CLAIMS

What is claimed is:

1. A high energy photon energy converter for converting high energy photon emissions into electrical energy comprising

a first layer of material that absorbs high energy photons and emits electrons ejected from an atom in the first layer of material by a high energy photon absorbed in the first layer of material, the first layer having a thickness less than the length of the mean free path of the ejected electrons in the first layer of material, and

a second layer of material that collects electrons emitted from the first layer of material and electrically coupled to the first layer of material, the second layer of material having a thickness greater than the length of the mean free path in the second layer of material of the electrons emitted from the first layer of material.

2. The converter of claim 1 further comprising a third layer of material coupled to the second layer of material, the third layer of material comprising an insulator material.

3. The converter of claim 1 wherein the first and second layers are stacked face-to-face.

4. The converter of claim 1 wherein the first layer of material is configured as a cylindrical core and the second layer of material is configured as a cylindrical shell disposed about the cylindrical core, wherein the radius of the cylindrical core is less than 1/2 the length of the mean free path of the ejected electrons in the first material.

5. The converter of claim 4 further comprising a third layer of insulating material configured as a cylindrical shell disposed about the cylindrical shell of the second layer of material.

6. The converter of claims 1 through 5 wherein the first layer of material comprises a high atomic charge number component.

7. The converter of claim 6 wherein the high atomic charge number component is a refractory metal or metal oxide.

8. The converter of claim 6 wherein the high atomic charge number component is tungsten.

9. The converter of claims 1 through 8 wherein the atomic charge number of the second layer of material differs from the atomic charge number of the first layer of material.

10. The converter of claims 1 through 8 wherein the atomic charge number of the second layer of material is lower than the atomic charge number of the first layer of material.

11. The converter of claims 1 through 10 wherein the second layer of material is a metal.

12. The converter of claim 11 wherein the metal is aluminum.

13. The converter of claims 2 and 5 wherein the third layer of material is SiO2.

14. The converter of claim 1 wherein the first layer of material is sandwiched between the second layer of material and a third layer of material comprising the same material as the second layer of material.

15. The converter of claims 1 through 14 wherein the high energy photons absorbable by the first layer of material have energies in the range of about 100 eV or greater.

16. The converter of claims 1 through 14 wherein the high energy photons absorbable by the first layer of material include X, XUV or gamma rays.

17. The converter of claim 1 through 16 wherein the first and second layers of material are coupled to a circuit having a load.

18. The converter of claims 17 wherein the load is a electrically drivable component, an electricity storage system or an electricity grid.

19. The converter of claims 1 through 18 wherein the first and second layers of material are couplable to a surface that intercepts and is substantially perpendicular to a direction of propagation of a photon flux emitted from a photon flux source and wherein each layer of the first and second layers is oriented at a grazing angle to the direction of propagation of the photon flux.

20. An energy converter for converting high energy photon emissions into electrical energy comprising

a first plurality of layers of a first material that absorbs high energy photons and emits electrons ejected from an atom in the first material by a high energy photon absorbed in the first material, each layer of the first plurality of layers having a thickness less than the length of the mean free path of the ejected electrons in the first material, and

a second plurality of layers of a second material that collects electrons emitted from the first plurality of layers of the first material and electrically coupled to the first plurality of layers of the first material, each layer of the second plurality of layers of the second material having a thickness greater than the length of the mean free path in the second material of the electrons emitted from the first plurality of layers of the first material, wherein one or more layers of the second plurality of layers of the second material interposing adjacent layers of the first plurality of layers of the first material.

21. The converter of claim 20 further comprising a third plurality of layers of a third material, each layer of the third plurality of layers interposing adjacent layers of the one or more layers of the second plurality of layers of the second material.

22. The converter of claim 20 wherein the first and second plurality of layers are stacked face-to-face.

23. The converter of claim 20 wherein each layer of the first plurality of layers of the first material is configured as a cylindrical core and each layer of the second plurality of layers of the second material is configured as a cylindrical shell concentrically disposed about the cylindrical core of the first material, wherein the radius of the cylindrical core is less than 1/2 the length of the mean free path of the ejected electrons in the first material.

24. The converter of claim 23 further comprising a third plurality of layers of a third insulating material configured as a cylindrical shell concentrically disposed about the cylindrical shell of the second material.

