CLAIMS

1. A metasurface device comprising:

- a substrate having a rear surface and a front surface, the substrate comprising a ground structure able to have a ground plane function,

- an emission and/or reception device able to emit and/or receive an electromagnetic wave, the emission and/or reception device being configured and arranged such that the wave is able to propagate in the form of a surface wave over the front surface of the substrate,

- an antenna element comprising a two-dimensional array of electrically conductive patches arranged on the front surface of the substrate, spaced from one another and having dimensions smaller than the operating wavelength of the emission and/or reception device, the antenna element being able to radiate, under the effect of the propagation of a surface wave over the front surface of the substrate, in a direction having a component perpendicular to the front surface of the substrate when the ground structure has the ground plane function,
the substrate comprising a layer, called a connection layer, made of photoconductive semiconductor material, in direct physical contact with the conductive patches, the semiconductor material being insulating when it is not illuminated and able to be conductive when it is illuminated at a wavelength called a reconfiguration wavelength.

2. The metasurface device as claimed in the preceding claim, comprising an optical reconfiguration device able to illuminate a set of at least one area, called illuminated area, of the connection layer such that the connection layer is conductive only in the set of at least one illuminated area, so as to electrically connect, in pairs, the metal patches of the antenna element that are separate and connected by a continuous area of the connection layer that is located completely within an illuminated area of the set of at least one illuminated area so as to form at least one group of conductive patches that are electrically connected to one another.

3. The metasurface device as claimed in the preceding claim, wherein the optical reconfiguration device comprises a single optical reconfiguration source able to emit an optical beam at the reconfiguration wavelength and a diffractive optical device that

makes it possible, using the optical beam, through diffraction, to illuminate the set of at least one illuminated area at the reconfiguration wavelength.

4. The metasurface device as claimed in the preceding claim, wherein the diffractive device makes it possible to illuminate an array of illuminated areas of the connection layer or a set of at least one illuminated area delimiting areas of the connection layer that are not illuminated by the diffractive device.

5. The metasurface device as claimed in the preceding claim, wherein the diffractive device is able to alternately illuminate various of at least one illuminated area of the connection layer.

6. The metasurface device as claimed in any one of the preceding claims, wherein the ground structure is able to be alternately in an insulating state, in which it prevents the propagation of the surface wave over the front surface of the substrate from the emission and/or reception device to the conductive patches, or vice versa, and in a conductive state, in which the ground structure has the ground plane function, allowing the propagation of the surface wave over the front surface of the substrate from the emission and/or reception device to the conductive patches, or vice versa, the ground structure being able to change from the insulating state to the conductive state through illumination of the ground structure by an optical beam at a wavelength called a switching wavelength.

7. The metasurface device as claimed in any one of claims 2 to 6, wherein the reconfiguration device is configured and arranged to illuminate the substrate on the rear face.

8. The metasurface device as claimed in any one of claims 2 to 6, wherein the reconfiguration device is able to illuminate the substrate on the front face.

9. The metasurface device as claimed in claim 8, wherein the diffractive device is mounted on a cover of the metasurface device, the cover being arranged facing the antenna element at a distance from the antenna element.

10. The metasurface device as claimed in claim 8, wherein the diffractive device (DIFF) has the shape of a substantially flat plate substantially perpendicular to the front surface.