CLAIMS

What is claimed is:

1. An external cavity laser, characterized in that, the external cavity laser comprises a gain chip, and a tunable reflector coupled with the gain chip; wherein the tunable reflector includes:

a main waveguide coupled to the gain chip and configured to receive an optical signal transmitted by the gain chip;

a beam splitter coupled to the main waveguide and configured to equally split the optical signal transmitted by the main waveguide into a first optical signal and a second optical signal;

a first branch waveguide coupled to the beam splitter and configured to receive the first optical signal;

a first photonic crystal modulator arranged beside the first branch waveguide and configured to tune the first optical signal transmitted by the first branch waveguide;

a second branch waveguide coupled to the beam splitter and configured to receive the second optical signal;

a second photonic crystal modulator arranged beside the second branch waveguide and configured to tune the second optical signal transmitted by the second branch waveguide; and

wherein the first photonic crystal modulator and the second photonic crystal modulator are configured to perform modulation of the first optical signal and the second optical signal under the action of electrical signals.

2. The external cavity laser according to claim 1, characterized in that the

tunable reflector further includes a common waveguide;

wherein the first photonic crystal modulator is arranged on one side of the first branch waveguide close to the second branch waveguide, and the second photonic crystal modulator is arranged on one side of the second branch waveguide close to the first branch waveguide;

wherein the common waveguide is arranged between the first photonic crystal modulator and the second photonic crystal modulator, and is configured to receive the first optical signal tuned by the first photonic crystal modulator, and transmit the first optical signal after tuned to a resonant cavity of the second photonic crystal modulator, so as to be coupled to the second branch waveguide after the secondary tuning by the second photonic crystal modulator; and, to receive the second optical signal tuned by the second photonic crystal modulator, and transmit the second optical signal after tuned to a resonant cavity of the first photonic crystal modulator, so as to be coupled to the first branch waveguide after the secondary tuning by the first photonic crystal modulator.

3. The external cavity laser according to claim 2, characterized in that the tunable reflector further includes a lower cladding layer and an upper cladding layer arranged opposite to each other;

wherein the main waveguide, the beam splitter, the first branch waveguide, the first photonic crystal modulator, the second branch waveguide, the second photonic crystal modulator, and the common waveguide are respectively arranged between the lower cladding layer and the upper cladding layer.

4. The external cavity laser according to claim 3, characterized in that an upper surface of the lower cladding layer is provided with a semiconductor layer and the tunable reflector further includes a first electrode, a second electrode, and a common electrode;

wherein the first electrode, the second electrode, and the common electrode are respectively disposed on an upper surface of the upper cladding layer, and are respectively connected to the semiconductor layer via through holes in the upper cladding layer;

wherein the first photonic crystal modulator is arranged between the first electrode and the common electrode and is configured to tune the optical signal under the action of the electrical signal provided by the first electrode and the common electrode;

wherein the second photonic crystal modulator is arranged between the second electrode and the common electrode and is configured to tune the optical signal under the action of the electrical signal provided by the second electrode and the common electrode.

5. The external cavity laser according to claim 3 or claim 4, characterized in that an orthogonal projection of the common waveguide on the upper cladding layer is a "U" shape.

6. The external cavity laser according to claim 5, characterized in that, when the tunable reflector includes the common electrode, the common electrode is located in a concave area of the orthographic projection of the common

waveguide on the upper cladding layer.

7. The external cavity laser according to claim 3 or claim 4, characterized in that the tunable reflector further includes:

a first heating layer disposed on the upper surface of the upper cladding layer and located within an orthographic projection range of the first photonic crystal modulator on the upper cladding layer; and

a second heating layer disposed on the upper surface of the upper cladding layer and located within an orthographic projection range of the second photonic crystal modulator on the upper cladding layer.

8. The external cavity laser according to claim 1, characterized in that the tunable reflector further includes a common waveguide;

wherein the first branch waveguide extends along a first direction, and the second branch waveguide extends along a second direction; wherein the first direction and the second direction respectively intersect with a transmission direction of the main waveguide, and are symmetrical with the transmission direction of the main waveguide as the center; wherein the first photonic crystal modulator is arranged beside the first branch waveguide along the first direction, and the second photonic crystal modulator is arranged beside the second branch waveguide along the second direction;

wherein the common waveguide is disposed on a side of the first photonic crystal modulator away from the first branch waveguide, and on a side of the second photonic crystal modulator away from the second branch waveguide; wherein the common waveguide is configured to receive the

first optical signal tuned by the first photonic crystal modulator and transmit the tuned first optical signal into the resonant cavity of the second photonic crystal modulator, so as to be coupled to the second branch waveguide after being secondary tuning by the second photonic crystal modulator; and, to receive the second optical signal tuned by the second photonic crystal modulator, and transmit the tuned second optical signal to the resonant cavity of the first photonic crystal modulator, so as to be coupled to the first branch waveguide after being secondary tuning by the first photonic crystal modulator.

