

CLAIMS

1. A system comprising:
an integrated photonic device comprising a plurality of sample wells;
a light source comprising at least one laser diode and configured to produce one or more pulsed light signals for exciting a plurality of samples within the plurality of sample wells; and
a driver circuit coupled to the light source and configured to receive a clock signal and to control a timing of the one or more pulsed light signals based on the clock signal.
2. The system of claim 1, wherein the at least one laser diode comprises a plurality of laser diodes, and wherein the driver circuit is further configured to generate a plurality of drive signals having timing based on the clock signal to drive respective laser diodes within the plurality of laser diodes with the drive signals.
3. The system of claim 2, wherein the driver circuit is further configured to apply an adjustable delay to timing in some or all of the plurality of drive signals.
4. The system of claim 1, wherein the at least one laser diode is configured to operate in an amplitude modulation mode.
5. The system of claim 1, wherein the integrated photonic device comprises at least one million sample wells and wherein the at least one laser diode is configured to produce the one or more pulsed light signals with an optical power level of less than 100mW.
6. The system of claim 1, further comprising at least one waveguide configured to optically couple the one or more pulsed light signals to some or all of the plurality of sample wells.
7. The system of claim 6, wherein the integrated photonic device further comprises one or more grating couplers configured to optically couple the one or more pulsed light signals to the at least one waveguide.
8. The system of claim 7, wherein the light source comprises an array of laser diodes, the one or more grating couplers are a plurality of grating couplers, and the system further comprises a plurality of optical paths each coupling a laser diode of the array of laser diodes to a corresponding grating coupler of the plurality of grating couplers.

9. The system of claim 8, wherein the plurality of optical paths comprise a first optical path and a second optical path that form an angle of at least 90 degrees.
10. The system of claim 6, further comprising one or more optical elements configured to optically couple the one or more pulsed light signals to the at least one waveguide, wherein the one or more optical elements comprises a mirror, a lens, an optical fiber or combinations thereof.
11. The system of claim 1, wherein the at least one laser diode comprises a gain-switched laser diode, and wherein the one or more pulsed light signals has a full-width-half-maximum of between 100 and 1000 ps.
12. A system comprising:
 - a chip comprising a plurality of sample wells and at least one waveguide;
 - at least one laser diode configured to produce one or more pulsed light signals for exciting samples within the plurality of sample wells of the chip via a corresponding waveguide of the at least one waveguide; and
 - a driver circuit configured to receive a clock signal and to synchronize a timing of the produced one or more pulsed light signals based on the clock signal.
13. The system of claim 12, wherein the at least one laser diode comprises a plurality of laser diodes, and wherein the driver circuit is further configured to generate a plurality of drive signals having timing based on the clock signal to drive respective laser diodes within the plurality of laser diodes with the drive signals.
14. The system of claim 12, wherein the chip comprises at least one million sample wells and wherein the at least one laser diode is configured to produce the one or more pulsed light signals with an optical power level of less than 100mW.
15. The system of claim 12, wherein the chip further comprises one or more grating couplers configured to optically couple the one or more pulsed light signals to the at least one waveguide.
16. A method of operating a system comprising a chip, at least one laser diode and a driver circuit, the chip having a plurality of sample wells, the method comprises:
 - receiving a clock signal at the driver circuit;

based on the received clock signal, generating one or more drive signals with the driver circuit;

producing one or more pulsed light signals with the at least one laser diode based on the one or more drive signals; and

exciting a plurality of samples within the plurality of sample wells with the one or more pulsed light signals.

17. The method of claim 16, wherein the at least one laser diode comprises a plurality of laser diodes, and the method further comprises:

generating a plurality of synchronized pulsed light signals based on the clock signal.

18. The method of claim 17, wherein generating the plurality of synchronized pulsed light signals comprises:

generating, with the driver circuit, a plurality of drive signals each having a timing based on the clock signal; and

driving each laser diode of the plurality of laser diodes with a corresponding drive signal.

19. The method of claim 18, wherein generating the plurality of drive signals comprises:

delaying the clock signal to produce a plurality of delayed timing signals each having a programmable delay;

setting the timing of each of the drive signal based on a corresponding delayed timing signal, wherein

the programmable delay for each drive signal are selected such that the plurality of synchronized pulsed light signals excite the plurality of samples in the chip with a predefined timing relationship.

20. The method of claim 16, wherein the chip has at least one million sample wells and wherein producing one or more pulsed light signals comprises operating the at least one laser diode to produce a pulsed light signal with an optical power level of less than 100mW.