Claims:

1. A bimodal near-field resonant wireless electrical power transfer system configured for simultaneous capacitive power transfer and inductive power transfer according to an adjustable transfer mode ratio of the capacitive power transfer to the inductive power transfer at a variable resonant power signal oscillation frequency, the system comprising:

a transmitter subsystem comprising a transmitter antenna subsystem and a power signal tuner module, the power signal tuner module configured to adjust the transfer mode ratio by adjusting a power signal provided by the power signal tuner module to the transmitter antenna subsystem; and

a receiver subsystem comprising a receiver antenna subsystem configured for to receive electrical power from the transmitter antenna at the transfer mode ratio.

2. The system of claim 1~~1~~, wherein the power signal tuner module is configured to adjust the power signal by adjusting a phase difference between a current and a voltage of the power signal provided to the transmitter antenna subsystem.

3. The system of claim 2~~2~~, wherein the transmitter subsystem further comprises a controller and at least one sensor, wherein the controller is configured to receive sensor information from the at least one sensor and automatically provide a tuning instruction to the power signal tuner module based on the sensor information, and wherein the tuner module is configured to adjust according to the tuning instruction the phase difference between the current and the voltage of the power signal provided to the transmitter antenna subsystem.

4. The system of claim 3~~3~~, wherein the at least one sensor is disposed in the transmitter subsystem.

5. The system of claim 3~~3~~, wherein the at least one sensor is disposed in the receiver subsystem and the controller is configured for wirelessly receiving the sensor information.

6. The system of any one of claims 3~~3~~-5, wherein the at least one sensor comprises at least one of a power load sensor, a transmission power sensor, a surrounding object detector, and a distance detector for detecting a distance between the transmitter antenna subsystem and the receiver antenna subsystem.

7. The system of any one of claims 1~~1~~-5, wherein the variable resonant power signal oscillation frequency is free to vary within a predetermined frequency band.

8. The system of claim 7, wherein the predetermined frequency band is between 1MHz and 1GHz.

9. The system of claim 7, wherein the system is detuned to a degree that allows the variable resonant power signal oscillation frequency to vary within opposing limits of the predetermined frequency band.

10. The system of any one of claims 1-9, comprising an electrical load disposed in electrical communication with an electrically conductive mechanical load-bearing structure, wherein the receiver antenna subsystem comprises at least a portion of the electrically conductive mechanical load-bearing structure.

11. A method for bimodally transferring power from a direct current source to a load, the method comprising:

providing in electrical communication with the direct current source a transmitter subsystem comprising a transmitter antenna subsystem, and a power signal tuner module, and a controller;

providing at least one sensor;

providing in electrical communication with the load a receiver subsystem comprising a receiver antenna subsystem;

transferring power by simultaneous capacitive power transfer and inductive power transfer at a variable resonant power signal oscillation frequency from the transmitter antenna subsystem to the receiver antenna subsystem; and

adjusting the power signal module to change a transfer mode ratio of the capacitive power transfer to the inductive power transfer at a variable resonant power signal oscillation frequency.

12. The method of claim 11, wherein adjusting the power signal module comprises adjusting a phase difference between a current and a voltage of a power signal provided from the power signal module to the transmitter antenna subsystem.

13. The method of claim 12, wherein adjusting the phase difference between the current and the voltage of the power signal comprises,

receiving in the controller sensor information from the at least one sensor,

automatically providing a tuning instruction from the controller to the power signal tuner module based on the sensor information, and

adjusting according to the tuning instruction the phase difference between the current and the voltage of the power signal provided to the transmitter antenna subsystem.

14. The method of claim 11, wherein providing the transmitter subsystem comprises providing the at least one sensor disposed in the transmitter subsystem.

15. The method of claim 13, wherein

providing the receiver subsystem comprises providing the at least one sensor disposed in the receiver subsystem; and

the receiving in the controller the sensor information comprises wirelessly receiving the sensor information in the controller.

16. The method of any one of claims 11- 15, wherein providing the at least one sensor comprises at least one of providing a power load sensor, a transmission power sensor, a surrounding object detector, and a distance detector for detecting a distance between the transmitter antenna subsystem and the receiver antenna subsystem.

17. The method according to any one of claims 11-13, wherein the bimodally transferring power comprises allowing the variable resonant power signal oscillation frequency to vary within a predetermined frequency band contained within the range between 1MHz and 1GHz.

