Laser-Assisted Muon-Catalyzed Fusion

Patent Pending

This process provides the missing component to making muon-catalyzed a source of fusion energy—namely the use of quantum control with an x-ray laser to control the molecule formation and the subsequent muon release.

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Key Features:
Provides a source of fusion, which has the potential to provide abundant net energy.

Field:
Physics

Technology:
Uses X-ray lasers and accelerator produced muons

Stage of Development:
Feasibility and reactor concept are under study

Status:
Seeking venture capital support

Patent Status:
Pending

Background:

The United States has now narrowed its research focus in the quest to produce fusion energy in a commercially viable way. The two primary directions are magnetic confinement using Tokamaks (ITER—International Thermonuclear Experimental Reactor at Cadarache, France) and fast ignition (laser generated implosion) at the Lawrence Livermore Laboratory NIF (National Ignition Facility). Alternative fusion concepts are being de-emphasized by the government funding. This patent proposal is concerned with another alternative fusion concept (distinguished from alternative confinement concept)—muon catalyzed fusion (μCF).

Statement of Problem:

The objective is to use X-ray lasers to enhance μCF. The X-ray laser is used in a quantum control mode (interference of laser beams to manipulate a reaction) to catalyze the fusion of a deuterium nucleus and a tritium nucleus having started with a deuterium-tritium-muon (dtμ) molecule, and to eject a muon for a subsequent molecule formation and fusion chain reaction. The fundamental feature of this system which makes it interesting for fusion is that the muon has a mass which is much larger than the mass of an electron and thus the deuterium and tritium are much closer together in the molecule and as a result, fusion is much more likely. The muon has a lifetime of about two seconds and about one million fusions can occur in the lifetime of the muon. The problem is that the molecule takes too long to form and the muon sticks to the residual nucleus far too long. Thus, experimentally, only about one hundred fusions have been achieved in the lifetime of the muon. About one hundred and ninety fusions are needed to produce more output energy than is imput into the muon fusion system.

Potential Solution:

The connection between X-ray lasers and μCF has been considered before but apparently not in terms of a quantum control application. The present proposal is to use the X-ray laser to enhance the tunneling of the muon into the continuum by Quantum Control, as well as to control the quantum states of collision products in a way, which will increase the fusion rate. The core idea is to use X-ray lasers in a quantum control mode to catalyze the fusion of a deuterium nucleus and a tritium nucleus, having started with dtμ and to eject a muon for a subsequent molecule formation (reduced sticking fraction) and fusion.

Commercialization Status:

The feasibility and reactor design are under study.