CLAIMS

1. A label comprising:

three or more input resonators, wherein the input resonators comprise at least one of a fluorophore, a quantum dot, or a dye and all of the input resonators comprise the same fluorophore, quantum dot, or dye excited at a single wavelength;

an output resonator, wherein the output resonator comprises at least one of a fluorophore, a quantum dot, or a dye;

a receptor, wherein the receptor is antibody, aptamer, or protein; and

an organic backbone,

wherein the receptor selectively interacts with an analyte of interest to permit detection of the presence, amount, or location of the analyte of interest in a sample,

wherein the two or more input resonators, the output resonator, and the receptor are coupled to the backbone, and

wherein the backbone maintains relative locations of the input resonators and the output resonator such that energy can be transmitted from each of the input resonators to the output resonator.

2. The label of claim 1, wherein the three or more input resonators comprise a first input resonator, a second input resonator, and a third input resonator, and wherein the backbone maintains relative locations of the first, second, and third input resonators and the output resonator such that energy can be transmitted from the second input resonator to the output resonator via the first input resonator.

3. The label of claim 2, wherein energy can further be transmitted from the first input resonator to the second and/or third input resonator.

4. The label of claim 2, wherein all of the input resonators comprise the same fluorophore.

5. The label of claim 3, wherein each of the input resonators is coupled to the backbone via a respective linker,

wherein each of the linkers have a characteristic linker length,

wherein the input resonators are characterized by a Förster radius, and wherein the linkers are coupled to the backbone at respective coupling locations,

wherein the coupling locations are separated from each other by less than the Förster radius and by more than twice a characteristic distance for quenching of the input resonators.

6. The label of claim 1, wherein the three or more input resonators comprise four input resonators.

7. The label of claim 1, wherein the three or more input resonators comprise thirty input resonators.

8. The label of claim 1, wherein the output resonator is a first output resonator, wherein the label further comprises:

a second output resonator; and

one or more additional input resonators,

wherein the one or more additional resonators and the second output resonator are coupled to the backbone, and

wherein the backbone maintains relative locations of the additional input resonators and the second output resonator such that energy can be transmitted from the additional input resonators to the second output resonator.

9. The label of claim 8, wherein the backbone maintains relative locations of the additional input resonators and the first output resonator such that energy can be transmitted from the additional input resonators to the first output resonator.

10. The label of claim 1, further comprising:

one or more mediating resonators, wherein the one or more mediating resonators are coupled to the backbone, wherein the backbone maintains the relative locations of at least one of the one or more mediating resonators and the output resonator such that the output resonator can receive energy from the at least one of the one or more mediating resonators, and wherein the backbone maintaining relative locations of the input resonators and the output resonator such

that energy can be transmitted from each of the input resonators to the output resonator comprises the backbone maintaining relative locations of the input resonators, the output resonator, and the one or more mediating resonators such that energy can be transmitted from each of the input resonators to the output resonator via the one or more mediating resonators.

11. The label of claim 10, wherein the input resonators absorb light at an excitation wavelength, wherein the output resonator emits light at an emission wavelength, wherein the emission wavelength differs from the excitation wavelength, wherein the one or more mediating resonators are characterized by respective emission wavelengths, and wherein the emission wavelengths of the one or more mediating resonators are intermediate between the excitation wavelength of the input resonator and the emission wavelength of the output resonator.

12. The label of claim 10, wherein the one or more mediating resonators are disposed within the label as a resonator wire between the input resonators and the output resonator.

13. The label of claim 10, wherein all of the mediating resonators comprise the same fluorophore.

14. The label of claim 10, further comprising a facilitator resonator that is coupled to the backbone, wherein the backbone maintains relative locations of the input resonators, the output resonator, the one or more mediating resonators, and the facilitator resonator such that the facilitator resonator being in a dark state facilitates transmission of energy from the input resonators to the output resonator via the one or more mediating resonators.

15. The label of claim 10, further comprising an inhibitor resonator that is coupled to the backbone, wherein the backbone maintains relative locations of the input resonators, the output resonator, the one or more mediating resonators, and the inhibitor resonator such that the inhibitor resonator being in a dark state inhibits transmission of energy from the input resonators to the output resonator via the one or more mediating resonators.

16. The label of claim 1, wherein the analyte of interest is selected from the group consisting of a surface protein, molecular epitope, a hormone, a cell, and a cell surface receptor or other cell surface element.

17. The label of claim 1, wherein the backbone comprises two strands of DNA that are at least partially complementary.

18. A label comprising:

three or more input resonators wherein all of the input resonators comprise at least one of a fluorophore, a quantum dot, or a dye excited at a single wavelength;

one or more mediating resonators, wherein a first one of the one or more mediating resonators is disposed proximate to the input resonator such that the first one or more mediating resonators can receive energy from the input resonator;

an output resonator, wherein at least one of the one or more mediating resonators is disposed within the label proximate to the output resonator such that the output resonator can receive energy from the at least one of the one or more mediating resonators;

a receptor, wherein the receptor is an antibody, aptamer, or protein, and wherein the receptor selectively interacts with an analyte of interest to permit detection of the presence, amount or location of the analyte of interest in a sample; and

a backbone, wherein the three or more input resonators, the output resonator, the receptor and the one or more mediating resonators are coupled to the backbone, and wherein the backbone maintains relative locations of the three or more input resonators, the output resonator, and the one or more mediating resonators such that energy can be transmitted from each of the input resonators to the output resonator via the one or more mediating resonators.

