

# The simple amateur fusor: a description, a definition and how it works

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## Overview

This short paper will describe, in some detail, the simple amateur fusor as normally constructed that is capable of fusion. A complete description of the device will be given followed by a comprehensive definition of the device in the shortest possible, yet complete, scientific manner. Following the definition, the physics involved in achieving fusion within the simple fusor will be given.

## Description

The simple fusor is a closed, evacuated metallic conductive vessel that contains an insulated single grid. This vessel can be a sphere, a cylinder, or any regular shape about the grid. The grid is typically optically transparent to light. It can mime the shape of its reactor vessel. The grid is normally constructed of some form of high melting point metal and is most often constructed of wire made from this metal.

A DC power supply that is fully variable from zero volts to an extremely high DC potential with some current capacity is placed between the insulated grid and the reactor's metal shell or vessel. The power supply must have a "DC positive ground" terminal connected to the reactor vessel or shell. The "hot" high voltage is "negative" with respect to the metallic reactor vessel.

Deuterium gas is admitted in a manner suitable that a working pressure of 5-20 microns, ( $5 \times 10^{-3}$  to  $2 \times 10^{-2}$  torr), is maintained during operation over a wide range of voltages.

With proper operation, by a trained hand, fusion takes place within the reactor vessel.

## Definition

The simple amateur fusor is a deuteron "accelerator-collider", achieving fusion within a large volume of contained "velocity space." Deuterium-Deuterium Fusion takes place by many and varied reactions within this velocity space.

## The fusion physics of D-D fusion in the simple fusor.

The admitted Deuterium gas is ionized to deuterons via the applied high voltage creating a glow discharge or ionization, within the vessel. This process is on-going. The system is delicately balanced between simple glow discharge and Townsend arc breakdown by a competent operator.

Positive charged Deuterons created in the gas volume are accelerated towards the negative grid. The vast majority of these never attain the applied potential fusion energy. Some tiny fraction of these idealized deuterons will collide head-on with other fusion energy deuterons within the grid. This is the "ideal" fusion and is rare. Both fusion energy and non-fusion energy deuterons that do not collide within the grid can recirculate within the fusor's gas volume. Thus, the entire interior of the fusor is filled with a "velocity space" of fast deuterons and fast neutralized deuterium gas molecules. Within this large volumetric velocity space many other equally rare fusion events can take place via collisions. Among those listed below, no data exists as to which if any of the collisional processes produce the greatest fusion. It is known that all do occur within the velocity space in the reactor.

The degree to which all the processes are involved is unknown. This is due to the simplistic operational nature of the simple fusor that a complex mixture of all the processes listed below can take place. In the end, it is a summed group of disparate, unlikely fusion events and processes that can and do occur in the fusor's velocity space.

### **Types of fusion possible within the simple fusor that contribute to the totality of the fusion produced.**

**Deuteron-Deuteron fusion** – These are idealized fusions and the reaction that the physics says will do fusion. Note: these can be fast deuteron and slow deuteron collisions within the grid or within velocity space outside of the grid. Thus, within this one category we have two possibilities for fusion.

**Deuteron-Neutral fusion** – a fast or full fusion energy deuteron can strike a slow neutral deuterium gas atom and produce fusion. This is a rare occurrence in velocity space.

**Deuteron- Fast neutral fusion** - Many high-speed or “fast Deuterons” can be neutralized by similar directional and velocity electrons within the gas plasma in velocity space. Neutralization does not alter the velocity of the now neutralized deuterium gas atom. A full energy deuteron can collide and fuse with a fast neutral in some rare instances.

**Fast neutral-Fast neutral fusion** – this would be an extremely rare, but statistically possible event when two recently full energy deuterons are neutralized to just fast neutral deuterium atoms. Again, velocity space makes this a possibility within the simple fusor.

**Fast neutral-Target fusion** - It is known that deuterium neutrals be they fast or slow, if not re-ionized in velocity space, will strike the wall of the vessel, and be “implanted” within the wall's metal lattice. This is a well-known process involving hydrogen and its isotopes. A fast neutral slamming into a deuterium atom within the wall's metal lattice can do fusion.

**Wall boosted fusion** - Embedded deuterium atoms in the wall's metal lattice are constantly bombarded by electrons and fast neutrals. This can dislodge and ionize the buried deuterium atom, creating a deuteron. Deuterons popping out of the wall are ideal! They can accelerate from that point to full fusion energy as they accelerate to the grid.

Thus, the entire surface area of the vessel will, over time, load to some degree with deuterium atoms. Popping out of the wall as deuterons they can act as a broad source of deuterons much as would an ion gun source!

### **Summary**

It is to be remembered that all the above processes contribute to the fusion total within the simple amateur fusor. Many things conspire to reduce the idealized deuteron-deuteron fusion that we seek, but many processes within velocity space still create fusion. fusion, the fusor is a grossly inefficient fusion reactor with a COP, (Coefficient of Performance) of  $1:10^9$ . Nevertheless, some fusors have been made by amateurs that can produce 4-6 million fusions per second.