CLAIMS

What is claimed is:

1. An integrated device, comprising:

a first pixel, comprising:

a first photodetection region; and

one or more first charge storage bins spaced from the first photodetection region in a first direction;

a second pixel, comprising:

a second photodetection region; and

one or more second charge storage bins spaced from the second photodetection region in the first direction,

wherein the first and second pixels are positioned in a first row in a second direction perpendicular to the first direction; and

an optical barrier comprising a first contact elongated in the second direction and positioned, in the first direction, between the first photodetection region and the one or more first charge storage bins and between the second photodetection region and the one or more second charge storage bins ~~configured~~ to block at least some photons from reaching the one or more first charge storage bins and the one or more second charge storage bins.

2. The integrated device of claim 1, wherein the optical barrier comprises an at least partially opaque material.

3. The integrated device of claim 1, wherein the optical barrier further comprises a second contact elongated in the second direction, the first and second contacts positioned on opposite sides, in the first direction, of the first and second photodetection regions.

4. The integrated device of claim 3, further comprising:

a third pixel, comprising:

a third photodetection region; and

one or more third charge storage bins spaced from the third photodetection region in the first direction;

a fourth pixel, comprising:

a fourth photodetection region; and

one or more fourth charge storage bins spaced from the fourth photodetection region in the first direction,

wherein the third and fourth pixels are positioned in a second row in the second direction, and

wherein the second contact is positioned, in the first direction, between the first photodetection region and the one or more third charge storage bins and between the second photodetection region and the one or more fourth charge storage bins to block at least some photons from reaching the one or more third charge storage bins and the one or more second charge storage bins.

~~3. The integrated device of claim 2, wherein the at least partially opaque component comprises a contact.~~

4~~5~~. The integrated device of claim 3, further comprising a metal layer spaced from the photodetection region in a ~~second~~ third direction perpendicular to the first and second direction~~s~~, wherein the first contact is elongated from the metal layer toward the photodetection region.

6~~5~~. The integrated device of claim ~~-5~~4, wherein the first contact is electrically isolated from the photodetection region.

7. The integrated device of claim 6, wherein:

the second contact is elongated from the metal layer toward the photodetection region and electrically isolated from the photodetection region.

6~~8~~. The integrated device of claim 7~~5~~, wherein ~~the contact is a first contact and~~ the integrated device further comprises:

a transfer gate disposed between the metal layer and the photodetection region in the ~~second~~ third direction; and

a ~~second~~ third contact elongated from the metal layer to the transfer gate,

wherein the ~~second~~ third contact is electrically coupled to the transfer gate.

~~7. The integrated device of claim 6, further comprising:~~

~~a third contact elongated from the metal layer toward the photodetection region and electrically isolated from the photodetection region, wherein the first contact and the third contact are disposed on opposite sides of the photodetection region in the first direction.~~

~~8. The integrated device of claim 7, further comprising:~~

~~a first pixel comprising the photodetection region and the one or more storage bins; and~~

~~a second pixel comprising a second photodetection region and one or more second storage bins, wherein the first and second pixels are spaced from one another in a third direction perpendicular to the first and second directions,~~

~~wherein the first contact and the third contact are configured to block at least some photons from reaching the one or more storage bins of the first pixel and the one or more second storage bins of the second pixel.~~

~~9~~9. The integrated device of claim ~~8~~1, wherein the first contact and the ~~third~~ second contact are elongated in the ~~third~~ second direction from a first end of the first pixel to a second end of the second pixel.

10. The integrated device of claim 1, wherein:

the first pixel further comprises a first drain spaced from the one or more first charge storage bins in the second direction, with the first contact positioned, in the first direction, between the first photodetection region and the first drain; and

the second pixel further comprises a second drain spaced from the one or more second charge storage bins in the second direction, with the first contact positioned, in the first direction, between the second photodetection region and the second drain.

11. The integrated device of claim 10, wherein:

the first pixel further comprises a first drain transfer gate configured to draw charge carriers from the first photodetection region to the first drain; and

the second pixel further comprises a second drain transfer gate configured to draw charge carriers from the second photodetection region to the second drain.

