CLAIMS

1. ~~A~~ A method of merging and compressing compact tori plasma within a system ~~for merging and compressing compact tori plasma~~ comprising

~~a compression~~central chamber~~,~~

~~first and second~~ (20), diametrically opposed ~~compact tori~~ formation sections~~, the first and second~~ (12N, 12S), a plurality of active magnetic coils (32N, 32S) disposed about and axially along the formation sections ~~comprising modularized formation and~~, one or more acceleration ~~systems for generating first and second plasma compact tori and axially accelerating the compact tori and translating the compact tori towards a mid-plane of the compression chamber,~~

~~first and second diametrically opposed compression sections coupled on a first end to an exit end of the first and second formation~~ sections (16N, 16S), a plurality compression sections~~, the first and second compression sections being~~ (14N, 14S) configured ~~to adiabatically compress the compact tori as the compact tori traverse the first and second compression sections towards the mid-plane of the compression chamber,~~

~~first and second diametrically opposed~~ with a conically constricting flux conserver and interposing the formation sections and adjacent acceleration sections ~~coupled on a first end to a second end of~~and interposing the ~~first and second compression sections, the first~~central chamber and ~~second~~adjacent acceleration ~~section comprising modularized acceleration systems for axially accelerating the compact tori~~ sections, and ~~translating the compact tori towards the mid-plane of the compression chamber, and~~

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

~~2. The system of claim 1, wherein the compression chamber is configured to magnetically compressing the compact tori upon collision and merger thereof.~~

~~3. The system of claim 1, wherein the compression chamber comprises a modularized acceleration system for magnetically compressing the compact tori upon collision and merger thereof.~~

~~4. The system of claims 1 through 3, wherein the first and second formation sections, the first and second acceleration sections and the compression chamber are cylindrically shaped, the diameter of the first and second acceleration sections being smaller than the diameter of the first and second formation sections and the diameter of the compression chamber being than the diameter of the first and second acceleration sections.~~

~~5. The system of claims 1 through 4, wherein the first, second, third and fourth compression sections are truncated conically shaped with the diameter of the first, second, third and fourth compression section being larger on first end than on the second end.~~

~~6. The system of claims 1 through 5, wherein the first and second formation sections, the first and second compression sections, the first and second acceleration sections and the third and fourth compression sections are axially symmetric.~~

~~7.~~ ~~The system of claims 1 through 6, wherein~~ a plurality of active magnetic coils ~~are disposed about and axially along the first and second formation sections, the first and second acceleration sections, and the compression chamber.~~

~~8. The system of claims 1 through 7, further comprising triggering control and switch systems configured to enable a staged symmetric sequence of compact tori formation in the first and second formation sections and axial acceleration by active magnetic coils in the first and second acceleration sections.~~

~~9. The system of claims 1 through 8, wherein the triggering control and switch systems are configured to synchronize the compact tori formation and acceleration in the first and second formation sections and synchronize the compact tori acceleration in the first and second acceleration sections.~~

~~10. The system of claim 9, wherein the triggering control and switch systems are further configured to synchronize the magnetic compression with the compact tori formation and acceleration in the first and second formation sections and the compact tori acceleration in the first and second acceleration sections.~~

~~11. The systems of claims 1 through 10 further comprising a plurality of DC magnetic coils~~(36N and 36S) disposed about and axially along the ~~central compression chamber and the formation, compression and acceleration sections to form a bias or DC guide field within and extending axially through the central compression chamber and the formation, compression and acceleration sections.~~

~~12. The system of claims 1 through 11 further comprising a cylindrical shell or liner positioned within the central compression chamber for fast liner compression.~~

~~13. 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 sections 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.

14. The system of claim 13, wherein the compression chamber is configured to magnetically compress the compact toroid.

15. The system of claims 13 and 14, 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.

16. The system of claims 13 through 15, 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.

17. The system of claims 13 through 16, wherein the formation section, the first and second compression sections, the acceleration section, and the compression chamber are axially aligned.

~~18. The system of claims 13 through 17, wherein a plurality of active magnetic coils are disposed about and axially along the formation section, the acceleration section, and the compression chamber.~~

~~19. The system of claims 13 through 18, further comprising triggering control and switch systems configured to enable a staged sequence of compact toroid formation and axial acceleration by active magnetic coils.~~

~~20. The system of claim 19, 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.~~

~~21. The system of claim 19, 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.~~

~~22. The system of claim 20, 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.~~

~~23. The systems of claims 13 through 22 further comprising a plurality of DC magnetic coils disposed about and axially along the central compression chamber and the formation, compression and acceleration sections to form a bias or DC guide field within~~

and extending axially through the central compression chamber and the formation, compression and acceleration sections.

