Claims

1. A diffractive exit pupil expander arrangement for display applications, the arrangement comprising

- a first lightguide element comprising an exit pupil expander and arranged in a first plane,
- a second lightguide element comprising an in-coupler and arranged in a second plane, the in-coupler being optically coupled with the exit pupil expander,

wherein

- the first lightguide element is arranged to confine propagation of light laterally in said first plane by reflections, and
- the first plane and the second plane are arranged at an angle with respect to each other,
- the exit pupil expander of the first lightguide element is an exit pupil expander grating adapted to expand the exit pupil in a first dimension
- the in-coupler of the second lightguide element is an in-coupler grating
- said angle is 20-60 degrees, the angle being defined about an axis parallel to said first dimension.

2. The arrangement according to claim 1, wherein the first lightguide element comprises lateral side walls arranged perpendicular to the first plane and is arranged to confine propagation of light by reflection at the lateral side walls.

3. The arrangement according to claim 2, wherein said side walls are of optical quality.

4. The arrangement according to claim 2 or 3, wherein said side walls are arranged to reflect light by total internal reflections or provided with a reflective coating.

5. The arrangement according to claim 1, wherein the out-coupler is adapted to expand the exit pupil in a second dimension perpendicular to the first dimension.

6. The arrangement according to any of the preceding claims, wherein the first lightguide element further comprises an in-coupler optically coupled with the exit pupil expander.

7. The arrangement according to claim 6, wherein the in-coupler of the first lightguide is located outside the footprint of the second lightguide element, when inspected perpendicular to the second plane.

8. The arrangement according to claim 6 or 7, wherein the in-coupler and exit pupil expander comprise gratings whose grating lines are oblique with respect to main axes of the lightguide.

9. The arrangement according to any of the preceding claims, wherein the second lightguide element further comprises an out-coupler optically coupled with the in-coupler of the second lightguide element.

10. The arrangement according to claim 9, wherein

- said lateral confinement produces a mirror image of an initial image propagating in the first lightguide element, and
- said angle is chosen so that the out-coupler reflects the mirror image but out-couples the normal image.

11. The arrangement according to any of the preceding claims, wherein the first lightguide element comprises multiple lightguide layers.

12. The arrangement according to any of the preceding claims, wherein the lateral width of the first lightguide element is the same or less than the largest hop length of light rays in the second lightguide.

13. The arrangement according to any of the preceding claims, wherein the first lightguide element comprises lightguide material having a higher refractive index than the second lightguide element.

14. A personal display device comprising

- a display element comprising a diffractive exit pupil expander arrangement according to any of the preceding claims, and
- a microprojector for projecting an image to the display element.

~~15. Use of a cascade of diffractive lightguide elements whose lightguide planes are arranged at an angle with respect to each other for expanding the exit pupil of a diffractive display.~~