WHAT IS CLAIMED IS:

1. A three-surface optical arrangement for an array camera comprising:

a first lens element having a first convex proximal surface and a first concave distal surface, wherein the diameter of the first convex surface is larger than the diameter of the first concave surface;

a second lens element having a substantially flat second proximal surface and a second convex distal surface, wherein the diameter of the flat second proximal surface is smaller than the diameter of the second convex surface, and wherein the diameter of the second convex surface is intermediate between the diameters of the first convex surface and the first concave surface; and

wherein the first and second lens elements are arranged sequentially in optical alignment with an imager positioned at the distal end thereof.

2. The three-surface optical arrangement of claim 1, wherein surfaces of the first element are separated by a first substrate, and the surfaces of the second element are separated by a second substrate.

3. The three-surface optical arrangement of claim 2, wherein the flat second proximal surface is formed by the second substrate.

4. The three-surface optical arrangement of claim 1, further comprising an aperture stop disposed on the flat second proximal surface.

5. The three-surface optical arrangement of claim 2, further comprising at least one aperture disposed on at least one of the first or second substrates.

6. The three-surface optical arrangement of claim 1, further comprising an aperture structure disposed between said first and second lens elements, said aperture structure comprising at least one aperture substrate having at least one aperture disposed thereon.

7. The three-surface optical arrangement of claim 1, wherein the first and second lens elements and the second lens element and the imager are separated by spacers.

8. The three-surface optical arrangement of claim 2, further comprising a filter disposed on at least one of the first or second substrates.

9. The three-surface optical arrangement of claim 1, wherein at least two of the surfaces of the lens elements are formed from materials having different Abbe-numbers.

10. The three-surface optical arrangement of claim 8, wherein the convex surfaces are formed from crown-like materials and the concave surfaces are formed from flint-like materials.

11. An array comprising a plurality of the three-surface optical arrangements of claim 1,

wherein the array is designed to image a selected wavelength band, and wherein the profile of at least one of the lens surfaces within each optical arrangement is adapted to optimally image only a narrow-band portion of the selected wavelength band such that in combination the plurality of arrangements within the array image the entirety of the selected wavelength band.

12. A five-surface optical arrangement for an array camera comprising:

a first lens element having a first convex proximal surface and a first concave distal surface, wherein the diameter of the first convex surface is larger than the diameter of the first concave surface;

a second lens element having a second concave proximal surface and a second convex distal surface, wherein the diameter of the second concave proximal surface is smaller than the diameter of the second convex surface;

a third lens element having a third concave proximal surface and a third planar distal surface, wherein the diameter of the third concave proximal surface is larger than the diameters of any of the surfaces of the first and second lens elements; and

wherein the first, second and thirds lens elements are arranged sequentially in optical alignment with an imager positioned at the distal end thereof.

13. The five-surface optical arrangement of claim 12, wherein surfaces of the first element are separated by a first substrate, and the surfaces of the second element are separated by a second substrate.

14. The five-surface optical arrangement of claim 12, wherein the third planar distal surface is in contact with one of either the image sensor or a cover glass disposed over the image sensor.

15. The five-surface optical arrangement of claim 12, further comprising an aperture stop disposed on the first concave distal surface.

16. The five-surface optical arrangement of claim 13, further comprising an aperture stop disposed on the first substrate adjacent to the first concave distal surface.

17. The five-surface optical arrangement of claim 12, further comprising at least one aperture disposed within the first lens element.

18. The five-surface optical arrangement of claim 12, further comprising an aperture structure disposed between at least two of said lens elements, said aperture structure comprising at least one aperture substrate having at least one aperture disposed thereon.

19. The five-surface optical arrangement of claim 12, wherein the first and second lens elements, and the second and thirds lens elements are separated by spacers.

20. The five-surface optical arrangement of claim 12, further comprising a filter disposed within at least one of the first and second lens elements.

21. The five-surface optical arrangement of claim 12, wherein at least two of the surfaces of the lens elements are formed from materials having different Abbe-numbers.