18. The method according to claim 17, further allowing the variable resonant power signal oscillation frequency to vary within opposing limits of the predetermined frequency band.

19. A bimodal near-field wireless power transfer system configured for simultaneous capacitive power transfer and inductive power transfer to one or more receiver resonators according to an adjustable transfer mode ratio of the capacitive power transfer to the inductive power transfer at a variable resonant power signal oscillation frequency, the system comprising:

the one or more receiver resonators;

a transmission subsystem comprising:

~~one or more~~ transmitter resonators collectively arranged to form a transmission surface; and

~~one or more~~ corresponding transmitter modules in electrical communication with the ~~one or more~~ transmitter resonators for controlling a power signal output to the ~~one or more~~ transmitter resonators, each transmitter module comprising a transmitter controller and each transmitter module and its corresponding transmitter resonator forming a transmitter pair,

wherein the ~~one or more~~ transmitter pairs are electrically decoupled from one another.

20. The system of claim 19, wherein the transmitter controller of every first one of the ~~one or more~~ transmitter modules is configured for adjusting the phase of the power signal transmitted by the first transmitter module to match a phase of a power signal transmitted by any second one of the ~~one or more~~ transmitter module.

21. The system of claim 20, wherein the ~~one or more~~ transmitter pairs are electrically decoupled from one another by a grounded shield grid.

22. The system of claim 19, wherein the transmission controller of each transmitter module in a transmitter pair comprises

a tuner module for varying a phase of the power signal; and

a load detector configured for measuring an input impedance of the ~~one or more coupled~~ transmitter resonators, and wherein the load detector is configured to detect a change in the input impedance when the one or more receiver resonators are proximate to the ~~one or more coupled~~ transmitter resonators.

23. The system of claim 22, wherein the transmission controller is configured to vary the variable resonant power signal oscillation frequency based on a measured input impedance of the ~~coupled~~ transmitter resonators.

24. The system of claim 22, wherein the load detector of the transmission controller of each transmitter module measures an input impedance of one ~~coupled~~ transmitter resonator.

25. The system of claim 22, wherein the load detector of the transmission controller of each transmitter module measures an input impedance of two or more ~~coupled~~ transmitter resonators.

~~26. A method of varying a power signal of a wireless transfer system, the method comprising:~~

providing a transmission surface comprised of one or more transmitter resonators;

monitoring an input impedance of each of the one or more transmitter resonators;

calibrating a baseline input impedance for the one or more transmitter resonators; and

either assigning an off state to a transmitter resonator of the one or more transmitter resonators when the input impedance is less than the baseline impedance; or assigning an active state to the transmitter resonator when the input impedance is greater than the baseline impedance.

27. The method of claim 26, further comprising setting a frequency of the power signal output to the one or more transmitter resonators assigned to the active state.

28. The method of claim 27, further comprising adjusting a phase of the power output signal of the one or more transmitter resonators assigned to the active state to a maximum power transfer phase, at which power transfer through the transmitter resonator is substantially maximal.

29. The method of any one of claims 26-28, further comprising providing one or more receiver resonators proximal to the transmission surface.

30. A near-field resonant wireless electrical power transfer system comprising:

a transmission subsystem comprising a plurality of substantially mutually decoupled transmitter resonators and corresponding transmitter modules in power signal communication with each transmitter resonator, each transmitter module comprising a transmission controller and a power signal source having a power signal oscillation frequency and a power signal phase, each power signal source controlled by the corresponding transmission controller;

one or more receiver subsystems each comprising a corresponding receiver resonator;

a software lookup table of discrete allowed power signal oscillation frequencies for the power signal sources; and

software which when loaded in a memory and executed by the controller of any of the transmitter modules performs the actions of:

measuring one of an input impedance of the corresponding transmitter resonator and a test signal power draw by the corresponding transmitter resonator; and

selecting for the corresponding power signal source a frequency from the lookup table based on one of the input impedance of the corresponding transmitter resonator and the test signal power draw by the corresponding transmitter resonator.

