i.e. making sure that the proton beam remains turned on - have not yet been demonstrated. This means that several pricey accelerators are required, not just one. Little ADSR research has so far been carried out.

One promising idea for delivering a reliable beam of high-power protons is the non-scaling fixedfield alternating-gradient accelerator (nsFFAG). A prototype nsFFAG called EMMA has been built at the Daresbury Laboratory in the UK to test the concept, and is now conducting experiments. ThorEA expects that the technologies required for ADSRs will be developed, and functioning demonstrations delivered, within five years and that a privately funded prototype could be built and commissioned by 2025.

Travelling wave react

First suggested by the Nobel-prize-winning

taken on by various research organizations.

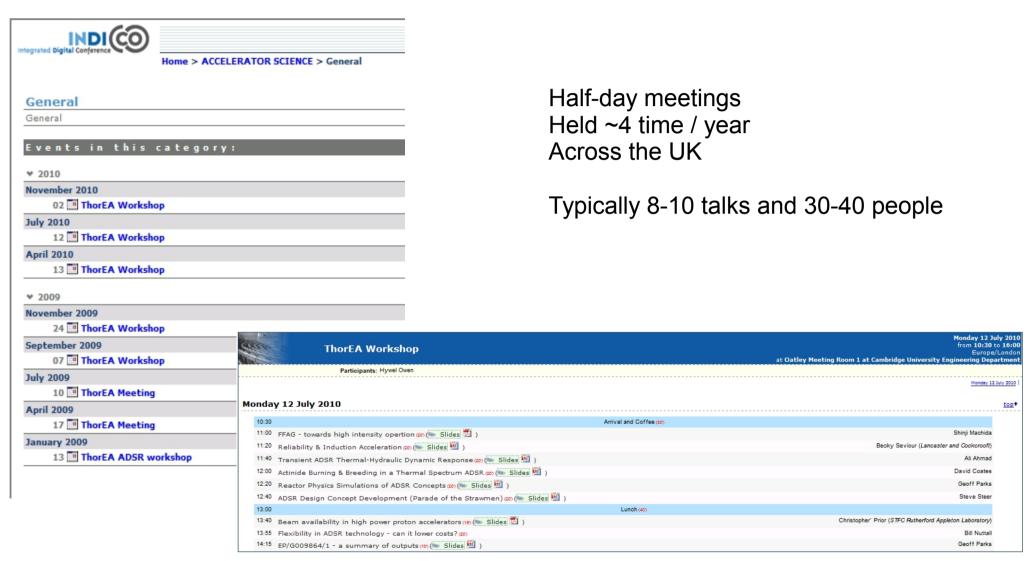
Who is behind it?





## Meetings







## Research



Keep an eye out for opportunities and submit joint research proposals

Score so far: 3/3

- Physics of Thorium ADSRs
- Economics of Thorium ADSRs
- Spallation as a method of enriching Thorium fuel rods

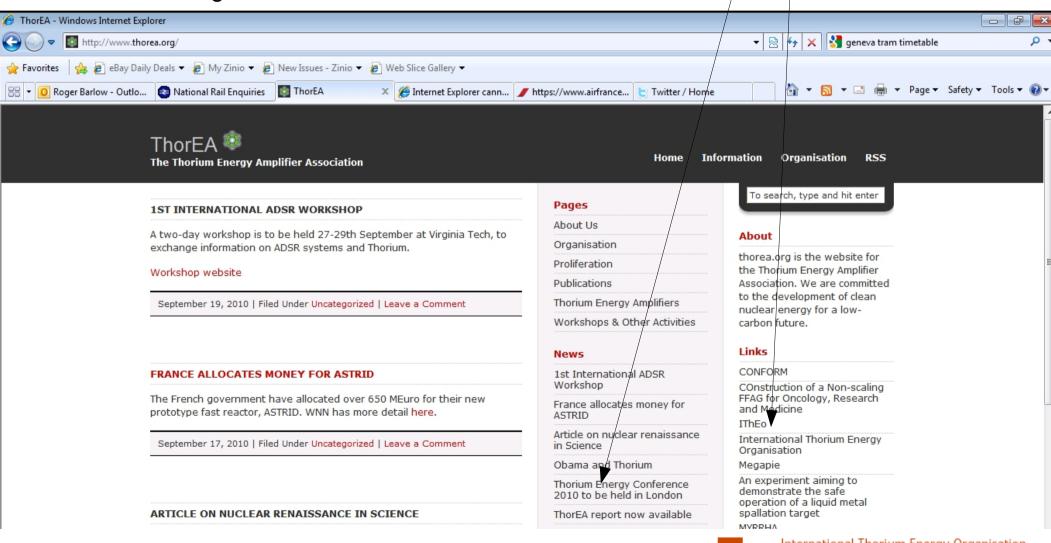


### Website



### http://www.thorea.org

Details of the organisation - Facts about Thorium and ADSRs Links to other sites





## Membership



Membership is open to individual scientists and engineers, to research institutes, and to industrial companies. Individual membership is free of charge

We have about 80 members on our mailing list

Of these about 40 have agreed to have their names on the website as public 'members of ThorEA'

Accelerator scientists
Nuclear Physicists
Reactor engineers
Nuclear chemists
Particle physicists
Nuclear economists

. . . . . .

Universities – Manchester, Liverpool, Cambridge, Huddersfield, Bristol, Imperial College...

Institutes – Daresbury, Rutherford, Cockcroft, John Adams, NNL...

Industry

Overseas

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## Going forward





Next meeting: 2<sup>nd</sup> November, Daresbury Laboratory

Hope to see you there.