WHAT IS CLAIMED IS:

1. An optical device, comprising:

a substrate having a planar surface and having an optical core thereon;

a two-dimensional grating located in the optical core, said two-dimensional grating being formed by a regular two-dimensional pattern of light-refractive structures, one of said light-refractive structures being located at each node of a regular 2D lattice located in a laterally bounded region, and

first and second optical waveguides being on the planar substrate and having ends end-coupled to the two-dimensional grating, the first optical waveguide being such that a direction of propagation near the end thereof is substantially along a primitive lattice vector of said 2D lattice, the second optical waveguide being such that a direction of propagation near the end thereof is not-parallel to a primitive lattice vector of said regular 2D lattice.

2. The device of claim 1, further comprising:

a third optical waveguide being on the planar substrate and having an end end-coupled to the two-dimensional grating, the third optical waveguide being such that a direction of propagation near the end thereof is substantially along a different primitive lattice vector of said 2D lattice.

3. The device of claim 2, wherein one of said one or more waveguides carries a first polarized portion of said light and another of said one or more waveguides

carries a different second polarized portion of said light.

4. The device of claim 3, wherein said polarized portions of said light are separately directed by each one of said two waveguides to different ends of a photodiode integrated in said optical device.

5. The device of claim 1, further including an optical fiber oriented to direct light towards said planar surface of the planar substrate such that said directed light passes into the two-dimensional grating.

6. The device of claim 1, wherein said regular 2D lattice has either primitive lattice vectors of different lengths or primitive lattice vectors that are neither parallel nor perpendicular.

7. An optical device, comprising:

a substrate having a planar surface and having an optical core thereon;

a two-dimensional grating located in the optical core, said two-dimensional grating being formed by a regular two-dimensional pattern of light-refractive structures, one of said light-refractive structures being located at each node of a regular 2D lattice located in a laterally bounded region, and

one or more optical waveguides being on the planar substrate and having ends end-coupled to the two-dimensional grating, said one or more optical waveguide

being such that a direction of propagation near said end thereof is substantially along a non-primitive lattice vector of said regular 2D lattice.

8. A method of using an optical device, comprising:

transmitting a light through an optical coupler, including: directing said light towards a two-dimensional grating in a optical core layer, said light being directed at an angle that is substantially normal to a planar substrate that said optical core layer is located on, wherein said two-dimensional grating being formed by a regular two-dimensional pattern of light-refractive structures, one of said light-refractive structures being located at each node of a regular 2D lattice located in a laterally bounded region; and

diffracting said light in said two-dimensional grating such that said light exits said two-dimensional grating into first and second optical waveguides being on the planar substrate and having ends end-coupled to the two-dimensional grating, the first optical waveguide being such that a direction of propagation near the end thereof is substantially along a primitive lattice vector of said 2D lattice, the second optical waveguide being such that a direction of propagation near the end thereof is not-parallel to a primitive lattice vector of said regular 2D lattice.

9. The method of claim 8, wherein said propagation direction of said light is reversed.

10. A method of manufacturing an optical device, comprising:

fabricating an optical coupler on a planar substrate, including:

forming a two-dimensional grating, including:

forming a optical core layer on said substrate;

patterning said optical core layer to form a periodic arrangement of light-refractive structures, one of said light-refractive structures being located at each node of a regular 2D lattice located in a laterally bounded region; and

patterning said optical core layer to form first and second optical waveguides on the planar substrate and having ends end-coupled to the two-dimensional grating, the first optical waveguide being such that a direction of propagation near the end thereof is substantially along a primitive lattice vector of said 2D lattice, the second optical waveguide being such that a direction of propagation near the end thereof is not-parallel to a primitive lattice vector of said regular 2D lattice.

IN THE CLAIMS:

1) An optical device, comprising:

a substrate having a planar surface and having an optical core thereon;

a two-dimensional grating located in the optical core, said two-dimensional grating being formed by a regular two-dimensional pattern of light-refractive structures, one of said light-refractive structures being located at each node of a regular 2D lattice located in a laterally bounded region, and

first and second optical waveguides located in different portions of the optical core and in a same plane as the optical core, and having ends end-coupled to the two-dimensional grating, the first optical waveguide being such that a direction of propagation through the laterally bounded region is parallel with the planar surface and near the end thereof is substantially along one of two primitive lattice vectors of said 2D lattice, the second optical waveguide being such that a direction of propagation through the laterally bounded region is parallel with the planar surface and near the end thereof is not-parallel to said primitive lattice vectors of said regular 2D lattice; and

a third optical waveguide being on the planar substrate and having an end end-coupled to the two-dimensional grating, the third optical waveguide being such that a direction of propagation near the end thereof is substantially not parallel to said primitive lattice vectors of said 2D lattice.