25. The converter of claims 20 through 24 wherein the first material comprises a high atomic charge number component.

26. The converter of claim 25 wherein the high atomic charge number component is a refractory metal or metal oxide.

27. The converter of claim 25 wherein the high atomic charge number component is tungsten.

28. The converter of claims 20 through 27 wherein the atomic charge number of the second material differs from the atomic charge number of the first material.

29. The converter of claims 20 through 27 wherein the atomic charge number of the second material is lower than the atomic charge number of the first material.

30. The converter of claims 20 through 29 wherein the second material is a metal.

31. The converter of claim 30 wherein the metal is aluminum.

32. The converter of claims 21 and 24 wherein the third material is SiO2.

33. The converter of claim 20 wherein each of layers of the first plurality of layers of the first material is sandwiched between two layers of the second plurality of layers of the second material.

34. The converter of claims 20 through 33 wherein the high energy photons absorbable by the first material have energies in the range of about 100 eV or greater.

35. The converter of claims 20 through 33 wherein the high energy photons absorbable by the first layer of material include X, XUV or gamma rays.

36. The converter of claim 20 through 35 wherein the first and second plurality of layers are coupled to a circuit having a load.

37. The converter of claims 36 wherein the load is a electrically drivable component, an electricity storage system or an electricity grid.

38. The converter of claims 20 through 37 wherein the first and second plurality of layers of material are couplable to a surface that intercepts and is substantially perpendicular to a direction of propagation of a photon flux emitted from a photon flux source and wherein each layer of the first and second plurality of layers is oriented at a grazing angle to the direction of propagation of the photon flux.

39. The converter of claim 38 wherein each layer of the first plurality of layers of the first material is configured as a cylindrical core and each layer of the second plurality of layers of the second material is configured as a cylindrical shell concentrically disposed about the cylindrical core of the first material, wherein the radius of the cylindrical core is less than 1/2 the length of the mean free path of the ejected electrons in the first material.

40. The converter of claim 39 further comprising a third plurality of layers of a third insulating material configured as a cylindrical shell concentrically disposed about the cylindrical shell of the second material.

41. The converter of claims 38 through 40 wherein an aggregate thickness of the first plurality of layers of the first material measured along the direction of propagation of the photon flux is greater than the length of a mean free path for a photon of the photon flux in the first material.

42. An energy converter system for converting high energy photon emissions into electrical energy comprising

a wall surrounding a photon flux source and having a surface that intercepts and is substantially perpendicular to a direction of propagation of a photon flux emitted from the photon flux source, and

a plurality of converter tiles covering the surface of the wall, each converter tile comprising

a first plurality of layers of a first material that absorbs high energy photons and emits electrons ejected from an atom in the first material by a high energy photon absorbed in the first material, each layer of the first plurality of layers having a thickness less than the length of the mean free path of the ejected electrons in the first material, and

a second plurality of layers of a second material that collects electrons emitted from the first plurality of layers of the first material and electrically coupled to the first plurality of layers of the first material, each layer of the second plurality of layers of the second material

having a thickness greater than the length of the mean free path in the second material of the electrons emitted from the first plurality of layers of the first material, wherein one or more layers of the second plurality of layers of the second material interposing adjacent layers of the first plurality of layers of the first material.

43. The converter system of claim 42 wherein each layer of the first and second plurality of layers is oriented at a grazing angle to the direction of propagation of the photon flux.

44. The converter system of claim 42 each converter tile further comprising a third plurality of layers of a third material, each layer of the third plurality of layers interposing adjacent layers of the one or more layers of the second plurality of layers of the second material.

45. The converter system of claim 42 wherein the first and second plurality of layers are stacked face-to-face.

46. The converter system of claim 42 wherein each layer of the first plurality of layers of the first material is configured as a cylindrical core and each layer of the second plurality of layers of the second material is configured as a cylindrical shell concentrically disposed about the cylindrical core of the first material, wherein the radius of the cylindrical core is less than 1/2 the length of the mean free path of the ejected electrons in the first material.

47. The converter system of claim 46 each converter tile further comprising a third plurality of layers of a third insulating material configured as a cylindrical shell concentrically disposed about the cylindrical shell of the second material.

48. The converter system of claims 42 through 47 wherein the first material comprises a high atomic charge number component.

