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Laser-plasma acceleration inducing nuclear fusion reactions

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After the development of very high intensity, ultra-short pulse laser systems, laser-plasma acceleration has become a concrete reality. This new acceleration technique is an interesting alternative to the gigantism of conventional accelerators and is, however, paving the way for innovative applications in a number of fields, especially the medical one. What was difficult to predict is that such acceleration techniques could also be useful in the field of the studies on nuclear fusion processes. In fact, considering the energy values of protons and ions accelerated by laser-plasma techniques (some MeV/uma), it is possible to induce nuclear fusion processes by addressing these protons/ions on suitable targets. Essentially, instead of bringing the fusion plasma to several dozen or hundreds of keVs, the partners of the fusion process are collided, giving them a kinetic energy in the mass center of the same order or higher. This report will present recent results obtained in collaboration with the INER group of the ENEA Research Center in Frascati at the CELIA laboratory in Bordeaux, regarding the nuclear fusion processes D+D and p+11B.

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