CLAIMS

1. An optical antenna comprising:

at least one first particle;

at least one second particle having a diameter that is larger than a diameter of the at least one first particle; and

at least one light source interposed between the at least one first particle and the at least one second particle, the at least one light source configured to provide the optical signal;

wherein the at least one first particle and the at least one second particle are arranged along a plane, and

wherein the at least one first particle is configured to enhance an optical emission of the at least one light source providing an optical signal to the optical antenna and the at least one second particle is configured to direct the optical signal in the form of an inverted cone perpendicular to the plane.

2. The optical antenna as claimed in claim 1, wherein each of the at least one first particle and the at least one second particle is made of a material having a refractive index of at least two.

3. The optical antenna as claimed in claim 2, wherein the material is a dielectric material or a semiconductor material.

4. The optical antenna as claimed in claim 1, wherein each of the at least one first particle and the at least one second particle comprises a nanoparticle.

5. The optical antenna as claimed in claim 2, wherein the material is silicon.

6. The optical antenna as claimed in claim 4, wherein the nanoparticle of the at least one first particle is made of silicon, has a cylindrical shape, and has a height of about 150 nm ± 50 nm and a diameter of about 120 nm ± 40 nm.

7. The optical antenna as claimed in claim 4, wherein the nanoparticle of the at least one second particle is made of silicon, has a cylindrical shape, has a height of about 150 nm ± 50 nm and a diameter of about 160 nm ± 40 nm.

8. The optical antenna as claimed in claim 1, wherein the at least one first particle and the at least one second particle are arranged in contact with each other.

9. The optical antenna as claimed in claim 1, wherein the at least one first particle and the at least one second particle are arranged spaced apart from each other.

10. The optical antenna as claimed in claim 9, wherein a side-to-side separation of the at least one first particle and the at least one second particle is in a range of between about 10 nm and about 100 nm.

11. The optical antenna as claimed in claim 1, further comprising:

a plurality of second particles arranged along the plane and at least substantially surrounding the at least one first particle,

wherein each second particle has a diameter that is larger than the diameter of the at least one first particle.

12. The optical antenna as claimed in claim 1, further comprising:

a plurality of first particles; and

a plurality of second particles at least substantially surrounding the plurality of first particles, the plurality of first particles and the plurality of second particles being arranged along the plane,

wherein each second particle has a diameter that is larger than a diameter of each first particle.

13. The optical antenna as claimed in claim 1, further comprising:

a plurality of first particles; and

a plurality of second particles arranged interposed among the plurality of first particles, the plurality of first particles and the plurality of second particles being arranged along the plane,

wherein each second particle has a diameter that is larger than a diameter of each first particle.

14. The optical antenna as claimed in claim 1, further comprising:

a plurality of first particles and a plurality of second particles arranged alternately along the plane,

wherein each second particle has a diameter that is larger than a diameter of each first particle.

15. The optical antenna as claimed in claim 1, wherein the at least one light source comprises at least one of a fluorophore, a quantum dot or a dye.

16. The optical antenna as claimed in claim 1, further comprising a plurality of light sources configured to provide the optical signal.

17. The optical antenna as claimed in claim 1, further comprising a substrate on which the at least one first particle and the at least one second particle are formed.

18. The optical antenna as claimed in claim 1, wherein the optical emission of the at least one light source comprises an emission rate of the at least one light source or an intensity of the optical emission of the at least one light source.

19. optical antenna as claimed in claim 1, wherein each of the at least one first particle and the at least one second particle comprises a cylindrical particle, a cuboidal particle, a prismatic particle, or a spherical particle.