49. The converter system of claim 48 wherein the high atomic charge number component is a refractory metal or metal oxide.

50. The converter system of claim 48 wherein the high atomic charge number component is tungsten.

51. The converter system of claims 42 through 50 wherein the atomic charge number of the second material differs from the atomic charge number of the first material.

52. The converter system of claims 42 through 50 wherein the atomic charge number of the second material is lower than the atomic charge number of the first material.

53. The converter system of claims 42 through 52 wherein the second material is a metal.

54. The converter system of claim 53 wherein the metal is aluminum.

55. The converter system of claims 43 and 47 wherein the third material is SiO2.

56. The converter system of claim 42 wherein each of layers of the first plurality of layers of the first material is sandwiched between two layers of the second plurality of layers of the second material.

57. The converter system of claims 42 through 56 wherein the high energy photons absorbable by the first material have energies in the range of about 100 eV or greater.

58. The converter system of claims 42 through 56 wherein the high energy photons absorbable by the first layer of material include X, XUV or gamma rays.

59. The converter system of claim 42 through 58 wherein the first and second plurality of layers are coupled to a circuit having a load.

60. The converter system of claims 59 wherein the load is a electrically drivable component, an electricity storage system or an electricity grid.

61. The converter system of claims 42 through 60 wherein an aggregate thickness of the first plurality of layers of the first material for each converter tile measured along the direction of propagation of the photon flux is greater than the length of a mean free path for a photon of the photon flux in the first material.

62. A method of converting the energy from high energy photons into electricity comprising the steps of

absorbing a high energy photon of a photon flux emitted from the photon flux source in one of a first plurality of layers of a first material coupled to a surface of a wall surrounding the photon flux source, the surface is substantially perpendicular to a direction of propagation of the photon flux, and

collecting in one of a second plurality of layers of a second material one or more electrons ejected from an atom in the first material by the high energy photon,

wherein each layer of the first plurality of layers of the first material has a thickness less than the length of the mean free path of the ejected electrons in the first material, wherein the second plurality of layers of the second material are electrically coupled to the first plurality of layers of the first material, wherein each layer of the first and second plurality of layers is oriented at a grazing angle to the direction of propagation of the photon flux.

63. The method of claim 62 wherein each layer of the second plurality of layers of the second material having a thickness greater than the length of the mean free path in the second material of the electrons emitted from the first material, wherein one or more layers of the second plurality of layers of the second material interposing adjacent layers of the first plurality of layers of the first material.

64. The method of claim 62 wherein the first and second plurality of layers are stacked face-to-face.

65. The method of claim 62 wherein each layer of the first plurality of layers of the first material is configured as a cylindrical core and each layer of the second plurality of layers of the second material is configured as a cylindrical shell concentrically disposed about the cylindrical core of the first material, wherein the radius of the cylindrical core is less than 1/2 the length of the mean free path of the ejected electrons in the first material.

66. The method of claims 62 through 65 wherein the first material comprises a high atomic charge number component.

67. The method of claim 66 wherein the high atomic charge number component is a refractory metal or metal oxide.

68. The method of claim 66 wherein the high atomic charge number component is tungsten.

69. The method of claims 62 through 68 wherein the atomic charge number of the second material differs from the atomic charge number of the first material.

70. The method of claims 62 through 68 wherein the atomic charge number of the second material is lower than the atomic charge number of the first material.

71. The method of claims 62 through 70 wherein the second material is a metal.

72. The method of claim 71 wherein the metal is aluminum.

73. The method of claim 62 wherein each of layers of the first plurality of layers of the first material is sandwiched between two layers of the second plurality of layers of the second material.

74. The method of claims 62 through 73 wherein the high energy photons absorbable by the first material have energies in the range of about 100 eV or greater.

75. The method of claims 62 through 74 wherein the high energy photons absorbable by the first layer of material include X, XUV or gamma rays.

76. The method of claims 62 through 75 wherein an aggregate thickness of the first plurality of layers of the first material measured along the direction of propagation of the photon flux is greater than the length of a mean free path for a photon of the photon flux in the first material.