12. The integrated device of claim 11, wherein:

the first pixel further comprises a first storage transfer gate configured to direct charge carriers from the first photodetection region to the one or more first charge storage bins; and

the second pixel further comprises a second storage transfer gate configured to direct charge carriers from the second photodetection region to the one or more second charge storage bins.

13. The integrated device of claim 12, wherein:

the first and second drain transfer gates are configured to draw the charge carriers to the first and second drains during a rejection period; and

the first and second storage transfer gates are configured to direct the charge carriers to the one or more first and second charge storage bins during a binning period following the rejection period.

14. The integrated device of claim 13, wherein:

the first and second photodetection regions are configured to receive fluorescent emission photons from a sample excited during the rejection period; and

a number of charge carriers collected in the one or more first and second charge storage bins during the binning period indicates fluorescent emission decay characteristics of the sample.

~~10. The integrated device of claim 4, wherein the one or more storage bins are one or more first charge storage bins, and the integrated device further comprises one or more second storage bins spaced from the photodetection region in the first direction and spaced from the one or more first charge storage bins in a third direction perpendicular to the first and second directions.~~

~~11. The integrated device of claim 3, further comprising:~~

~~a transfer gate configured to control a flow of charge carriers from the photodetection region to the one or more storage bins; and~~

~~a metal layer elongated in the first direction and spaced from the transfer gate in a second direction perpendicular to the first direction,~~

~~wherein the contact is elongated from the transfer gate to the metal layer.~~

~~12. The integrated device of claim 11, wherein the at least partially opaque component further comprises a via elongated from the metal layer to a second metal layer spaced from the metal layer in the second direction.~~

13. The integrated device of claim 11, wherein the contact is positioned cylindrically around the photodetection region.

14. The integrated device of claim 11, wherein the contact comprises metal.

15. The integrated device of claim 2, further comprising:

a transfer gate configured to control a flow of charge carriers from the photodetection region to the one or more storage bins,

wherein the at least partially opaque component comprises a layer positioned around the transfer gate.

16. The integrated device of claim 15, wherein the layer comprises a semiconductor-metal compound.

17. The integrated device of claim 15, wherein the layer comprises a dielectric film.

18. The integrated device of claim 15, wherein the layer comprises metal.

19. The integrated device of claim 2, further comprising:

a transfer gate configured to control a flow of charge carriers along the primary path,

wherein the at least partially opaque component comprises a portion of the transfer gate.

20. The integrated device of claim 19, wherein the portion of the transfer gate comprises metal.

21. The integrated device of claim 19, wherein the portion comprises an oxide component.

22. The integrated device of claim 2, further comprising:

a metal transfer gate configured to control a flow of charge carriers along the primary path,

wherein the at least partially opaque component comprises the metal transfer gate.

~~23. The integrated device of claim 1, wherein the optical barrier includes an optical waveguide elongated from the photodetection region in a second direction perpendicular to the first direction.~~

~~24. An integrated device, comprising:~~

~~a photodetection region;~~

~~one or more storage bins coupled to the photodetection region via a primary path; and~~

~~a doped semiconductor region configured to block at least some charge carriers from reaching the one or more storage bins along at least one secondary path.~~

~~25. The integrated device of claim 24, wherein the doped semiconductor region is positioned above, below, and/or adjacent the one or more storage bins.~~

~~26. The integrated device of claim 25, further comprising:~~

~~a bulk semiconductor region positioned around the photodetection region and the one or more storage bins,~~

~~wherein the doped semiconductor region is positioned between the one or more storage bins and the bulk semiconductor region.~~

~~27. The integrated device of claim 26, wherein the doped semiconductor region comprises an opposite conductivity type from the photodetection region and the one or more storage bins and is configured to impede the at least some charge carriers from reaching the one or more storage bins.~~

~~28. The integrated device of claim 26, wherein the doped semiconductor region comprises a same conductivity type as the photodetection region and the one or more storage bins and is configured to impede the at least some charge carriers from reaching the one or more storage bins.~~

15. A method of operating the integrated circuit of any one of claims 1-14, the method comprising:

receiving incident photons at the first and second photodetection regions; and

blocking at least some photons from reaching the one or more first charge storage bins and the one or more second charge storage bins.~~29. An integrated device, comprising:~~

a photodetection region configured to receive emission photons along a first portion of a primary path;

one or more storage bins electrically coupled to receive charge carriers from the photodetection region along a second portion of the primary path; and

at least one barrier configured to block at least some photons and/or at least some charge carriers from reaching the one or more storage bins along at least one secondary path.

