WHAT IS CLAIMED IS:

1. A light detection and ranging (LIDAR) system comprising:

a laser configured to output a beam;

a modulator configured to receive the beam from the laser and modulate the beam to generate a modulated beam;

a photonic integrated circuit having an optical amplifier coupled to receive the modulated beam from the modulator and generate an amplified beam, wherein a structural configuration within the optical amplifier includes (i) an active layer, and (ii) a guiding layer coupled to the active layer and including a particular structure of alternating alloy materials that is configured to dissipate heat; and

a transceiver chip coupled to the photonic integrated circuit, the transceiver chip configured to emit the amplified beam and receive a reflected beam from a target.

2. The LIDAR system of claim 1, wherein the active layer is an offset bulk quantum mechanical structure or a multi quantum mechanical structure.

3. The LIDAR system of claim 2, wherein the offset bulk quantum mechanical structure is one from a group of an offset multiple quantum wells or an offset quantum dot layer(s).

4. The LIDAR system of claim 1, wherein the photonic integrated circuit includes a first heat dissipation structure to reduce heat from a lower side of the photonic integrated circuit and a second heat dissipation structure to reduce heat from an upper side of the photonic integrated circuit.

5. The LIDAR system of claim 1, wherein the particular structure includes one or more alternating indium phosphide (InP) layers.

6. The LIDAR system of claim 1, wherein the particular structure includes an alternating or periodic or super lattice structure that comprises one or more alternating

Indium Phosphide and Indium Gallium Arsenide Phosphide (InGaAsP) or Indium Gallium Aluminium Arsenide (InGaAlAs) or other quaternary or ternary alloy layers for improved thermal dissipation resulting in high wall plug efficiency.

7. The LIDAR system of claim 1, wherein the particular structure is integrated with a silicon photonics waveguide, the particular structure having an optical mode converter.

8. The LIDAR system of claim 1, wherein the photonic integrated circuit includes a monolithically integrated spot-size converter, wherein the photonic integrated circuit is optically coupled to an optical waveguide connector.

9. The LIDAR system of claim 1, wherein the photonic integrated circuit includes one or more passive components monolithically integrated with the optical amplifier.

10. The LIDAR system of claim 9, wherein the one or more passive components include a semiconductor optical amplifier (SOA) coupled by a U-turn to a coupler monolithically integrated to provide an input on a same side of the photonic integrated circuit.

11. The LIDAR system of claim 1, wherein the particular structure includes an alternating or a periodic or a super lattice structure.

12. The LIDAR system of claim 1, wherein the photonic integrated circuit comprises and integrates monolithically a second amplifier providing a particular gain, and an output of the second amplifier is coupled to an input of the optical amplifier.

13. A photonic integrated circuit comprising:

a first amplifier coupled to receive an input beam and generate an amplified beam, a structural configuration within the first amplifier including an active layer and a guiding layer coupled to the active layer, the guiding layer including a particular structure of alternating alloy materials that is configured for improved thermal dissipation; and

one or more passive components monolithically integrated with the first amplifier as part of the photonic integrated circuit.

14. The photonic integrated circuit of claim 13, wherein the active layer is an offset bulk or multi-quantum well structure.

15. The photonic integrated circuit of claim 14, wherein the offset bulk or multi quantum well structure is one from a group of an offset bulk quantum well, multiple quantum wells or an offset quantum dot layer.

16. The photonic integrated circuit of claim 13, wherein the particular structure includes an alternating or periodic or super lattice structure that comprises an alternating indium phosphide (InP) and an alloyed layer for high wall plug efficiency through improved thermal dissipation.

17. The photonic integrated circuit of claim 13, wherein the particular structure includes an alternating or periodic or super lattice structure that comprises an alternating gallium arsenide (GaAs) and an alloyed layer with high wall plug efficiency and improved thermal dissipation.

18. The photonic integrated circuit of claim 13, wherein the particular structure has an optical mode converter for integration with a silicon photonics waveguide.

19. The photonic integrated circuit of claim 13 comprising a monolithically integrated spot-size converter, wherein the photonic integrated circuit is optically coupled to an optical waveguide.

20. The photonic integrated circuit of claim 13, wherein the one or more passive components includes a semiconductor optical amplifier (SOA) coupled by a U-turn to a coupler.

21. The photonic integrated circuit of claim 13 further comprising a second amplifier providing a particular gain, an output of the second amplifier coupled to an input of the first amplifier.