CLAIMS

What is claimed is:

1. A high energy photon energy converter for converting high energy photon emissions into electrical energy comprising

a first layer of material that absorbs high energy photons and emits electrons ejected from an atom in the first layer of material by a high energy photon absorbed in the first layer of material, the first layer having a thickness less than the length of the mean free path of the ejected electrons in the first layer of material, wherein the high energy photons are in the non-visible regime, and

a second layer of material that collects electrons emitted from the first layer of material and electrically coupled to the first layer of material, the second layer of material having a thickness greater than the length of the mean free path in the second layer of material of the electrons emitted from the first layer of material,

wherein the first layer of material and the second layer of material for a converter element laterally stackable adjacent to other converter elements wherein an aggregate thickness of the first layers of material in the converter elements measured along the direction of propagation of a high energy photon is greater than the length of a mean free path of the high energy photon in the first layer of material.

2. The converter of claim 1 further comprising a third layer of material coupled to the second layer of material, the third layer of material comprising an insulator material.

3. The converter of claim 1 wherein the first and second layers are stacked face-to-face.

4. The converter of claim 1 wherein the first layer of material is configured as a cylindrical core and the second layer of material is configured as a cylindrical shell disposed about the cylindrical core, wherein the radius of the cylindrical core is less than 1/2 the length of the mean free path of the ejected electrons in the first material.

5. The converter of claim 4 further comprising a third layer of insulating material configured as a cylindrical shell disposed about the cylindrical shell of the second layer of material.

6. The converter of claims 1 through 5 wherein the first layer of material comprises a high atomic charge number component.

7. The converter of claim 6 wherein the high atomic charge number component is a refractory metal or metal oxide.

8. The converter of claim 6 wherein the high atomic charge number component is tungsten.

9. The converter of claims 1 through 8 wherein the atomic charge number of the second layer of material differs from the atomic charge number of the first layer of material.

10. The converter of claims 1 through 8 wherein the atomic charge number of the second layer of material is lower than the atomic charge number of the first layer of material.

11. The converter of claims 1 through 10 wherein the second layer of material is a metal.

12. The converter of claim 11 wherein the metal is aluminum.

13. The converter of claims 2 and 5 wherein the third layer of material is SiO2.

14. The converter of claim 1 wherein the first layer of material is sandwiched between the second layer of material and a third layer of material comprising the same material as the second layer of material.

15. The converter of claims 1 through 14 wherein the high energy photons absorbable by the first layer of material have energies in the range of about 100 eV or greater.

16. The converter of claims 1 through 14 wherein the high energy photons absorbable by the first layer of material include X, XUV or gamma rays.

17. The converter of claim 1 through 16 wherein the first and second layers of material are coupled to a circuit having a load.

18. The converter of claims 17 wherein the load is a electrically drivable component, an electricity storage system or an electricity grid.

19. The converter of claims 1 through 18 wherein the first and second layers of material are couplable to a surface that intercepts and is substantially perpendicular to a direction of propagation of a photon flux emitted from a photon flux source and wherein each layer of the first and second layers is oriented at a grazing angle to the direction of propagation of the photon flux.

20. An energy converter for converting high energy photon emissions into electrical energy comprising

a first plurality of layers of a first material that absorbs high energy photons and emits electrons ejected from an atom in the first material by a high energy photon absorbed in the first material, each layer of the first plurality of layers having a thickness less than the length of the mean free path of the ejected electrons in the first material, wherein the high energy photons are in the non-visible regime, and wherein a plurality of layers of material in the first plurality of layers of a first material having an aggregate thickness measured along the direction of propagation of a high energy photon is greater than the length of a mean free path for the high energy photon in the first material, and

a second plurality of layers of a second material that collects electrons emitted from the first plurality of layers of the first material and electrically coupled to the first plurality of layers of the first material, each layer of the second plurality of layers of the second material having a thickness greater than the length of the mean free path in the second material of the electrons emitted from the first plurality of layers of the first material, wherein one or more layers of the second plurality of layers of the second material interposing adjacent layers of the first plurality of layers of the first material

21. The converter of claim 20 further comprising a third plurality of layers of a third material, each layer of the third plurality of layers interposing adjacent layers of the one or more layers of the second plurality of layers of the second material.

22. The converter of claim 20 wherein the first and second plurality of layers are stacked face-to-face.

23. The converter of claim 20 wherein each layer of the first plurality of layers of the first material is configured as a cylindrical core and each layer of the second plurality of layers of the second material is configured as a cylindrical shell concentrically disposed about the cylindrical core of the first material, wherein the radius of the cylindrical core is less than 1/2 the length of the mean free path of the ejected electrons in the first material.