22. The five-surface optical arrangement of claim 21, wherein the convex surfaces are formed from crown-like materials and the concave surfaces are formed from flint-like materials.

23. The five-surface optical arrangement of claim 12, further comprising an air-gap between the third lens element and the image sensor.

24. The five-surface optical arrangement of claim 12, further comprising at least one substrate, said at least one substrate disposed between the surfaces of at least one of the lens elements.

25. The five-surface optical arrangement of claim 24, further comprising a substrate disposed between the third lens element and the imager.

26. The five-surface optical arrangement of claim 24, further comprising at least one aperture disposed on at least one substrate within the lens elements.

27. The five-surface optical arrangement of claim 26, wherein the at least one aperture is embedded within the first lens element.

28. An array comprising a plurality of the five-surface optical arrangements of claim 12, wherein the array is designed to image a selected wavelength band, and wherein the profile of at least one of the lens surfaces within each optical arrangement is adapted to optimally image only a narrow-band portion of the selected wavelength such that in combination the plurality of arrangements within the array image the entirety of the selected wavelength band.

29. A substrate embedded hybrid lens optical arrangement for an array camera comprising:

a substrate having proximal and distal sides;

a first monolithic lens element having first proximal and distal surfaces disposed on the proximal side of said substrate;

a second monolithic lens element having second proximal and distal surfaces disposed on the distal side of said substrate;

at least one aperture disposed on said substrate in optical alignment with said first and second lens elements; and

wherein the first and second lens elements are arranged sequentially in optical alignment with an imager positioned at the distal end thereof.

30. A wafer stack comprising a plurality of the substrate embedded hybrid lens optical arrangements of claim 29, the wafer stack further comprising:

a plurality of wafer surfaces formed from the elements of the arrangements;

at least two alignment marks formed in relation to each wafer surface, each of said alignment marks being cooperative with an alignment mark on an adjacent wafer surface such that said alignment marks when cooperatively aligned aide in the lateral and rotational alignment of the lens surfaces with the corresponding apertures.

31. The substrate embedded hybrid lens optical arrangement of claim 29, wherein at least two axially aligned apertures are disposed on said substrate.

32. The substrate embedded hybrid lens optical arrangement of claim 31, wherein the at least two axially aligned apertures are one of either the same or different sizes.

33. The substrate embedded hybrid lens optical arrangement of claim 29, further comprising at least one coating disposed on said substrate in optical alignment with said at least one aperture.

34. The substrate embedded hybrid lens optical arrangement of claim 33, wherein the at least one coating is selected from the group consisting of a polarization filter, a color filter, an IRCF filter, and a NIR-pass filter.

35. The substrate embedded hybrid lens optical arrangement of claim 29, wherein the substrate is formed from a material that acts as a filter selected from the group consisting of a polarization filter, a color filter, an IRCF filter, and a NIR-pass filter.

36. The substrate embedded hybrid lens optical arrangement of claim 29, wherein the substrate further comprises an adaptive optical element.

37. The substrate embedded hybrid lens optical arrangement of claim 29, wherein at least two of the lens elements are formed from materials having different Abbe-numbers.

38. An array comprising a plurality of the substrate embedded hybrid lens optical arrangements of claim 29, wherein the array is designed to image a selected wavelength band, and wherein the profile of at least one of the lens surfaces within each optical arrangement is adapted to optimally image only a narrow-band portion of the selected wavelength such that in combination the plurality of arrangements within the array image the entirety of the selected wavelength band.

39. A monolithic lens optical arrangement for an array camera comprising:

at least one lens element comprising:

a first monolithic lens having first proximal and distal surfaces, wherein the first proximal surface of the first monolithic lens has one of either a concave or convex profile, and wherein the first distal surface of the first monolithic lens has a plano profile;

at least one aperture disposed on the first distal surface of the first monolithic lens and in optical alignment therewith;

a second monolithic lens having second proximal and distal surfaces, wherein the second proximal surface of the second monolithic lens has a plano profile, and wherein the second distal surface of the second monolithic lens has one of either a concave or convex profile, and wherein the second monolithic lens is arranged in optical alignment with said aperture; and

wherein the first monolithic lens element is in direct contact with the aperture and the second monolithic lens.

