CLAIMS

What is claimed is:

1. A filtering apparatus, wherein the filtering apparatus comprises:

a force generating apparatus;

a first channel system, wherein the first channel system comprises a first point and a second point, wherein objects of interest are able to move through the first channel system between the first point and second point, wherein the force generating apparatus can be configured to apply a force on objects of interest within at least a portion of the channel system, wherein the force comprises a non-zero component directed from the first point towards the second point on average; and

a second channel system, wherein the second channel system comprises a first point and a second point, and wherein objects of interest are able to move through the second channel system between the first point and second point, wherein the force generating apparatus can be configured to apply a force on objects of interest within at least a portion of the channel system, wherein the force comprises a non-zero component directed from the first point towards the second point on average; and

wherein the second point in the second channel system is diffusively coupled to the second point in the first channel system, and

wherein the average shear stress coefficient of the second channel system between the first point and the second point is larger than the average shear stress coefficient of the first channel system between the first point and the second point

2. The apparatus of claim 1, wherein the first point in the first channel system is diffusively coupled to a first reservoir

3. The apparatus of claim 1, wherein the first point in the second channel system is diffusively coupled to a second reservoir

4. The apparatus of claim 1, wherein an diffusive coupling comprises a channel through which objects of interest can move

5. The apparatus of claim 1, wherein at least a portion of the first channel system is isolated from a second channel system

6. The apparatus of claim 1, wherein the force generating apparatus comprises an electric field generating apparatus, wherein at least a portion of the force is electric in nature

7. The apparatus of claim 1, wherein the force generating apparatus comprises a gravitational field generating apparatus, and wherein at least a portion of the force is gravitational in nature

8. The apparatus of claim 1, wherein the force generating apparatus comprises a magnetic field generating apparatus, and wherein at least a portion of the force is magnetic in nature

9. The apparatus of claim 1, wherein the force generating apparatus comprises an electromagnetic field generating apparatus, and wherein at least a portion of the force is electromagnetic in nature

10. The apparatus of claim 1, wherein the force generating apparatus comprises an accelerating apparatus, wherein the accelerating apparatus is configured to accelerate the first channel system or the second channel system in an inertial frame, and wherein at least a portion of the force is inertial in nature

11. The apparatus of claim 10, wherein the accelerating apparatus is configured to rotate the first channel system or the second channel system, thereby accelerating the interior surfaces of the channel system relative to the objects of interest

12. The apparatus of claim 1, wherein the force generating apparatus comprises a work exchange apparatus configured to do work on the objects of interest, or allowing the objects of interest to do work on the work exchange apparatus

13. The apparatus of claim 12 wherein the work exchange apparatus comprises a centrifugal compressor, or a centrifugal turbine

14. The apparatus of claim 12, wherein the work exchange apparatus comprises a axial compressor, or a axial turbine

15. The apparatus of claim 12, wherein the work exchange apparatus comprises a converging duct, a diverging duct, or a converging diverging duct

16. The apparatus of claim 1, wherein the objects of interest in the first channel system or second channel system comprise air molecules

17. The apparatus of claim 1, wherein the objects of interest in the first channel system or second channel system comprise molecules in a gas

18. The apparatus of claim 1, wherein the objects of interest in the first channel system or second channel system comprise molecules in a liquid

19. The apparatus of claim 1, wherein the objects of interest in the first channel system or second channel system comprise waves, or wavelike particles

20. The apparatus of claim 19, wherein the objects of interest in the first channel system or second channel system comprise phonons

21. The apparatus of claim 1, wherein the bulk material of a first channel system or second channel system comprises a metal

22. The apparatus of claim 1, wherein the bulk material of a first channel system or second channel system comprises composite materials

23. The apparatus of claim 1, wherein the bulk material of a first channel system or second channel system comprises carbon nanotubes

24. The apparatus of claim 1, wherein the average mean free path between the first and second points in the second material is smaller than the average mean free path between the first and second points in the first material

