Claims

1. An optical component for illuminating a sample region with a periodic light pattern, the optical component comprising a first waveguide, a further waveguide, and an optical splitter, the optical splitter having (i) an input for receiving input light, (ii) a first output, and (iii) a second output, wherein:

the first output of the optical splitter is optically coupled to the first waveguide so as to direct first input light into the first waveguide;

the first waveguide is arranged to use total internal reflection to direct the first input light into the sample region along a first path in a first direction;

the second output of the optical splitter is optically coupled to the sample region so as to direct second input light into the sample region along a second path in a second direction;

the further waveguide is arranged to receive third input light and to use total internal reflection to direct the third input light into the sample region along a third path in a third direction;

the second direction is different from the first direction so that, in use, the first input light interferes with the second input light to form a periodic light pattern in the sample region;

the third direction is different from the first direction and from the second direction; and

the first, second and third directions are coplanar.

2. An optical component as claimed in claim 1, further comprising a second waveguide, wherein the second output of the optical splitter is optically coupled to the second waveguide, the second waveguide being arranged to use total internal reflection to direct the second input light into the sample region along the second direction.

3. An optical component as claimed in claim 1 or 2, wherein the optical splitter is a y-branch splitter, an evanescent waveguide coupler, or a multimode interference component.

4. An optical component as claimed in any of claims 1-3, wherein the optical component is a photonic integrated component.

5. An optical component as claimed in any of claims 1-4, wherein the first direction is parallel and opposite to the second direction.

6. An optical component as claimed in any of claims 1-5, wherein at least one of said waveguides is arranged to guide the received light towards the sample region along a respective optical path, wherein said optical path has a width that increases in a direction towards the sample region.

7. An optical component as claimed in any of claims 1-6, wherein at least one of said waveguides comprises an end facet arranged to direct light into the sample region.

8. An optical component as claimed in any of claims 1-7, wherein at least one of said waveguides is arranged to direct, into the sample region, only an evanescent field component of light received by the waveguide.

9. An optical component as claimed in any of claims 1-8, wherein the optical component defines a sample well for holding a sample.

10. An optical component as claimed in claim 9, comprising a core layer and an optical cladding layer, wherein the sample well is defined at least partly by the optical cladding layer and the core layer.

11. An optical component as claimed in any of claims 1-10, further comprising a phase adjuster, wherein one of said waveguides is coupled to the phase adjuster, the phase adjuster being arranged to adjust the phase of input light before the input light is directed into the sample region.

12. An optical component as claimed in any of claims 1-11, further comprising an input formed on a single face of the optical component and arranged to receive the first, second and third input lights.

13. An optical component as claimed in claim 12, wherein the input comprises a single socket for coupling with one or more fiber optic cables.

14. An optical component as claimed in any of claims 1-13, wherein the first, second and third paths lie in a common plane.

15. An optical component as claimed in any of claims 1-14, further comprising a fourth waveguide, wherein the fourth waveguide is arranged to receive fourth input light and to use total internal reflection to direct the fourth input light into the sample region along a fourth path in a fourth direction, wherein the fourth direction is different from the first, the second, and the third directions and is coplanar with the first, second and third directions.

16. An optical component as claimed in any of claims 1-14, further comprising an optical grating and a fourth waveguide, wherein the fourth waveguide is arranged to receive fourth input light and to use total internal reflection to direct the fourth input light onto the optical grating and the optical grating is arranged to direct the received fourth input light into the sample region along a fourth path in a fourth direction, wherein the fourth direction is different from the first, the second, and the third directions and is not coplanar with the first, second and third directions.

17. A method for illuminating a sample region of an optical component, the method comprising:

providing an optical component comprising a first waveguide, a further waveguide, and an optical splitter;

receiving input light at the optical splitter;

receiving first input light in the first waveguide from a first output of the optical splitter;

using total internal reflection within the first waveguide to direct the first input light into the sample region along a first path in a first direction;

directing, from a second output of the optical splitter, second input light into the sample region along a second path in a second direction, wherein the second direction is different from the first direction;

receiving third input light in the further waveguide;

using total internal reflection within the further waveguide to direct the third input light into the sample region along a third path in a third direction, wherein the third direction is different from the first and the second directions, and the first, second and third directions are coplanar; and

interfering the first input light and the second input light, or the first, second and the third input light, together to form a periodic light pattern in the sample region.

18. A method as claimed in claim 17, further comprising:

receiving fourth input light in a fourth waveguide of the optical component;

using total internal reflection within the fourth waveguide to direct the fourth input light into the sample region along a fourth path in a fourth direction, wherein the fourth direction is different from the first, the second, and the third directions;

interfering the first input light with the second input light to form a first periodic light pattern in the sample region; and

interfering the third input light with the fourth input light to form a second periodic light pattern in the sample region.

19. A method as claimed in claim 17 or 18, further comprising:

collecting light emanating from the sample region; and

performing structured illumination microscopy with the collected light.

20. A system for imaging a sample using structured illumination microscopy, the system comprising:

a light-injecting apparatus;

an optical component comprising a first waveguide, a further waveguide, and an optical splitter, the optical splitter having (i) an input for receiving input light, (ii) a first output, and (iii) a second output, wherein:

- the first output of the optical splitter is optically coupled to the first waveguide so as to direct first input light into the waveguide;

- the first waveguide is arranged to use total internal reflection to direct the first input light into the sample region along a first path in a first direction;

- the second output of the optical splitter is optically coupled to the sample region so as to direct second input light into the sample region along a second path in a second direction;

- the further waveguide is arranged to receive third input light and to use total internal reflection to direct the third input light into the sample region along a third path in a third direction;

- the second direction is different from the first direction so that, in use, the first input light interferes with the second input light to form a periodic light pattern in the sample region;

- the third direction is different from the first direction and from the second direction; and

- the first, second and third directions are coplanar;

an objective lens arranged to collect light emanating from the sample region; and

an imaging unit arranged to perform structured illumination microscopy with the collected light.