CLAIMS:

1. An optical component comprising

(a) a substrate; and

(b) an array of subwavelength-spaced phase-shifting metasurface elements, which are tessellated on the substrate configured to produce, when illuminated with a polarized incident light, a diffracted light beam with a distinct polarization state for each of a finite number of diffraction orders, wherein the finite number is 2 or more,

wherein the subwavelength-spaced phase-shifting metasurface elements are tessellated on the substrate and are configured to produce, when illuminated with the polarized incident light, four distinct polarization states.

2. The optical component of claim 1, wherein the array is a one-dimensional array.

3. The optical component of claim 1, wherein the phase-shifting metasurface elements comprise pillars.

4. The optical component of claim 3, wherein the pillars have a rectangular cross-section.

5. The optical component of claim 1, wherein the phase-shifting metasurface elements comprise an oxide, a nitride, a sulfide, or pure chemical element.

6. The optical component of claim 1, wherein the subwavelength-spaced phase-shifting metasurface elements are configured to produce a +45° linear polarization state, a right circular polarization state, a left circular polarization state and a -45° linear polarization state at -2, -1, +1

and +2 diffraction orders, respectively, when illuminated with the incident light which is +45° linear polarized relative to a surface of the substrate.

7. The optical component of claim 1, wherein the subwavelength-spaced phase-shifting metasurface elements are configured to produce at -2, -1, +1 and +2 diffraction orders four polarization states corresponding to vertices of a tetrahedron
inscribed in the Poincare sphere when illuminated with the incident light which is +45° linear polarized relative to a surface of the substrate.

8. The optical component of claim 1, wherein each dimension of the substrate parallel to a surface of the substrate is no more than 2 millimeters (mm).

9. The optical component of claim 1, wherein a number of the subwavelength-spaced phase-shifting metasurface elements is in a range from 10 to 40.

10. The optical component of claim 1, wherein polarization states for each of the diffraction orders are linearly independent.

11. An optical instrument comprising:
(a) the optical component of claim 1; and
(b) one or more detecting elements, each configured to detect the diffracted light beam for one of the diffraction orders.

12. The optical instrument of claim 11, comprising the finite number of the detecting elements.

13. The optical instrument of claim 11, wherein the detecting elements comprise single-wavelength detecting elements.

14. The optical instrument of claim 13, wherein the single-wavelength detecting elements are linear in intensity at a wavelength of the incident light.

15. The optical instrument of claim 11, wherein the detecting elements are multi-wavelength detecting elements.

16. The optical instrument of claim 15, wherein the optical instrument is a spectroscopic polarimeter.

17. The optical instrument of claim 11, wherein the detecting elements are imaging sensors.

18. The optical instrument of claim 17, wherein the optical instrument is a polarization imaging instrument.

19. The optical instrument of claim 11, wherein the optical instrument is a polarimeter.

20. The optical instrument of claim 19, wherein the polarimeter is configured to determine an unknown polarization in a test light, wherein an incident angle of the test light differs from a calibration incident angle of the optical component by ± 5°.

21. The optical instrument of claim 11, further comprising a first linear polarizer positioned on an optical path of an incident light towards the optical component.

22. The optical instrument claim 11, which does not comprise a birefringent optical element.

23. The optical instrument of claim 11, further comprising a second linear polarizer on an optical path of the diffracted beams towards the detecting elements.

24. The optical instrument of claim 23, wherein an extinction ratio of the second linear polarizer is in a range from 500 to 200000.

25. The optical instrument of claim 11, further comprising a lens positioned on an optical path of one or more of the diffracted beams towards the detecting elements.

26. The optical instrument of claim 11, which does not comprise a metasurface element other than the optical component.

27. A polarization testing method comprising:
illuminating the optical component of claim 1 with a test light; and
measuring a light intensity of a beam diffracted from the optical component for each of the finite number of the diffraction orders.

28. The method of claim 27, wherein the test light is a partially polarized or an unpolarized light.

29. The method of claim 27, wherein an incident angle of the test light differs from a calibration incident angle of the optical component by ± 5°.