~~31. The system according to claim 30, wherein the software when executed performs the actions of measuring a level of power transferred by the corresponding transmitter resonator while adjusting a phase of a power signal from the corresponding power signal source.~~

~~32. The system according to claim 30 or 31, wherein transmitter resonators are substantially mutually decoupled by a grounded shield grid.~~

~~33.~~26. A bimodal near-field resonant wireless system for transferring power from one or more photovoltaic cells to a power load, the system comprising:

one or more transmission modules in electrical communication with the one or more photovoltaic cells, each transmission module configured to convert the power from at least one of the one or more photovoltaic cells into an oscillating electrical power signal having a variable oscillation frequency;

one or more transmitter resonators in electrical communication with the one or more transmission modules, each transmitter resonator configured to resonate at the variable oscillation frequency;

one or more receiver resonators, each receiver resonator configured to resonate at the variable oscillation frequency and disposed to bimodally receive power from at least one of the one or more transmitter resonators simultaneously via capacitive coupling and magnetic induction according to an adjustable transfer mode ratio of the capacitive power transfer to the inductive power transfer at the variable oscillation frequency; and

one or more receiver modules in electrical communication with the receiver resonator, each receiver module configured to receive power from at least one of the one or more receiver resonators, render the power received from the one or more receiver resonators into a direct current voltage, and transmit the direct current voltage to the power load.

~~34.~~27. The system according to claim ~~33~~26, wherein the one or more transmission modules each comprises a power amplifier configured to modulate the power received from the one or more photovoltaic cell at the variable oscillation frequency.

~~35.~~28. The system according to claim ~~34~~27, wherein the one or more transmission modules each comprises an oscillator configured to provide the variable oscillation frequency to the power amplifier.

~~36.~~29. The system according to any one of claims ~~33~~26-~~35~~28, wherein the one or more transmission modules each further comprises a controller and one or more sensors, the controller configured to vary the variable oscillation frequency based on first information from at least one of the one or more sensors.

~~37.~~30. The system according to claim ~~36~~29, wherein the one or more transmission modules each comprises a transmission tuning network configured to change under control of the controller at least a phase of the power provided by the transmission module to the one or more transmitter resonators based on second information from at least one of the one or more sensors.

~~38.~~31. The system according to any one of claims ~~33~~26-~~35~~28, wherein one or more receiver resonator is disposed for receiving power from any proximate transmitter resonator.

~~39.~~32. The system according to any one of claims ~~33~~26-~~35~~28, wherein the one or more transmitter resonators are disposed on a surface of at least one of the one or more photovoltaic cells opposing an active solar radiation receiving surface of the at least one of the one or more photovoltaic cells.

~~40.~~33. The system according to any one of claims ~~33~~26-~~35~~28, wherein the variable oscillation frequency of the oscillating electrical power signal is free to vary within a predetermined frequency band contained within the range between 1MHz and 1GHz.

~~41.~~34. The system of claim ~~40~~33, wherein the system is detuned to a degree that allows the variable oscillation frequency of the oscillating electrical power signal to vary within opposing limits of the predetermined frequency band

~~42.~~35. A method method for bimodally transferring power from one or more photovoltaic cells to a power load, the method comprising

providing one or more transmission modules, each transmission module being in electrical communication with a corresponding one of the one or more photovoltaic cells;

providing one or more transmitter resonators configured to resonate at a variable oscillation frequency, each transmitter resonator being in electrical communication with a corresponding one of the one or more transmission modules;

providing one or more receiver resonators configured to resonate at the variable oscillation frequency, each receiver resonator in electrical communication with a corresponding receiver module;

converting in each transmission module power from the corresponding one of the one or more photovoltaic cells into an oscillating electrical power signal having the variable oscillation frequency;

bimodally transferring power from at least one of the one or more transmitter resonators to one or more of the receiver resonators via simultaneously capacitive coupling and magnetic induction according to an adjustable transfer mode ratio of the capacitive power transfer to the inductive power transfer at the variable oscillation frequency;

rendering the power received from the one or more receiver resonators into a direct current voltage; and

supplying the direct current voltage to the power load.

~~43.~~36. The method of claim ~~42~~35, wherein:

providing the one or more transmission modules comprises providing one or more transmission modules each comprising a power amplifier; and

modulating in at least one power amplifier the power received from the one or more photovoltaic cells at the variable oscillation frequency.

~~44.~~37. The method according to claim ~~43~~36, wherein:

providing the one or more transmission modules comprises providing one or more transmission modules each comprising an oscillator; and

providing from the oscillator to the power amplifier the variable oscillation frequency.

~~45.~~38. The method according to any one of claims ~~42~~35-~~44~~37, wherein providing the one or more transmission modules comprises providing one or more transmission modules each having a controller and one or more sensors, and the method comprises adjusting via the controller the variable oscillation frequency based on first information from at least one of the one or more sensors.