30. The integrated device of claim 29, wherein the at least one barrier comprises an optical barrier configured to block the at least some photons from reaching the one or more storage bins along the at least one secondary path.

31. The integrated device of claim 30, wherein the optical barrier comprises an at least partially opaque component positioned along the at least one secondary path between a source of the at least some photons and the one or more storage bins.

32. The integrated device of claim 31, wherein the at least partially opaque component comprises a contact and/or via.

33. The integrated device of claim 31, further comprising:

a transfer gate configured to control a flow of charge carriers along the primary path,

wherein the at least partially opaque component comprises a layer positioned around the transfer gate.

34. The integrated device of claim 33, wherein the layer comprises silicide.

35. The integrated device of claim 33, wherein the layer comprises metal.

36. The integrated device of claim 31, further comprising:

a transfer gate configured to control a flow of charge carriers along the primary path,

wherein the at least partially opaque component comprises a metal portion of the transfer gate.

37. The integrated device of claim 31, wherein the at least partially opaque component comprises a metal transfer gate of the integrated device, wherein the metal transfer gate is configured to control a flow of charge carriers along the primary path.

38. The integrated device of claim 29, wherein the at least one barrier comprises an electrical barrier configured to block the at least some charge carriers from reaching the one or more storage bins along the at least one secondary path.

39. The integrated device of claim 38, wherein the electrical barrier comprises a doped semiconductor region positioned above, below, and/or adjacent the one or more storage bins.

40. The integrated device of claim 38, wherein the one or more storage bins are positioned with respect to the photodetection region such that the electrical barrier comprises a region of bulk semiconductor material positioned therebetween.

41. The integrated device of claim 30, wherein the optical barrier includes an optical waveguide elongated along the first portion of the primary path.

42. An integrated device comprising:

a photodetection region; and

one or more storage bins shaped and/or positioned along a primary path relative to the photodetection region as to enable receipt of first charge carriers along the primary path from the photodetection region and impede receipt of second charge carriers along at least one secondary path.

43. An integrated device comprising:

a photodetection region configured to receive photons along a primary optical path; and

a first storage bin configured to receive charge carriers transferred laterally along a primary electrical path from the photodetection region;

wherein the storage bin is shaped and/or located to reduce receipt, by the storage bin, of undesirable charge carriers along at least one secondary path.

44. A method comprising:

exciting a sample with a light pulse;

receiving, at a photodetection region along a primary optical path, emissions from the sample;

providing, by the photodetection region to a storage bin along a primary electrical path, first charge carriers indicative of the emissions; and

limiting a number of photons and/or second charge carriers received by the storage bin through at least one secondary path.

45. The method of claim 44, wherein limiting the number of second charge carriers comprises blocking, by an optical barrier positioned adjacent the storage bin, secondary path photons incident along the at least one secondary path from reaching the storage bin.

46. The method of claim 44, wherein:

receiving the emissions from the sample comprises receiving the emissions along a first direction; and

limiting the number of second charge carriers comprises blocking, by a doped semiconductor region positioned adjacent the storage bin in a second direction perpendicular to the first direction, the second charge carriers from reaching the storage bin.

47. An integrated device, comprising:

a photodetection region configured to receive fluorescent emission photons from a sample along a primary optical path;

one or more storage bins electrically coupled to the photodetection region along a primary electrical path; and

at least one barrier configured to block:

at least some photons from reaching the one or more storage bins along at least one secondary optical path different from the primary optical path; and/or

at least some photo-electrons from reaching the one or more storage bins along at least one secondary electrical path different from the primary electrical path.

48. A method of performing at least partial sequencing and/or analysis of a sample, the method comprising:

exciting the sample with a light pulse;

receiving, at a photodetection region along a primary optical path, emissions from the sample;

providing, by the photodetection region to a storage bin along a primary electrical path, first charge carriers indicative of the emissions; and

limiting a number of photons and/or second charge carriers received by the storage bin through at least one secondary path.

49. The method of claim 48, wherein the at least partial sequencing and/or analysis includes at least one of DNA sequencing, RNA sequencing, and/or protein sequencing.