24. The system of claims 13 through 23 further comprising a cylindrical shell or liner positioned within the central compression chamber for fast liner compression.

25. The system of claims 13 through 24 further comprising one of a mirror and a bounce cone coupled to a second end of the central compression chamber.

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

a central chamber,

a pair of diametrically opposed formation sections,

one or more diametrically opposed pairs of acceleration sections, and

one or more diametrically opposed pairs of compression sections interposing the formation sections and acceleration sections adjacent to the formation sections and interposing the central chamber and acceleration sections adjacent to the central chamber,

wherein the system is configured to enable a staged symmetric sequence of compact tori formation, axial acceleration by active magnetic coils about the formation and acceleration sections, passive adiabatic compression of the compact tori within a conically constricting flux conserver of the compression sections, and magnetic compression within the central chamber.

27. The system of claim 26, wherein the compression chamber is configured to magnetically compress the compact tori upon collision and merger thereof.

~~28. The system of claims 26 and 27, wherein the formation sections, the acceleration sections and the central chamber are cylindrically shaped, the diameter of the acceleration sections being smaller than the diameter of the formation sections and smaller than the preceding acceleration section in a direction from the formation section to the central chamber, and the diameter of the central chamber being smaller than the diameter of the acceleration sections.~~

~~29. The system of claims 26 through 28, wherein the compression sections are trunco-conically shaped with the diameter of the compression section being larger on a first end than on a second end, wherein the second end of each compression section being closer to the central chamber than the first end.~~

~~30. The system of claims 26 through 29, wherein the formation sections, the one or more pairs of compression sections, and the one or more pairs of acceleration sections are axially symmetric.~~

~~31. The system of claims 26 through 30, wherein a plurality of active magnetic coils are disposed about and axially along the formation sections, the acceleration sections, and the central chamber.~~

~~32. The system of claims 26 through 31, further comprising triggering control and switch systems configured to enable staged symmetric sequence of compact tori formation in the formation sections and axial acceleration in the acceleration sections.~~

~~33. The system of claim 32, wherein the triggering control and switch systems are further configured to enable magnetic compression of the compact tori by active magnetic coils in a staged sequence following the staged sequence of compact tori formation and axial acceleration by active magnetic coils.~~

~~34. The system of claim 32, wherein the triggering control and switch systems are configured to synchronize the compact tori formation and acceleration in the pair of formation sections and synchronize the compact tori acceleration in the one or more pairs of acceleration sections.~~

~~35. The system of claim 33, wherein the triggering control and switch systems are further configured to synchronize the compression of the compact tori with the compact tori formation and acceleration in the formation section and the compact tori acceleration in the acceleration section.~~

~~36. The system of claims 26 through 35 wherein the compression sections interpose the central chamber and adjacent acceleration sections.~~

~~37. The systems of claims 26 through 36 further comprising a plurality of DC magnetic coils disposed about and axially along the central compression chamber and the formation, compression and acceleration sections to form a bias or DC guide field within and extending axially through the central compression chamber and the formation, compression and acceleration sections.~~

~~38. The system of claims 26 through 437 further comprising a cylindrical shell or liner positioned within the central compression chamber for fast liner compression.~~

~~39. A method of merging and compressing compact tori plasma within in a system comprising a central chamber, diametrically opposed formation sections, one or more acceleration stages, and a plurality compression stages interposing the formation sections and adjacent acceleration stages, and the central chamber and adjacent acceleration stages,~~acceleration section (16N, 16S) the steps comprising:

forming and accelerating compact tori in a staged symmetric sequence within the formation sections and the acceleration ~~stages~~sections towards a mid-plane of the central chamber,

passively adiabatically compressing the compact tori within the compression sections, and

magnetically compressing ~~a~~the merged compact tori within the central chamber.

~~40.~~ 2. The method of claim ~~39 wherein~~1 further comprising the steps of ~~forming, accelerating and compressing compact tori results in the compact tori~~ colliding and merging the compact tori within the central chamber.

~~41.~~ 3. The method of claims ~~39~~1 and ~~40~~2 wherein the steps of forming and accelerating the compact tori includes powering the plurality of active magnetic coils about and axially along the formation sections and acceleration ~~stages~~sections.