~~46.~~39. The method according to claim ~~45~~38, wherein providing the one or more transmission modules comprises providing one or more transmission modules each having a transmission tuning network, and the method comprises adjusting via the controller based on second

information from at least one of the one or more sensors at least a phase of the power provided by the transmission module to the one or more transmitter resonators.

~~47.~~40. The method of claim ~~42~~35, wherein providing the one or more receiver resonator comprises providing at least one of the one more receiver resonators disposed proximate to more than one of the transmitter resonators and receiving in the at least one receiver resonator power from one or more receiver resonators proximate the at least one receiver resonator.

~~48.~~41. The method according to any one of claims ~~33~~26-~~35~~28, wherein the bimodally transferring power comprises allowing the variable oscillation frequency to vary within a predetermined frequency band contained within the range between 1MHz and 1GHz.

~~49. A method for power transfer from a direct current power source to a power load, the method comprising:~~

~~providing a power transfer system in wired electrical communication with the power source, the power transfer system comprising a radio frequency power amplifier in radio frequency communication with an adjustable phase radio frequency rectifier in wired electrical contact with the power load;~~

~~converting the power from the direct current source into a radio frequency oscillating power signal in the amplifier;~~

~~converting the radio frequency oscillating power signal to direct current power signal in the rectifier; and~~

~~adjusting an efficiency of the power transfer by adjusting a current-voltage phase characteristic of the rectifier.~~

~~50. The method of claim 49, wherein the direct current power source comprises at least one solar photovoltaic cell.~~

~~51. The method of claim 49, further comprising adjusting the efficiency of the power transfer by automatically adjusting a direct current equivalent input resistance of the amplifier.~~

~~52. The method of claim 49, further comprising automatically adjusting the efficiency of the power transfer by automatically adjusting a current-voltage phase characteristic of the power amplifier.~~

53. The method of claim 49, further comprising adjusting the efficiency of the power transfer by changing the oscillation frequency of the power amplifier.

54. The method of claim 49, wherein the providing the power transfer system comprises providing the power amplifier in directly wired radio frequency communication with the adjustable phase radio frequency rectifier.

55. The method of claim 49, wherein the providing the power transfer system comprises providing the power amplifier in wireless near-field radio frequency communication with the adjustable phase radio frequency rectifier.

56. The method of claim 49, wherein the providing the power transfer system comprises providing the power amplifier in bimodal wireless near-field wireless communication with the rectifier.

57. An electrical power transfer system for supplying power from a direct current source to a power load, the system comprising:

a radio frequency power amplifier in wired electrical communication with the direct current and configured to convert direct current voltage from the source into an alternating voltage signal having an oscillation frequency;

an adjustable phase radio frequency rectifier in wired electrical contact with the power load and in radio frequency communication with the power amplifier; the rectifier configured to receive power transferred from the amplifier; and

a receiver controller in communication with the rectifier, the receiver controller configured for automatically adjusting an efficiency of power transfer from the amplifier to the rectifier by adjusting a current-voltage phase characteristic of the rectifier.

58. The system of claim 57, further comprising a load management system in wired communication with the load and power signal-wise disposed between the load and the rectifier, the load management system configured for increasing an efficiency of the power transfer by automatically adjusting an input impedance of the rectifier.

59. The system of claim 57, further comprising a transmitter controller in communication with the amplifier, the transmitter controller configured for increasing an efficiency of the power transfer by automatically adjusting a current-voltage phase characteristic of the amplifier.

~~60. The system of claim 59, further comprising an oscillator in communication with the amplifier and the transmitter controller, wherein the transmitter controller is configured for adjusting the oscillation frequency via the oscillator.~~

~~61. The system of claim 57, wherein the power amplifier is in directly wired radio frequency communication with the rectifier.~~

~~62. The system of claim 57, wherein the power amplifier is in wireless near-field radio frequency communication with the rectifier.~~

~~63. The system of claim 57, wherein the power amplifier is in bimodal near-field wireless radio frequency communication with the rectifier.~~

~~64. The system of claim 57, wherein the direct current source comprises a rechargeable battery and the load comprises an electric motor.~~

~~65. The system of claim 57, wherein a resonant structure of the system comprises at least one electrically conductive mechanical load bearing structural component of the system.~~

~~66. The system of claim 57, further comprising a power conditioning unit electrically disposed between the power source and the power amplifier, the power conditioning unit configured for adjusting at least one of a current and a voltage from the power source to improve the efficiency of the power transfer.~~