mid-plane of the compression chamber, a first compression section coupled on a first end to an exit end of the formation section, the first compression section being configured to adiabatically compress the compact toroid as the compact toroid traverses the first compression section towards the mid-plane of the compression chamber, an acceleration section coupled on a first end to a second end of the first compression section, the acceleration section comprising modularized acceleration systems for axially accelerating the compact toroid and translating the compact toroid towards the mid-plane of the compression chamber, a second compression section coupled on a first end to a second end of the acceleration section and on a second end to a first end of the compression chamber, the second compression section being configured to adiabatically compress the compact toroid as the compact toroid traverses the second compression section towards the mid-plane of the compression chamber.

[0011] In certain embodiments, a system for merging and compressing compact tori comprises a staged symmetric sequence of compact tori formation, axial acceleration by fast active magnetic coils, passive adiabatic compression by way of a conically constricting flux conserver, and ultimately merging of the compact tori and final fast magnetic compression in a central compression chamber. The intermediate steps of sufficient axial acceleration followed by adiabatic compression can be repeated multiple times to achieve adequate target conditions before merging and final compression. In this way a reactor can be realized by adding further sections to the system.

south diametrically opposed compact tori formation sections 12N and 12S. The first and second formation sections 12N and 12S include a modularized formation and acceleration systems 120 (discuss below in detail with regard to see Figures 2-4) for generating first and second compact plasma tori and axially accelerating and translating the compact tori towards a mid-plane of the compression chamber 20.

[0041] As depicted, the system 10 further includes a first pair of north and south diametrically opposed compression sections 14N and 14S coupled on a first end to an exit end of the north and south formation sections 12N and 12S. The north and south compression sections 14N and 14S being configured to adiabatically compress the compact tori as the compact tori traverse the north and south compression sections 14N and 14S towards the mid-plane of the compression chamber 20.

[0042] As depicted, the system 10 further includes a pair of north and south diametrically opposed acceleration sections 16N and 16S coupled on a first end to a second end of the first pair of north and south compression sections 14N and 14S. The north and south acceleration section 16N and 16S include modularized acceleration systems (discussed below with regard to Figures 2-4) for axially accelerating and translating the compact tori towards the mid-plane of the compression chamber 20.

[0043] As further depicted, the system 10 further includes a second pair of north and south diametrically opposed compression sections 18N and 18S coupled on a first end to a second end of the north and south acceleration sections 16N and 16S and on a second end to first and second diametrically opposed ends of the compression chamber, the second pair of north and south compression sections 18N and 18S being configured to adiabatically compress the compact tori as the compact tori traverse the second pair of north and south compression sections 18N and 18S towards the mid-plane of the compression chamber 20.

[0044] The compression chamber includes a modularized compression systems configured to magnetically compress the compact tori upon collision and merger thereof.

[0045] As depicted the north and south formation sections 12N and 12S, the north and south acceleration sections 16N and 16S and the compression chamber 20 are cylindrically shaped. The diameter of the north and south acceleration sections 16N and 16S is smaller than the diameter of the north and south formation sections 12N and 12S, while the diameter of the compression chamber 20 is smaller than the diameter of the north and south acceleration sections 16N and 16S.

[0046] The first and second pairs of north and south compression sections 14N, 14S, 18N and 18S are truncated conically shaped with their diameter being larger on a first end than on a second end enabling a transition in the overall diameter of the system 10 from the formation sections 12N and 12S to the acceleration sections 16N and 16S to the compression chamber 20. As depicted, the north and south formation sections 12N and 12S, the first pair of north and south compression sections

CLAIMS

What is claimed is:

1. A system for merging and compressing compact tori plasma comprising

a compression chamber,

a compact toroid formation section, the formation section comprising modularized formation and acceleration sections for generating a compact toroid and axially accelerating the compact toroid and translating the compact toroid towards a mid-plane of the compression chamber,

a first compression section coupled on a first end to an exit end of the formation section, the first compression section being configured to adiabatically compress the compact toroid as the compact toroid traverses the first compression section towards the mid-plane of the compression chamber,

an acceleration section coupled on a first end to a second end of the first compression section, the acceleration section comprising modularized acceleration systems for axially accelerating the compact toroid and translating the compact toroid towards the mid-plane of the compression chamber,

a second compression section coupled on a first end to a second end of the acceleration section and on a second end to a first end of the compression chamber, the second compression section being configured to adiabatically compress the compact toroid as the compact toroid traverses the second compression section towards the mid-plane of the compression chamber.