~~42.~~ 4. The method of claims ~~39 through 41~~1 and 2, wherein the step of ~~compressing the compact tori includes translating the compact tori through conically constricting flux conservers of the compression stages~~forming and accelerating the compact tori further comprises synchronously firing diametrically opposed pairs of active magnetic coils positioned about and along the formation and acceleration sections.

~~43.~~ 5. The method of ~~claims 39 through 42~~claim 3, wherein the step of forming and accelerating the compact tori further comprises synchronously firing diametrically opposed pairs of active magnetic coils positioned about and along the formation and acceleration sections.

6. The method of claim 4, wherein the step of magnetically compressing a merged compact tori comprises synchronously firing active magnetic coils positioned about and along the compression chamber with the firing active magnetic coils positioned about and along the formation and acceleration sections.

7.~~44. The method of claim 43~~ The method of claim 5, wherein the step of magnetically compressing a merged compact tori comprises synchronously firing active magnetic coils positioned about and along the compression chamber with the firing active magnetic coils positioned about and along the formation and acceleration sections.

~~45.~~ 8. The method of claims ~~39~~1, 2 and 5 through ~~44 wherein the compression sections interpose the central chamber and adjacent acceleration stages.~~

~~46. The method of claims 39 through 45~~7, further comprising the step of generating a DC guide field within and axially extending through the compression chamber, the formation sections, the acceleration ~~stages~~sections, and the compression stages.

47. A9. The method of merging and compressing compact tori plasma within in a systemclaim 3, further comprising a central the step of generating a DC guide field within and axially extending through the compression chamber, athe formation section, one or moresections, the acceleration stagessections, and one or more compression stages interposing the formation section and an adjacent acceleration stage and adjacent acceleration stages, the steps comprising

forming and accelerating a first compact toroid in a staged sequence within the formation section and the one or more acceleration stages towards a mid-plane of the central chamber to collide and merge with a second compact toroid,

passively adiabatically compressing the first compact toroid within the one or more compression stages, andsections.

magnetically compressing a merged compact toroid of the first and second compact tori within the central chamber.

48. The method of claim 47 wherein the steps of forming, accelerating and compressing the first compact toroid results in the first compact toroid colliding and merging with the second compact toroid within the central chamber.

49. The method of claims 47 and 48 wherein the steps of forming and accelerating the first compact toroid include powering active magnetic coils about and axially along the formation section and the one or more acceleration stages.

50. The method of claims 47 through 55, wherein the step of compressing the first compact toroid includes translating the compact toroid through a conically constricting flux conserver of the one or more compression stages.

51. The method of claims 47 through 56, wherein the step of forming and accelerating the first compact toroid further comprises synchronously firing the active

magnetic coils positioned about and along the formation and acceleration sections with the positioning of the second compact toroid within the central chamber.

52. The method of claims 47 through 51 wherein the one or more compression stages interpose the central chamber and an adjacent acceleration stage.

53. The method of claims 47 through 52

10. The method of claim 4, further comprising the step of generating a DC guide field within and axially extending through the compression chamber, the formation sections, the acceleration stagessections, and the compression stagessections.

54. 11. The method of claims 47 through 53 further comprising the steps

forming and accelerating the second compact toroid in a staged sequence within the formation section and the one or more acceleration stages towards a mid-plane of the central chamber,

passively adiabatically compressing the second compact toroid within the one or more compression stages, and

biasing the second compact toroid back toward the mid-plane of the central chamber as it passes through the central chamber with a mirror positioned adjacent an end of the central chamber.

55. The method of claims 47 through 54 further comprising the steps

forming and accelerating the second compact toroid in a staged sequence within the formation section and the one or more acceleration stages towards a mid-plane of the central chamber,

passively adiabatically compressing the second compact toroid within the one or more compression stages, and

~~biasing the second compact toroid back toward the mid-plane of the central chamber as it passes through the central chamber with a bounce cone positioned adjacent an end of the central chamber.~~

~~56. The system of claims 1 through 38~~any preceding claim wherein the compact tori are one of FRC and spheromak starter plasmas.

~~57.~~ 12. The ~~system~~method of ~~claims 1 through 38~~any preceding claim, wherein the compression sections are formed from conducting material and the central compression chamber and the formation and acceleration sections are formed from non-conducting material.

~~58. The method of claims 39 through 55 wherein the compact tori are one of FRC and spheromak starter plasmas.~~

~~59. The method of claims 39 through 55 wherein the compression sections are formed from conducting material and the central compression chamber and the formation and acceleration sections are formed from non-conducting material.~~