40. The monolithic optical arrangement of claim 39, further comprising at least one filter disposed on said plano surface in optical alignment with said at least one aperture.

41. The monolithic optical arrangement of claim 39, wherein the monolithic lenses are formed from materials having different Abbe-numbers.

42. The monolithic optical arrangement of claim 39, further comprising at least two lens elements.

43. An array comprising a plurality of the monolithic optical arrangements of claim 39, wherein the array is designed to image a selected wavelength band, and wherein the profile of at least one of the lens surfaces within each optical arrangement is adapted to optimally image only a narrow-band portion of the selected wavelength such that in combination the plurality of arrangements within the array image the entirety of the selected wavelength band.

44. A wafer stack comprising a plurality of the monolithic lens optical arrangements of claim 39, the wafer stack further comprising:

a plurality of wafer surfaces formed from the elements of the arrangements;

at least two alignment marks formed in relation to each wafer surface, each of said alignment marks being cooperative with an alignment mark on an adjacent wafer surface such that said alignment marks when cooperatively aligned aide in the lateral and rotational alignment of the lens surfaces with the corresponding apertures.

45. A three-element monolithic lens optical arrangement for an array camera comprising:

a first lens element having a first convex proximal surface and a first plano distal surface;

a second lens element having a second concave proximal surface and a second convex distal surface;

a third menisci lens element having a third concave proximal surface and a third convex distal surface;

at least one aperture disposed on the first plano distal surface; and

wherein the first, second and third lens elements are arranged sequentially in optical alignment with the aperture stop and an imager.

46. The three-element monolithic optical arrangement of claim 45, wherein the first and second lens elements are formed from low dispersion materials and the third lens element is formed from a high dispersion material.

47. The three-element monolithic optical arrangement of claim 45, further comprising at least one filter disposed on the first plano distal surface in optical alignment with the first lens element.

48. The three-element monolithic optical arrangement of claim 45, wherein the first lens element further comprises a substrate disposed on the distal surface thereof.

49. The three-element monolithic optical arrangement of claim 48, further comprising at least one aperture disposed on the distal surface of said substrate.

50. The three-element monolithic optical arrangement of claim 48, further comprising at least one filter disposed on the distal surface of said substrate.

51. The three-element monolithic optical arrangement of claim 45, wherein the second lens element further comprises a substrate disposed between the proximal and distal surfaces thereof.

52. An array comprising a plurality of the three-element monolithic optical arrangements of claim 45, wherein the array is designed to image a selected wavelength band, and wherein the profile of at least one of the lens surfaces within each optical arrangement is adapted to optimally image only a narrow-band portion of the selected wavelength such that in combination the plurality of arrangements within the array image the entirety of the selected wavelength band.

53. A plurality of optical arrangements for an array camera comprising:

a lens element array stack formed from a plurality of lens element arrays, each of said lens element arrays being in optical alignment with each other and a corresponding imager; and

wherein each of the individual lens elements of each of the lens element stacks is formed from one of either a high or low Abbe number material, and wherein the sequence in which one of either a high or low Abbe number material is used in any individual lens element stack depends upon the spectral band being detected by the imager related thereto.

54. A plurality of optical arrangements for an array camera comprising:

a lens element array stack formed from a plurality of lens element arrays, each of said lens element arrays being formed of a plurality of lens elements;

a plurality of structural features integrated into each of the lens element arrays;

wherein the structural features ensure alignment of the lens element arrays in relation to each other within the lens element array stack in at least one dimension.

55. The plurality of optical arrangements of claim 54, wherein the structural features are selected from the group consisting of lateral and rotational alignment features, spacers and stand-offs.