24. The converter of claim 23 further comprising a third plurality of layers of a third insulating material configured as a cylindrical shell concentrically disposed about the cylindrical shell of the second material.

25. The converter of claims 20 through 24 wherein the first material comprises a high atomic charge number component.

26. The converter of claim 25 wherein the high atomic charge number component is a refractory metal or metal oxide.

27. The converter of claim 25 wherein the high atomic charge number component is tungsten.

28. The converter of claims 20 through 27 wherein the atomic charge number of the second material differs from the atomic charge number of the first material.

29. The converter of claims 20 through 27 wherein the atomic charge number of the second material is lower than the atomic charge number of the first material.

30. The converter of claims 20 through 29 wherein the second material is a metal.

31. The converter of claim 30 wherein the metal is aluminum.

32. The converter of claims 21 and 24 wherein the third material is SiO2.

33. The converter of claim 20 wherein each of layers of the first plurality of layers of the first material is sandwiched between two layers of the second plurality of layers of the second material.

34. The converter of claims 20 through 33 wherein the high energy photons absorbable by the first material have energies in the range of about 100 eV or greater.

35. The converter of claims 20 through 33 wherein the high energy photons absorbable by the first layer of material include X, XUV or gamma rays.

36. The converter of claim 20 through 35 wherein the first and second plurality of layers are coupled to a circuit having a load.

37. The converter of claims 36 wherein the load is a electrically drivable component, an electricity storage system or an electricity grid.

38. The converter of claims 20 through 37 wherein the first and second plurality of layers of material are couplable to a surface that intercepts and is substantially perpendicular to a direction of propagation of a photon flux emitted from a photon flux source and wherein each layer of the first and second plurality of layers is oriented at a grazing angle to the direction of propagation of the photon flux.

39. The converter of claim 38 wherein each layer of the first plurality of layers of the first material is configured as a cylindrical core and each layer of the second plurality of layers of the second material is configured as a cylindrical shell concentrically disposed about the cylindrical core of the first material, wherein the radius of the cylindrical core is less than 1/2 the length of the mean free path of the ejected electrons in the first material.

40. The converter of claim 39 further comprising a third plurality of layers of a third insulating material configured as a cylindrical shell concentrically disposed about the cylindrical shell of the second material.

41. An energy converter system for converting high energy photon emissions into electrical energy comprising

a wall surrounding a photon flux source and having a surface that intercepts and is substantially perpendicular to a direction of propagation of a photon flux emitted from the photon flux source, wherein the photon flux comprises high energy photons in the non-visible regime, and

a plurality of converter tiles covering the surface of the wall, each converter tile comprising

a first plurality of layers of a first material that absorbs the high energy photons and emits electrons ejected from an atom in the first material by a high energy photon absorbed in the first material, each layer of the first plurality of layers having a thickness less than the length of the mean free path of the ejected electrons in the first material, wherein an aggregate thickness of a

plurality of layers of a first material in the converter tiles measured along the direction of propagation of the photon flux is greater than the length of a mean free path for a photon of the photon flux in the first material and

a second plurality of layers of a second material that collects electrons emitted from the first plurality of layers of the first material and electrically coupled to the first plurality of layers of the first material, each layer of the second plurality of layers of the second material having a thickness greater than the length of the mean free path in the second material of the electrons emitted from the first plurality of layers of the first material, wherein one or more layers of the second plurality of layers of the second material interposing adjacent layers of the first plurality of layers of the first material.

42. The converter system of claim 41 wherein each layer of the first and second plurality of layers is oriented at a grazing angle to the direction of propagation of the photon flux.

43. The converter system of claim 41 each converter tile further comprising a third plurality of layers of a third material, each layer of the third plurality of layers interposing adjacent layers of the one or more layers of the second plurality of layers of the second material.

44. The converter system of claim 41 wherein the first and second plurality of layers are stacked face-to-face.

45. The converter system of claim 41 wherein each layer of the first plurality of layers of the first material is configured as a cylindrical core and each layer of the second plurality of layers of the second material is configured as a cylindrical shell concentrically disposed about the cylindrical core of the first material, wherein the radius of the cylindrical core is less than 1/2 the length of the mean free path of the ejected electrons in the first material.