2) The device of claim 1, wherein the third optical waveguide is located in different portions of the optical core and in a same plane as the optical core on the planar substrate.

3) The device of claim 1, wherein one of said one or more waveguides carries a first polarized portion of light and another of said one or more waveguides carries a different second polarized portion of said light.

4) The device of claim 3, wherein said polarized portions of said light are separately directed by two different ones of said waveguides to different ends of a photodiode integrated in said optical device.

5) The device of claim 1, further including an optical fiber oriented to direct light towards said planar surface of the planar substrate such that said directed light passes into the two-dimensional grating.

6) The device of claim 5, wherein an axis of an end-portion of said optical fiber is tilted by an angle of about 2 to 10 degrees with respect to a normal vector to said planar surface

7) An optical device, comprising:

a substrate having a planar surface and having an optical core thereon;

a two-dimensional grating located in the optical core, said two-dimensional grating being formed by a regular two-dimensional pattern of light-refractive structures, one of said light-refractive structures being located at each node of a regular 2D lattice located in a laterally bounded region, and

first and second optical waveguides being on the planar substrate and having ends end-coupled to the two-dimensional grating, the first optical waveguide being such that a direction of propagation near the end thereof is substantially along a primitive lattice vector of said 2D lattice, the second optical waveguide being such that a direction of propagation near the end thereof is not-parallel to a primitive lattice vector of said regular 2D lattice, and wherein the two-dimensional grating is configured to couple light of a first wavelength from the optical fiber to one of the optical waveguides and to couple light of a second wavelength to the optical fiber from the other of the optical waveguides and a wavelength of said light is equal to about $a \cdot n_{eff}/\sqrt{2}$, where a is a center-to-center distance between adjacent ones of said light refractive structures and n_{eff} is an effective refractive index of said two-dimensional grating.

8) The device of claim 1, wherein said regular 2D lattice has

either said primitive lattice vectors of different lengths or said primitive lattice vectors that are neither parallel nor perpendicular.

9) The device of claim 1, wherein the two-dimensional grating is configured to couple light of a first wavelength from an optical fiber to one of the optical waveguides and to couple light of a second wavelength to the optical fiber from the other of the optical waveguides.

10) An optical device, comprising:

a substrate having a planar surface and having an optical core thereon;

a two-dimensional grating located in the optical core, said two-dimensional grating being formed by a regular two-dimensional pattern of light-refractive structures, one of said light-refractive structures being located at each node of a regular 2D lattice located in a laterally bounded region, and

first and second optical waveguides being on the planar substrate and having ends end-coupled to the two-dimensional grating, the first optical waveguide being such that a direction of propagation near the end thereof is substantially along a primitive lattice vector of said 2D lattice, the second optical waveguide being such that a direction of propagation near the end thereof is not-parallel to a primitive lattice vector of said regular 2D lattice, and wherein the two-dimensional grating is configured to couple light of a first wavelength from the optical fiber to one of the optical waveguides and to couple light of a second wavelength to the optical fiber from the other of the optical waveguides and a wavelength of said second light is equal to about $a \cdot n_{eff}$, where a is equal to a periodic center-to-center distance between adjacent ones of said light-refractive structures in a given primitive lattice vector and n_{eff} an effective refractive index of said two-dimensional grating.

11) The device of claim 10, wherein said light, having a first wavelength, is transmitted to said two-dimensional grating through an optical fiber located above said planar substrate, and said second light, having a different second wavelength, is transmitted out of said two-dimensional grating at said angle and into said optical fiber.

