ABC News

Lasers could create clean nuclear energy

By Stuart Gary for ABC Science Online

Updated Tue Apr 6, 2010 5:53pm AEST

An Australian-led team of scientists may have found a way of creating a cheap and abundant source of clean energy through nuclear fusion.

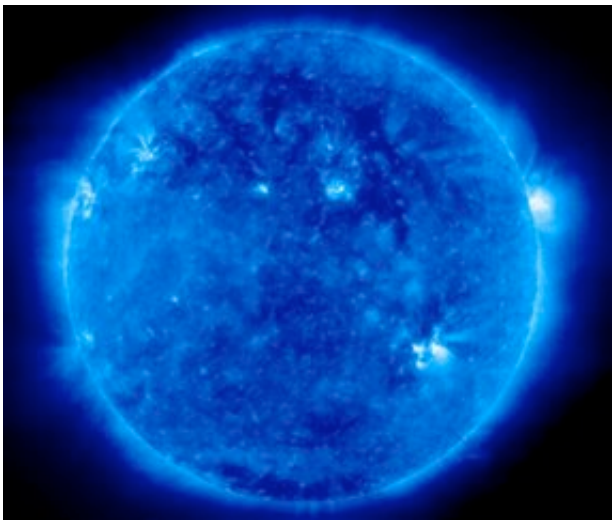
The process could generate no radioactivity and produce little pollution.

The scientists have used computer models to simulate nuclear fusion without the extreme temperatures currently needed for other fusion methods.

Emeritus Professor Heinrich Hora, of the Department of Theoretical Physics at the University of New South Wales, is leading the research effort, and says the process relies on a new generation of extremely powerful and very fast lasers being developed.

"The key is a very carefully controlled extremely short laser pulse essential for ignition. The pulse would ignite a fuel made of ordinary hydrogen and boron-11," Professor Hora said.

"The idea of a hydrogen and boron fusion reaction is interesting because it wouldn't cause neutron production. Neutrons are a problem because they generate radioactivity."



Researchers hope to one day recreate the nuclear process that drives the Sun, using lasers instead of heat and pressure to fuse atoms together (SOHO/ESA/NASA)

- ***Map:** University of New South Wales 2052*

The team's findings appear in the journal Energy and Environmental Science.

Professor Hora says his team was originally developing computer models using next generation lasers to duplicate the work being done at the new $4.34 billion National Ignition Facility at the Lawrence Livermore National Laboratory in the United States.

The US scientists are developing what is currently the world's largest laser to ignite highly compressed spheres of deuterium-tritium fuel in a nuclear fusion reaction.

Fast and furious

The laser can produce a pulse of a few billionths of a second duration which produces 500 times more power than all US power stations combined.

Professor Hora's team originally rejected the idea of a hydrogen-boron fuel for their simulations "because the higher temperatures and compression needed made it 100,000 times more difficult than the Lawrence Livermore approach, making it just about impossible".

"But when we ran computer simulations using these next generation petawatt [quadrillion watt] strength lasers with

a hydrogen-boron fuel, we were shocked to find that it's only 10 times more difficult than deuterium-tritium," he said.

"It makes this all within the reach of current technology in a relatively short time. In fact these types of lasers are already in early testing at the Los Alamos National Laboratory."

Professor Hora says the key is to ensure the laser pulse is "extremely clean", lasting no more than a millionth of a millionth of a second.

"This allows conversion of optical energy to mechanical energy without heating," he says.

Professor Hora says the hydrogen-boron fuel has a numberof advantages over deuterium-tritium.

"It would be largely free of radioactive emissions producing less radiation than that emitted by current power stations that burn coal, which contains trace amounts of uranium," he says.

According to Professor Hora, hydrogen and boron are plentiful and readily accessible, and the waste product of ignition would be clean helium gas.

"The hydrogen-boron fuel would not have to be compressed. This means it needs far less energy to start the ignition," he said.

But Professor Hora warns the study only demonstrates the potential of the new process and much work needs to be done to demonstrate it in practice.

Tags: science-and-technology, energy, engineering, physics, united-states, university-of-new-south-wales-2052

First posted Tue Apr 6, 2010 5:52pm AEST

MORE stories from New South Wales