19. The label of claim 18, wherein the backbone comprises two strands of DNA that are at least partially complementary.

20. The label of claim 18, wherein at least one of the mediating resonators, the input resonator, or the output resonator comprises a fluorophore.

21. The label of claim 18, wherein the one or more mediating resonators are disposed within the label as a resonator wire between the input resonator and the output resonator.

22. The label of claim 18, wherein all of the mediating resonators comprise the same fluorophore.

23. The label of claim 18, wherein the three or more input resonators comprise a first input resonator, a second input resonator, and a third input resonator, and wherein at least one of the one or more mediating resonators is disposed proximate to the second input resonator and/or the third input resonator such that the at least one of the one or more mediating resonators can receive energy from the second input resonator and/or the third input resonator.

24. The label of claim 23, wherein the first input resonator is characterized by a first excitation wavelength, wherein the second input resonator is characterized by a second excitation wavelength that differs from the first excitation wavelength, and wherein the third input resonator is characterized by a third excitation wavelength that differs from the first excitation wavelength or the second excitation wavelength.

25. The label of claim 18, wherein the output resonator is a first output resonator, wherein the label further comprises a second output resonator, wherein at least one of the one or more mediating resonators is disposed within the label proximate to the second output resonator such that the second output resonator can receive energy from the at least one of the one or more mediating resonators.

26. The label of claim 25, wherein the second output resonator is characterized by a second emission wavelength that differs from the emission wavelength of the first output resonator.

27. The label of claim 18, wherein the input resonator absorbs light at an excitation wavelength, wherein the output resonator emits light at an emission wavelength, and wherein the emission wavelength differs from the excitation wavelength.

28. The label of claim 27, wherein the one or more mediating resonators are characterized by respective emission wavelengths, and wherein the emission wavelengths of the one or more mediating resonators are intermediate between the excitation wavelength of the input resonator and the emission wavelength of the output resonator.

29. The label of claim 18, further comprising a facilitator resonator that is coupled to the backbone, wherein the backbone maintains relative locations of the input resonator, the output resonator, the one or more mediating resonators, and the facilitator resonator such that the facilitator resonator being in a dark state facilitates transmission of energy from the input resonator to the output resonator via the one or more mediating resonators.

30. The label of claim 18, further comprising an inhibitor resonator that is coupled to the backbone, wherein the backbone maintains relative locations of the input resonator, the output resonator, the one or more mediating resonators, and the inhibitor resonator such that the inhibitor resonator being in a dark state inhibits transmission of energy from the input resonator to the output resonator via the one or more mediating resonators.

31. The label of claim 18, wherein the analyte of interest is selected from the group consisting of a surface protein, molecular epitope, a hormone, a cell, and a cell surface receptor or other cell surface element.

32. A label comprising:

a plurality of input resonators, wherein the input resonators comprise at least one of a fluorophore, a quantum dot, or a dye and all of the input resonators comprise the same fluorophore, quantum dot, or dye excited at a single wavelength , and wherein the input resonators of the plurality of input resonators are disposed within the label proximate to each other such that the input resonators can transmit energy between each other;

a receptor, wherein the receptor is an antibody, aptamer, or protein, and wherein the receptor selectively interacts with an analyte of interest to permit detection of the presence, amount, or location of the analyte of interest in a sample; and

a backbone, wherein the input resonators are coupled to the backbone, and wherein the backbone maintains relative locations of the input resonators such that energy can be transmitted between the input resonators

33. The label of claim 32, wherein the backbone comprises two strands of DNA that are at least partially complementary.

34. The label of claim 32, wherein all of the input resonators of the plurality of input resonators comprise the same fluorophore.

35. The label of claim 32, further comprising a plurality of output resonators, wherein output resonators of the plurality of output resonators are coupled to the backbone, and wherein the backbone maintains relative locations of the input resonators and the output resonators such that energy can be transmitted to each of the output resonators from a respective input resonator of the plurality of input resonators.

36. The label of claim 32, wherein the input resonators absorb light at an excitation wavelength, wherein the output resonators emits light at an emission wavelength, and wherein the emission wavelength differs from the excitation wavelength.