25. The apparatus of claim 1, wherein the average resistivity to bulk flow of objects of interest between the first and second points in the second material is larger than the average resistivity to bulk flow of objects of interest between the first and second points in the first material

26. The apparatus of claim 1, wherein the characteristic width of a channel within a channel system in the second material is smaller than 1000 times the mean free path of objects of interest within the fluid comprising the objects of interest for at least a portion of the second material

27. The apparatus of claim 2, wherein a second reservoir is diffusively coupled to the first point in the second channel system

28. The apparatus of claim 27, wherein the pressure in the second reservoir can be larger than the pressure in the first reservoir for a static boundary condition, wherein the difference in pressure is at least in part due to the interaction of the objects of interest with the filtering apparatus

29. The apparatus of claim 1, wherein a bulk flow of objects of interest can be generated throughout the first or second channel system

30. The apparatus of claim 29, wherein a compressor or expander is located upstream of the first channel system and configured to interact with objects of interest

31. The apparatus of claim 29, wherein a compressor or expander is located downstream of the first channel system and configured to interact with objects of interest

32. The apparatus of claim 31, wherein a compressor or expander is located downstream of the second channel system and configured to interact with objects of interest

33. The apparatus of claim 29, wherein a heat exchanger is located downstream of the first channel system and configured to interact with objects of interest

34. The apparatus of claim 33, wherein a heat exchanger is located downstream of the second channel system and configured to interact with objects of interest

35 The apparatus of claim 1, wherein the first point in the first channel system is diffusively coupled with a first point in the second channel system

36. The apparatus of claim 35, wherein the apparatus can be configured to comprise a closed thermodynamic system, wherein objects of interest can flow from the first point in the first channel system to the second point in the first channel system, and via the first diffusive coupling from the second point in the first channel system to the second point in the second channel system, and from the second point in the second channel system to the first point in the second channel system, and via the second diffusive coupling from the first point in the second channel system to the first point in the first channel system.

37. The apparatus of claim 36, wherein the first or second diffusive coupling comprises a compressor, an expander, or a heat exchanger configured to interact with objects of interest

38. A system comprising two or more of the filtering apparatuses of claim 1

39. The system of claim 38, wherein a first filtering apparatus is diffusively coupled in series with a second filtering apparatus

40. The system of claim 35, wherein a first filtering apparatus is diffusively coupled in parallel with a second filtering apparatus

41. A method of filtering, comprising: providing a filtering apparatus of claim 1

42. A method of filtering, comprising:

providing a force generating apparatus;

providing a first channel system, wherein the first channel system comprises a first point and a second point, wherein objects of interest are able to move through the first channel system between the first point and second point;

employing the force generating apparatus to apply a force on objects of interest within at least a portion of the first channel system, wherein the force comprises a non-zero component directed from the first point towards the second point on average;

a second channel system, wherein the second channel system comprises a first point and a second point, and wherein objects of interest are able to move through the second channel system between the first point and second point;

employing the force generating apparatus to apply a force on objects of interest within at least a portion of the second channel system, wherein the force comprises a non-zero component directed from the first point towards the second point on average;

diffusively coupling the second point in the second channel system to the second point in the first channel system, and

configuring the geometry of the first channel system relative to the second channel system such that the average shear stress coefficient of the second channel system between the first point and the second point is larger than the average shear stress coefficient of the first channel system between the first point and the second point

43. The method of claim 42, wherein the method further comprises providing a work exchange apparatus to compress or expand the working material upstream or downstream of the filtering apparatus

44. The method of claim 42, wherein the method further comprises providing a heat exchange apparatus to deliver heat to the working material, or extract heat from the working material, upstream or downstream of the filtering apparatus

45. The method of claim 42, wherein the method further comprises diffusively coupling the first point in the second channel system to the first point in the first channel system, thereby forming a closed thermodynamic system