46. The converter system of claim 45 each converter tile further comprising a third plurality of layers of a third insulating material configured as a cylindrical shell concentrically disposed about the cylindrical shell of the second material.

47. The converter system of claims 41 through 46 wherein the first material comprises a high atomic charge number component.

48. The converter system of claim 47 wherein the high atomic charge number component is a refractory metal or metal oxide.

49. The converter system of claim 47 wherein the high atomic charge number component is tungsten.

50. The converter system of claims 41 through 49 wherein the atomic charge number of the second material differs from the atomic charge number of the first material.

51. The converter system of claims 41 through 49 wherein the atomic charge number of the second material is lower than the atomic charge number of the first material.

52. The converter system of claims 41 through 51 wherein the second material is a metal.

53. The converter system of claim 52 wherein the metal is aluminum.

54. The converter system of claims 42 and 46 wherein the third material is SiO2.

55. The converter system of claim 41 wherein each of layers of the first plurality of layers of the first material is sandwiched between two layers of the second plurality of layers of the second material.

56. The converter system of claims 41 through 55 wherein the high energy photons absorbable by the first material have energies in the range of about 100 eV or greater.

57. The converter system of claims 41 through 55 wherein the high energy photons absorbable by the first layer of material include X, XUV or gamma rays.

58. The converter system of claim 41 through 57 wherein the first and second plurality of layers are coupled to a circuit having a load.

59. The converter system of claims 58 wherein the load is a electrically drivable component, an electricity storage system or an electricity grid.

60. A method of converting the energy from high energy photons into electricity comprising the steps of

absorbing a high energy photon of a photon flux emitted from the photon flux source in one of a first plurality of layers of a first material coupled to a surface of a wall surrounding the photon flux source, the surface is substantially perpendicular to a direction of propagation of the photon flux, wherein the high energy photon is in the non-visible regime, and wherein a plurality of layers of material in the first plurality of layers of a first material having an aggregate thickness measured along the direction of propagation of the photon flux is greater than the length of a mean free path for a photon of the photon flux in the first material, and

collecting in one of a second plurality of layers of a second material one or more electrons ejected from an atom in the first material by the high energy photon,

wherein each layer of the first plurality of layers of the first material has a thickness less than the length of the mean free path of the ejected electrons in the first material, wherein the second plurality of layers of the second material are electrically coupled to the first plurality of layers of the first material, wherein each layer of the first and second plurality of layers is oriented at a grazing angle to the direction of propagation of the photon flux.

61. The method of claim 60 wherein each layer of the second plurality of layers of the second material having a thickness greater than the length of the mean free path in the second material of the electrons emitted from the first material, wherein one or more layers of the second plurality of layers of the second material interposing adjacent layers of the first plurality of layers of the first material.

62. The method of claim 60 wherein the first and second plurality of layers are stacked face-to-face.

63. The method of claim 60 wherein each layer of the first plurality of layers of the first material is configured as a cylindrical core and each layer of the second plurality of layers of the second material is configured as a cylindrical shell concentrically disposed about the cylindrical core of the first material, wherein the radius of the cylindrical core is less than 1/2 the length of the mean free path of the ejected electrons in the first material.

64. The method of claims 60 through 63 wherein the first material comprises a high atomic charge number component.

65. The method of claim 64 wherein the high atomic charge number component is a refractory metal or metal oxide.

66. The method of claim 64 wherein the high atomic charge number component is tungsten.

67. The method of claims 60 through 66 wherein the atomic charge number of the second material differs from the atomic charge number of the first material.

68. The method of claims 60 through 66 wherein the atomic charge number of the second material is lower than the atomic charge number of the first material.

69. The method of claims 60 through 68 wherein the second material is a metal.

70. The method of claim 69 wherein the metal is aluminum.

71. The method of claim 60 wherein each of layers of the first plurality of layers of the first material is sandwiched between two layers of the second plurality of layers of the second material.

72. The method of claims 60 through 71 wherein the high energy photons absorbable by the first material have energies in the range of about 100 eV or greater.

73. The method of claims 60 through 72 wherein the high energy photons absorbable by the first layer of material include X, XUV or gamma rays.