37. The label of claim 32, wherein the analyte of interest is selected from the group consisting of a surface protein, molecular epitope, a hormone, a cell, and a cell surface receptor or other cell surface element

38. The label of claim 32, wherein the plurality of input resonators comprises more than four input resonators.

39. The label of claim 32, wherein the plurality of input resonators comprises more than thirty input resonators.

40. A system comprising:

a sample container;

a light source;

a light detector; and

a controller, wherein the system is configured to perform operations comprising:

illuminating, using the light source, the sample container;

using the light detector, detecting at least one of a wavelength or an intensity of emission of a plurality of photons from the sample container; and

determining, based on the detected wavelength or intensity of emission of the plurality of photons, an identity of a label, wherein determining the identity of the label comprises selecting the identity of the label from a set of known labels, wherein the set of known labels includes a first label and a second label, wherein the first label comprises:

a first receptor, wherein the first receptor selectively interacts with a first analyte of interest, and wherein the first receptor is antibody, aptamer, or protein;

at least three first input resonators, wherein all of the first input resonators comprise at least one of a fluorophore, a quantum dot, or a dye and all of the first input resonators comprise the same fluorophore, quantum dot, or dye excited at a single wavelength;

at least one first output resonator, wherein a ratio between a number of first input resonators in the first label and a number of first output resonators in the first label has a first value; and

a first backbone, wherein the first receptor, the at least three first input resonators, and the at least one first output resonator are coupled to the first backbone, and wherein the first backbone maintains relative locations of the at least three first input resonators and the at least one first output resonator such that energy can be transmitted from each of the first input resonators to at least one first output resonator; and

wherein the second label comprises:

a second receptor, wherein the second receptor selectively interacts with a second analyte of interest, and wherein the second receptor is an antibody, aptamer, or protein;

at least three second input resonators, wherein all of the second input resonators comprise at least one of a fluorophore, a quantum dot, or a dye and all of the second input resonators comprise the same fluorophore, quantum dot, or dye excited at a single wavelength;

at least one second output resonator, wherein a ratio between a number of second input resonators in the second label and a number of second output resonators in the second label has a second value; and

a second backbone, wherein the second receptor, the at least three second input resonators, and the at least one second output resonator are coupled to the second backbone, and wherein the second backbone maintains relative locations of the at least three second input resonators and the at least one second output resonator such that energy can be transmitted from each of the second input resonators to at least one second output resonator.

41. The system of claim 40, wherein the first value and the second value differ.

42. The system of claim 40, wherein the operations further comprise:

sorting a content of the sample container into one or more locations based on the determined identity of the label.

43. A contrast agent comprising:

a first label that comprises:

a first receptor, wherein the first receptor selectively interacts with a first analyte of interest, and wherein the first receptor is an antibody, aptamer, or protein;

at least three first input resonators, wherein all of the first input resonators comprise at least one of a fluorophore, a quantum dot, or a dye and all of the first input resonators comprise the same fluorophore, quantum dot, or dye excited at a single wavelength;

at least one first output resonator, wherein a ratio between a number of first input resonators in the first label and a number of first output resonators in the first label has a first value; and

a first backbone, wherein the first receptor, the at least three first input resonators, and the at least one first output resonator are coupled to the first backbone, and wherein the first backbone maintains relative locations of the at least two first input resonators and the at least

one first output resonator such that energy can be transmitted from each of the first input resonators to at least one first output resonator; and

a second label that comprises:

a second receptor, wherein the second receptor selectively interacts with a second analyte of interest, and wherein the second receptor is an antibody, aptamer, or protein;

at least three second input resonators, wherein all of the second input resonators comprise at least one of a fluorophore, a quantum dot, or a dye and all of the second input resonators comprise the same fluorophore, quantum dot, or dye excited at a single wavelength;

at least one second output resonator, wherein a ratio between a number of second input resonators in the second label and a number of second output resonators in the second label has a second value; and

a second backbone, wherein the second receptor, the at least three second input resonators, and the at least one second output resonator are coupled to the second backbone, and wherein the second backbone maintains relative locations of the at least three second input resonators and the at least one second output resonator such that energy can be transmitted from each of the second input resonators to at least one second output resonator.

44. The contrast agent of claim 43, wherein the first value and the second value differ.

45. The contrast agent of claim 43, wherein the first input resonators and the second input resonators differ with respect to an absorption wavelength.

46. The contrast agent of claim 43, wherein the first output resonator and the second output resonator differ with respect to an emission wavelength.

47. The contrast agent of claim 43, wherein the first label further comprises:

one or more mediating resonators, wherein a first one of the one or more mediating resonators is disposed within the first label proximate to the at least three first input resonators such that the first one of the one or more mediating resonators can receive energy from each of the at least three first input resonators, wherein at least one of the one or more mediating resonators is disposed within the first label proximate to at least one first output resonator such that the at least

one first output resonator can receive energy from the at least one of the one or more mediating resonators, and wherein the first backbone maintaining relative locations of the at least three first input resonators and the at least one output resonator such that energy can be transmitted from each of the first input resonators to at least one first output resonator comprises the backbone maintaining relative locations of the first input resonators, the at least one first output resonator, and the one or more mediating resonators such that energy can be transmitted from each of the first input resonators to the at least one first output resonator via the one or more mediating resonators.