12) The device of claim 11, wherein said a and said angle have values that simultaneously satisfy the relationships:

$k_{out,X} = k_{in,X} \sin\theta + \frac{2\pi}{a}$, where $k_{in,X} = 2\pi n_{cl}/(\lambda 2)$ and $k_{out,X} = 2\pi n_{eff}/(\lambda 2)$, and

$k_{out,M}^2 = \left(\frac{2\pi}{a}\right)^2 + \left(\frac{2\pi}{a} - k_{in,M} \sin\theta\right)^2$, where $k_{in,M} = 2\pi n_{cl}/(\lambda 1)$ and $k_{out,M} = 2\pi n_{eff}/(\lambda 1)$, and,

where $\lambda 1$ is said first wavelength, $\lambda 2$ is said second wavelength, and θ is an incident angle of said angle away from a normal angle to said planar substrate.

13) An optical device, comprising:

a substrate having a planar surface and having an optical core thereon;

a two-dimensional grating located in the optical core, said two-dimensional grating being formed by a regular two-dimensional pattern of light-refractive structures, one of said light-refractive structures being located at each node of a regular 2D lattice located in a laterally bounded region, and

two or more optical waveguides located in different portions of the optical core and in a same plane as the optical core and having ends end-coupled to the two-dimensional grating, such that for at least one of the optical waveguides, a direction of propagation near said end thereof and through said laterally bounded region is substantially along a non-primitive lattice vector of said regular 2D lattice.

14) A method of using an optical device, comprising:

transmitting a light through an optical coupler, including:

directing said light towards a two-dimensional grating in a optical core layer, said light being directed at an angle that is substantially normal to a planar substrate that said optical core layer is located on, wherein said two-dimensional grating being formed by a regular two-dimensional pattern of light-refractive structures, one of said light-refractive structures being located at each node of a regular 2D lattice located in a laterally bounded region; and

diffracting said light in said two-dimensional grating such that said light exits from said laterally bounded region to said two-dimensional grating into first, second and third optical waveguides being on the planar substrate and in a same plane as the optical core layer and having ends end-coupled to different portions of the two-dimensional grating,

the first optical waveguide being such that a direction of propagation there-through is parallel with the planar surface and near the end thereof is substantially along one of two primitive lattice vectors of said 2D lattice,

the second optical waveguide being such that a direction of propagation there-through is parallel with the planar surface and near the end thereof is not-parallel to said primitive lattice vectors of said regular 2D lattice, and

the third optical waveguide being such that a direction of propagation there-through is parallel with the planar surface and near the end thereof is not-parallel to said primitive lattice vectors of said 2D lattice.

15) The method of claim 14, wherein said propagation direction of said light is reversed.

16) The method of claim 14, further including transmitting a second light through said optical coupler, wherein said second light has a different wavelength than said light, said transmitting including:

directing said second light to said two-dimensional grating by passing said second light through said third optical waveguide.

17) The method of claim 14, further including, transmitting a second light through said optical coupler, wherein said second light has a different wavelength than said light, said transmitting including:

directing said second light to said two-dimensional grating, said second light being directed at said angle; and

defracting said second light in said two-dimensional grating such that said second light exits said two-dimensional grating through said a third optical waveguide.

18) A method of manufacturing an optical device, comprising:

fabricating an optical coupler on a planar substrate, including:

forming a two-dimensional grating, including:

forming a optical core layer on said substrate;

patterning said optical core layer to form a periodic arrangement of light-refractive structures, one of said light-refractive structures being located at each node of a regular 2D lattice located in a laterally bounded region; and

patterning said optical core layer to form first, second and third optical waveguides on the planar substrate and in different portions of the optical core layer and having ends end-coupled to the two-dimensional grating,

the first optical waveguide being such that a direction of propagation near the end thereof and through the laterally bounded region is substantially along one of two primitive lattice vectors of said 2D lattice,

the second optical waveguide being such that a direction of propagation near the end thereof and through the laterally bounded region is not-parallel to said primitive lattice vectors of said regular 2D lattice, and

the third optical waveguide being such that a direction of propagation there-through is parallel with the planar surface and near the end thereof is not-parallel to said primitive lattice vectors of said 2D lattice.

19) The method of claim 18, wherein patterning of said optical core layer to form said periodic arrangement of light-refractive structures further includes etching holes in said optical core layer, each of said holes comprising individual ones of said light-refractive structures, and wherein adjacent ones of said holes in a same row have a same center-to-center separation distance, and at least one lateral dimension of said holes equals about one-half of said separation distance.