9. The external cavity laser according to claim 8, characterized in that the common waveguide includes a straight waveguide.

10. The external cavity laser according to claim 1, characterized in that the tunable reflector further includes:

a first phase shifter coupled to the first branch waveguide and configured to adjust a phase of the first optical signal received by the first branch waveguide; and

a second phase shifter coupled to the second branch waveguide and configured to adjust a phase of the second optical signal received by the second branch waveguide.

11. The external cavity laser according to claim 1, characterized in that the tunable reflector further includes:

a wavelength adjuster coupled to the main waveguide and configured

to adjust the wavelength of the optical signal received by the main waveguide.

12. The external cavity laser according to claim 1, characterized in that the first photonic crystal modulator and the second photonic crystal modulator each includes one photonic crystal modulation structure, or a plurality of cascaded photonic crystal modulation structures.

13. The external cavity laser according to claim 12, characterized in that the photonic crystal modulation structure includes a one-dimensional photonic crystal nanobeam cavity structure or a two-dimensional photonic crystal flat plate structure.

14. The external cavity laser according to claim 12, characterized in that the photonic crystal modulation structure includes a cylindrical array structure, a fishbone structure, or a hole array structure.

15. The external cavity laser according to claim 1, characterized in that the beam splitter includes a Y-branch waveguide, a 1×2 multimode interference coupler, a 2×2 multimode interference coupler, or a directional coupler with a beam splitting ratio of 50:50.

16. A tuning method for an external cavity laser, characterized in that, comprising:

a main waveguide receives an optical signal transmitted by a gain chip

and transmits the optical signal to a beam splitter;

the beam splitter splits the optical signal into a first optical signal and a second optical signal, transmits the first optical signal to a first branch waveguide, and transmits the second optical signal to a second branch waveguide;

a first photonic crystal modulator tunes the first optical signal transmitted by the first branch waveguide; and

a second photonic crystal modulator tunes the second optical signal transmitted by the second branch waveguide;

wherein the tuning method further comprises:

the first photonic crystal modulator and the second photonic crystal modulator perform modulation of the first optical signal and the second optical signal under the action of electrical signals.

17. The tuning method for an external cavity laser according to claim 16, characterized in that a tunable reflector of the external cavity laser further includes a common waveguide;

the tuning method further comprises:

the first photonic crystal modulator couples the tuned first optical signal to the common waveguide, and the common waveguide transmits the tuned first optical signal into a resonant cavity of the second photonic crystal modulator, and the second photonic crystal modulator performs secondary tuning on the tuned first optical signal and couples the secondarily tuned first optical signal to the second branch waveguide; and

the second photonic crystal modulator couples the tuned second

optical signal to the common waveguide, and the common waveguide transmits the tuned second optical signal into a resonant cavity of the first photonic crystal modulator, and the first photonic crystal modulator performs secondary tuning on the tuned second optical signal and couples the secondarily tuned second optical signal to the first branch waveguide.

18. The tuning method for an external cavity laser according to claim 16 or claim 17, characterized in that the tunable reflector of the external cavity laser further includes a first heating layer and a second heating layer;

the tuning method further comprises:

adjusting a resonant peak of the first photonic crystal modulator through the first heating layer, so as to make the resonance peak of the first photonic crystal modulator consistent with a resonance peak of the second photonic crystal modulator; and

adjusting the resonant peak of the second photonic crystal modulator through the second heating layer, so as to make the resonance peak of the second photonic crystal modulator consistent with the resonance peak of the first photonic crystal modulator.

19. The tuning method for an external cavity laser according to claim 18, characterized in that the tunable reflector of the external cavity laser further includes a wavelength adjuster;

the tuning method further comprises:

adjusting the wavelength of the optical signal by the wavelength adjuster before the main waveguide transmitting the optical signal to the

beam splitter, so as to make the wavelength of the optical signal consistent with an operating wavelength of the first photonic crystal modulator and an operating wavelength of the second photonic crystal modulator.

20. The tuning method for an external cavity laser according to claim 16, characterized in that the tunable reflector of the external cavity laser further includes a first phase shifter and a second phase shifter;

the tuning method further comprises:

adjusting a phase of the first optical signal through the first phase shifter before the first photonic crystal modulator tuning the first optical signal which is transmitted through the first branch waveguide, so as to make the phase of the first optical signal consistent with a phase of the second optical signal; and

adjusting the phase of the second optical signal through the second phase shifter before the second photonic crystal modulator tuning the second optical signal which is transmitted through the second branch waveguide, so as to make the phase of the second optical signal consistent with the phase of the first optical signal.