2. The system of claim 1, wherein the compression chamber is configured to magnetically compress the compact toroid.

3. The system of claim 1, wherein the formation section, the acceleration section and the compression chamber are cylindrically shaped, the diameter of the acceleration section being smaller than the diameter of the formation section and the diameter of the compression chamber being smaller than the diameter of the acceleration section.

4. The system of claim 1, wherein the first and second compression sections are trunco-conically shaped with the diameter of the first and second compression sections being larger on the first end than on the second end.

5. The system of claim 1, wherein the formation section, the first and second compression sections, the acceleration section, and the compression chamber are axially aligned.

6. The system of claim 1, wherein a plurality of active magnetic coils are disposed about and axially along the formation section, the acceleration section, and the compression chamber.

7. The system of claim 1, further comprising triggering control and switch systems configured to enable a staged sequence of compact toroid formation and axial acceleration by active magnetic coils.

8. The system of claim 7, wherein the triggering control and switch systems are further configured to enable magnetic compression of the compact toroid by active magnetic coils in a staged sequence following the staged sequence of compact toroid formation and axial acceleration by active magnetic coils.

9. The system of claim 7, wherein the triggering control and switch systems are configured to synchronize the compact toroid formation and acceleration in the formation section and synchronize the compact toroid acceleration in the acceleration section with the positioning of a second compact toroid at the mid-plane of the compression chamber.

10. The system of claim 9, wherein the triggering control and switch systems are further configured to synchronize the compression of the compact toroid and the second compact toroid with the compact toroid formation and acceleration in the formation section, the compact toroid acceleration in the acceleration section and the positioning of the second compact toroid at the mid-plane of the compression chamber.

11. The systems of claim 6 further comprising a plurality of DC magnetic coils disposed about and axially along the compression chamber and the formation,

compression and acceleration sections to form a bias or DC guide field within and extending axially through the compression chamber and the formation, compression and acceleration sections.

12. The system of claim 1 further comprising a cylindrical shell or liner positioned within the compression chamber for fast liner compression.

13. The system of claim 1 further comprising one of a mirror and a bounce cone coupled to a second end of the compression chamber.

14. The system of claims 1 through 12 further comprising

a second compact tori formation section diametrically opposed to the compact formation section, the second formation section comprising modularized formation and acceleration systems for generating fa plasma compact tori and axially accelerating the compact tori and translating the compact tori towards a mid-plane of the compression chamber,

a third compression section diametrically opposed to the first compression section and coupled on a first end to an exit end of the second formation section, the third compression section being configured to adiabatically compress the compact tori as the compact tori traverse the third compression section towards the mid-plane of the compression chamber,

a second acceleration section diametrically opposed to the acceleration section and coupled on a first end to a second end of the third compression section, the second acceleration section comprising modularized acceleration systems for axially accelerating the compact tori and translating the compact tori towards the mid-plane of the compression chamber, and

a fourth compression section diametrically opposed to the second compression section and coupled on a first end to a second end of the second acceleration section and on a second end to a second end of the compression chamber diametrically opposed to the first end of the compression chamber, the fourth compression section being configured to adiabatically compress the compact tori as the compact tori traverse the fourth compression section towards the mid-plane of the compression chamber.

15. The system of claim 14, wherein the compression chamber is configured to magnetically compressing the compact tori upon collision and merger thereof.

16. The system of claim 14, wherein the compression chamber comprises a modularized compression system for magnetically compressing the compact tori upon collision and merger thereof.

17. The systems of claim 14 further comprising a plurality of DC magnetic coils disposed about and axially along the compression chamber and the formation, compression and acceleration sections to form a bias or DC guide field within and extending axially through the compression chamber and the formation, compression and acceleration sections.

18. The system of claim 14 further comprising a cylindrical shell or liner positioned within the compression chamber for fast liner compression.