56. A method of compensation for systematic fabrication errors in an array having a plurality of optical channels comprising:

preparing a design incorporating a nominal shape of one of either a waveplate or a multilevel diffractive phase element used for only channel-wise color aberration correction of the optical channels of the array;

fabricating an array lens module based on the design;

experimentally determining the systematic deviation of the lens module from the design based on at least one parameter selected from the group consisting of lens metrologies, centering, distance and optical performance;

redesigning only the channel-wise color aberration correcting surfaces of the lens module based on the results of the experiment;

refabricating the lens module based on the redesign; and

compensating for any of the systematic deviations remaining using a back focal length of the lens module.

57. An optical arrangement comprising a plurality of optical channels, each optical channel including at least one optical element, comprising at least two optical surfaces, wherein one of the optical surfaces of each of the plurality of optical channels is a channel specific surface having a wavefront deformation sufficient solely to adapt the optical channel to a selected waveband of light.

58. The optical arrangement of claim 57, wherein the channel specific surface is selected from the group consisting of waveplates, kinoforms, and radial symmetric multilevel diffractive phase elements.

CLAIMS:

1. A five-surface optical arrangement for an array camera comprising:

a first lens element having a first convex proximal surface and a first concave distal surface, wherein the diameter of the first convex surface is larger than the diameter of the first concave surface;

a second lens element having a second concave proximal surface and a second convex distal surface, wherein the diameter of the second concave proximal surface is smaller than the diameter of the second convex surface;

a third lens element having a third concave proximal surface and a third planar distal surface, wherein the diameter of the third concave proximal surface is larger than the diameters of any of the surfaces of the first and second lens elements; and

wherein the first, second and thirds lens elements are arranged sequentially in optical alignment with an imager positioned at the distal end thereof.

2. The five-surface optical arrangement of claim 1, wherein surfaces of the first element are separated by a first substrate, and the surfaces of the second element are separated by a second substrate.

3. The five-surface optical arrangement of claim 2, further comprising an aperture stop disposed on the first substrate adjacent to the first concave distal surface.

4. The five-surface optical arrangement of claim 1, wherein the third planar distal surface is in contact with one of either the image sensor or a cover glass disposed over the image sensor.

5. The five-surface optical arrangement of claim 1, further comprising an aperture stop disposed on the first concave distal surface.

6. The five-surface optical arrangement of claim 1, further comprising at least one aperture disposed within the first lens element.

7. The five-surface optical arrangement of claim 1, further comprising an aperture structure disposed between at least two of said lens elements, said aperture structure comprising at least one aperture substrate having at least one aperture disposed thereon.

8. The five-surface optical arrangement of claim 1, wherein the first and second lens elements, and the second and thirds lens elements are separated by spacers.

9. The five-surface optical arrangement of claim 1, further comprising a filter disposed within at least one of the first and second lens elements.

10. The five-surface optical arrangement of claim 1, wherein at least two of the surfaces of the lens elements are formed from materials having different Abbe-numbers.

11. The five-surface optical arrangement of claim 10, wherein the convex surfaces are formed from crown-like materials and the concave surfaces are formed from flint-like materials.

12. The five-surface optical arrangement of claim 1, further comprising an air-gap between the third lens element and the image sensor.

13. The five-surface optical arrangement of claim 1, further comprising at least one substrate, said at least one substrate disposed between the surfaces of at least one of the lens elements.

14. The five-surface optical arrangement of claim 13, further comprising a substrate disposed between the third lens element and the imager.

15. The five-surface optical arrangement of claim 13, further comprising at least one aperture disposed on at least one substrate within the lens elements.

16. The five-surface optical arrangement of claim 15, wherein the at least one aperture is embedded within the first lens element.

17. An array comprising a plurality of the five-surface optical arrangements of claim 1, wherein the array is designed to image a selected wavelength band, and wherein the profile of at least one of the lens surfaces within each optical arrangement is adapted to optimally image only a narrow-band portion of the selected wavelength such that in combination the plurality of arrangements within the array image the entirety of the selected wavelength band.