CLAIMS

1. An illumination source comprising:

two or more input light sources; and

a collector including one or more lenses to combine illumination from the two or more input light sources into an illumination beam, wherein the illumination from the two or more input light sources occupy different portions of an input aperture of the collector; and

a beam uniformizer comprising:

a first noncircular-core fiber, wherein the first fiber receives the illumination beam;

a second noncircular-core fiber; and

one or more coupling lenses to relay a far-field distribution of the illumination beam from the first noncircular-core fiber to an input face of the second noncircular-core fiber, wherein a near-field output distribution and a far-field output distribution of the illumination beam from the second noncircular-core fiber are uniform within a selected tolerance.

2. The illumination source of claim 1, wherein the collector combines the light from the two or more input light sources into a common etendue.

3. The illumination source of claim 1, further comprising:

two or more collimating lenses to collimate the light from the two or more input light sources, wherein the collector receives the light from the two or more input light sources from the two or more collimating lenses.

4. The illumination source of claim 1, wherein a core of at least one of the first noncircular-core fiber or the second noncircular-core fiber has a shape of a regular hexagon, a rectangle, or a square.

5. The illumination source of claim 1, further comprising:

two or more output fibers having different etendues; and

a fiber coupler configured to selectively couple the illumination beam into a selected output fiber of the two or more output fibers to provide the illumination beam in a selected etendue.

6. The illumination source of claim 1, further comprising:

one or more additional beam uniformizers, wherein the two or more output fibers comprise:

the beam uniformizer and the one or more additional beam uniformizers.

7. The illumination source of claim 1, wherein at least one of the two or more input light sources comprises:

a coherent light source.

8. The illumination source of claim 7, wherein the coherent light beam comprises:

a laser source.

9. The illumination source of claim 7, wherein the laser source comprises:

a supercontinuum laser source.

10. The illumination source of claim 7, further comprising:

a speckle reducer including at least one phase-varying optical element to generate a plurality of decorrelated distributions of the illumination beam within a selected timeframe to mitigate speckle in the illumination beam.

11. The illumination source of claim 10, wherein the speckle reducer comprises:

a movable diffuser.

12. The illumination source of claim 10, wherein the speckle reducer comprises:

a translatable mirror configured to vary a position of the illumination beam on an input face of the first noncircular-core fiber.

13. The illumination source of claim 12, wherein the translatable mirror overscans the illumination beam across the input face of the first fiber.

14. The illumination source of claim 1, wherein at least one of the two or more light sources comprises:

an incoherent light source.

15. The illumination source of claim 14, wherein the incoherent light source comprises:

at least one of a laser-sustained plasma source or a lamp source.

16. The illumination source of claim 1, further comprising:

at least one of a tunable spectral filter or a tunable intensity filter.

17. A beam uniformizer comprising:

a first noncircular-core fiber, wherein the first fiber receives an illumination beam;

a second noncircular-core fiber; and

one or more coupling lenses to relay a far-field distribution of the illumination beam from the first noncircular-core fiber to an input face of the second noncircular-core fiber, wherein a near-field output distribution and a far-field output distribution of the illumination beam from the second noncircular-core fiber are uniform within a selected tolerance.

18. The beam uniformizer of claim 17, wherein the first noncircular-core fiber uniformizes a spatial distribution of the illumination beam at an output face of the first noncircular-core fiber with respect to a spatial distribution of the illumination beam at an input face of the first noncircular-core fiber within a selected tolerance.

19. The beam uniformizer of claim 18, wherein the second noncircular-core fiber uniformizes a spatial distribution of the illumination beam at an output face of the second noncircular-core fiber with respect to a spatial distribution of the illumination beam at the input face of the second noncircular-core fiber within a selected tolerance.

20. The beam uniformizer of claim 17, wherein the far-field distribution comprises:

an angular distribution of the illumination beam at an output face of the first noncircular-core fiber.

21. The beam uniformizer of claim 17, wherein a core of at least one of the first noncircular-core fiber or the second noncircular-core fiber has a shape of a regular hexagon, a rectangle, or a square.