MAGNETIC FIELD PLASMA CONFINEMENT FOR COMPACT FUSION POWER

TECHNICAL FIELD

[1] This disclosure generally relates to fusion reactors and more specifically to magnetic field plasma confinement for compact fusion power.

BACKGROUND

[2] Fusion power is power that is generated by a nuclear fusion process in which two or more atomic nuclei collide at very high speed and join to form a new type of atomic nucleus. A fusion reactor is a device that produces fusion power by confining and controlling plasma. Typical fusion reactors are large, complex, and cannot be mounted on a vehicle.

SUMMARY OF PARTICULAR EMBODIMENTS

[2a] According to a first aspect of the present invention, there is provided a fusion reactor comprising:

an enclosure comprising:

a centerline running down a center axis of the enclosure;

a first end and a second end that is opposite from the first end; and

a midpoint that is substantially equidistant between the first and second ends of the enclosure;

two internal magnetic coils suspended within the enclosure and centered on the centerline, the two internal magnetic coils each having a toroidal shape, the two internal magnetic coils comprising:

a first internal magnetic coil located between the midpoint and first end of the enclosure; and

a second internal magnetic coil located between the midpoint and the second end of the enclosure;

a plurality of encapsulating magnetic coils centered on the centerline, the encapsulating magnetic coils having a larger diameter than the internal magnetic coils, the plurality of encapsulating magnetic coils comprising:

at least two first encapsulating magnetic coils located between the midpoint and the first end of the enclosure; and

at least two second encapsulating magnetic coils located between the midpoint and the second end of the enclosure;

a center magnetic coil centered on the centerline and located proximate to the midpoint of the enclosure; and

two mirror magnetic coils centered on the centerline and comprising:

a first mirror magnetic coil located proximate to the first end of the enclosure; and

a second mirror magnetic coil located proximate to the second end of the enclosure;

wherein the magnetic coils are operable, when supplied with electrical currents, to form magnetic fields for confining plasma within the enclosure.

[2b] According to a second aspect of the present invention, there is provided a fusion reactor comprising:

an enclosure comprising:

a first end and a second end that is opposite from the first end; and

a midpoint that is substantially equidistant between the first and second ends of the enclosure;

two internal magnetic coils suspended within the enclosure, each internal magnetic coil positioned on an opposite side of the midpoint of the enclosure from the other internal magnetic coil;

one or more encapsulating magnetic coils positioned on each side of the midpoint of the enclosure, each encapsulating magnetic coil being coaxial with the internal magnetic coils; and

two mirror magnetic coils coaxial with the internal magnetic coils, each mirror magnetic coil positioned on an opposite side of the midpoint of the enclosure from the other mirror magnetic coil;

wherein the magnetic coils are operable, when supplied with electrical currents, to form magnetic fields for confining plasma within the enclosure.

[2c] According to a third aspect of the present invention, there is provided a fusion reactor comprising:

two internal magnetic coils suspended within an enclosure;

a center magnetic coil coaxial with the two internal magnetic coils and located proximate to a midpoint of the enclosure;

a plurality of encapsulating magnetic coils coaxial with the internal magnetic coils, the encapsulating magnetic coils being operable to preserve the magnetohydrodynamic (MHD) stability of the fusion reactor by maintaining a magnetic wall that prevents plasma within the enclosure from expanding; and

two mirror magnetic coil coaxial with the internal magnetic coils.

[3] According to one embodiment, a fusion reactor includes two internal magnetic coils suspended within an enclosure, a center magnetic coil coaxial with the two internal magnetic coils and located proximate to a midpoint of

the enclosure, a plurality of encapsulating magnetic coils coaxial with the internal magnetic coils, and two mirror magnetic coil coaxial with the internal magnetic coils. The encapsulating magnetic coils preserve the magnetohydrodynamic (MHD) stability of the fusion reactor by maintaining a magnetic wall that prevents plasma within the enclosure from expanding.

[4] Technical advantages of certain embodiments may include providing a compact fusion reactor that is less