Evidence found of ions behaving differently than expected in fusion reactions

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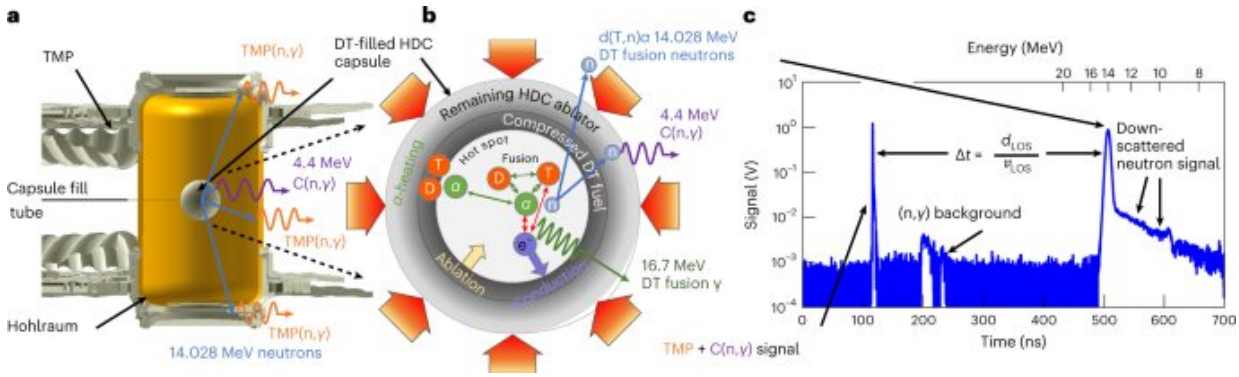

Indirect-drive inertial confinement fusion. Credit: *Nature Physics* (2022). DOI: 10.1038/s41567-022-01809-3

A team of researchers at the National Ignition Facility (NIF) at the Lawrence Livermore National Laboratory, in California, has found evidence of ions behaving differently than expected in their fusion reactions.

In their paper published in the journal *Nature Physics*, the group describes their study of ions in the plasma generated in their reactor. Stefano Atzeni, with Università di Roma "La Sapienza," has published a News & Views piece in the same journal issue giving an overview of the work being done at the NIF and the effort now being conducted by the team to better understand the unexpected ion behavior.

Scientists around the world have been trying for many years to replicate the fusion reactions that occur in the sun—this could provide humanity a nearly limitless source of energy. Such work has been step-by-step, with researchers tweaking reactors in search of the right combination of factors to produce more energy than is used to run the reactor.

The team at NIF built a reactor that involves firing multiple lasers at a cylinder containing a sphere of deuterium and tritium. This results in the atoms in the sphere fusing to become helium atoms, thereby releasing a large amount of energy. The problem still remains of keeping the reaction going without continuous firing of the lasers.

In their reactor, plasma forms as heat builds up in the sphere. And it was in the plasma that the researchers found something unexpected—the ions inside of it have higher energy than theory has been predicting, at least during the highest-performing stages.

This finding means that theorists will have to go back to their whiteboards and modify the theory before more experiments can be conducted. But it also offers reason for optimism: in modifying the theory to explain the higher energy, the researchers may find a way to achieve ignition—the beginnings of a self-sustaining reaction.

More information: E. P. Hartouni et al, Evidence for suprathermal ion distribution in burning plasmas, *Nature Physics* (2022). DOI: 10.1038/s41567-022-01809-3

Stefano Atzeni, Burning plasma surprise, *Nature Physics* (2022). DOI: 10.1038/s41567-022-01820-8