New laser technique may help find supernova

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One single atom of a certain isotope of hafnium found on Earth would prove that a supernova once exploded near our solar system. The problem is how to find such an atom - among billions of others. Researchers at the University of Gothenburg, Sweden, have developed a laser technique that, in combination with standard techniques, may be able to do the job.

Hafnium is a common metallic element used in nuclear reactors. However, one of its isotopes is hard to find since it is only made when a supernova explodes. This means that if the isotope, called 182Hf, were discovered on Earth, it would prove that a supernova once exploded near our solar system. This has caused physicists around the world to work hard to find the isotope.

Unfortunately, this particular isotope is difficult to distinguish from other atoms - only one in many billions of hafnium atoms is believed to be of the sought-after kind. Researcher Pontus Andersson from the Department of Physics at the University of Gothenburg and colleagues from USA, Germany and Austria have developed a laser technique that can be used to reject irrelevant atoms, and therefore isolate the unique 182Hf.

In technical terms, their new technique concerns negative ions, which are atoms or molecules with one extra electron. By using laser to detach the extra electron and at the same time register the level of energy needed to do this, it is known that the strength of the bond between the extra electron and the rest of the atom or molecule varies among different

substances.

This means that by choosing a certain wavelength of the laser light, they can detach the extra electron from some elements while ions of other elements remain intact. Consequently, if 182Hf exists on Earth, then Andersson and his colleagues should be able to find it, simply by using laser light to remove sufficient amount of other, more common, interfering atoms, to allow detection of 182Hf by conventional methods.

The new technique is a product of advanced atomic physics experiments conducted together with Stockholm University, The VERA institute i Vienna, Austria and Oak Ridge National Lab in USA.

'Our goal is to develop a method that can be of aid when searching for very unusual isotopes. In many cases the standard methods used are hampered by other, interfering atoms. The technique is still in its infancy, but we have shown that our laser beam can remove 99.99 % of the interfering ions in a beam without destroying the ions we are looking for', says Andersson.

Source: University of Gothenburg (news : web)