CLAIMS

1. An electro-optical device (1) having two interaction regions (2), which each comprise a longitudinal waveguide section (3) and one or two active elements (5), the active element or elements (5) each comprising at least one electro-optically active material the longitudinal waveguide sections (3) of the two interaction regions (2) being arranged spaced apart from one another and the active element or the respective active element (5) extending at least in sections at least one of above, below or within the longitudinal waveguide section (3) of the respective interaction region (2), and two or more contact elements (6) being provided, wherein the contact elements (6) are each in contact with at least one of the active elements (5), wherein the contact elements (6) comprise at least one inner contact element (6), which is arranged between the two spaced-apart longitudinal waveguide sections (3) and serves as an inner signal contact, and two outer contact elements (6), which are each arranged on the other side of the respective longitudinal waveguide section (3) with respect to the inner contact element (6) and each serve as an outer ground contact, or one outer contact element (6), which is formed at least in sections in a U-shape with two arms (6a) spaced apart from one another and a connecting section (6b) connecting the two arms (6a) and which engages around the outside of the two longitudinal waveguide sections (3), the two arms (6a) of the outer contact element (6) each serving at least in sections as an outer ground contact,

wherein two inner contact elements (6) are provided, and one of the inner contact elements (6) is in contact with the active element or one active element (5) of one interaction region (2) and the other inner contact element (6) is in contact with the active element or one active element (5) of the other interaction region (2).

2. The device (1) according to claim 1, **characterized in that** one outer contact element (6) is provided, which is in contact both with the active element or one of the active elements (5) of one interaction region (2) and with the active element or one of the active elements (5) of the other interaction region (2),
or **in that** two outer contact elements (2) are provided, and one of the outer contact elements (6) is in contact with the active element or one active element (5) of one interaction region (2) and the other outer contact element (6) is in contact with the active element or one active element (5) of the other interaction region (2).

3. The device (1) according to claim 1 or 2, **characterized in that** the two longitudinal waveguide sections (3) are part of one waveguide (4).

4. The device (1) according to claim 3, **characterized in that** the waveguide (4) comprises a bifurcation with two branching arms (4c, 4d), and one of the longitudinal waveguide sections (3) is located in the region of one arm (4c, 4d) of the bifurcation respectively, preferably, wherein a splitter (16) is provided, by means of which an incoming light signal can be distributed to the two arms (4c, 4d) of the bifurcation, preferably in equal proportions.

5. The device (1) according to claim 3, **characterized in that** the waveguide (4) is characterized at least in sections by an U-shaped course with two arms (4a) being spaced apart from one another, and a connecting section (4b) connecting the two arms (4a), wherein one of the two longitudinal waveguide sections (3) lies in the region of one of the two arms (4a) respectively.

6. An electro-optical device (1) having an interaction region (2), wherein the interaction region (2) has a U-shaped longitudinal waveguide

section (3), wherein the longitudinal waveguide section (3) has two arms (4a) spaced apart from one another and a connecting section (4b) connecting the two arms (4a), and one or two at least sectionally U-shaped active elements (5) having two arms (5a) spaced apart from one another and a connecting section (5b) connecting the two arms (5a), wherein the active element or the respective active element (5) comprises at least one electro-optically active material , wherein the active element or the respective active element (5) extends at least in sections above, below and/or within the longitudinal waveguide section (3), and wherein two or more contact elements (6) are provided, which are each in contact with the active element or one of the active elements (5),

wherein the contact elements (6) comprise at least one inner contact element (6), which is arranged within the at least sectionally U-shaped longitudinal waveguide section (3) and serves as an inner signal contact, and two outer contact elements (6), which are each arranged on the other side of the respective arm (4a) of the longitudinal waveguide section (3) with respect to the inner contact element (6) and each serve as an outer ground contact,

or one outer contact element (6), which is formed at least in sections U-shaped and has two arms (6a) spaced apart from one another and a connecting section (6b) connecting the two arms (6a) and which encompasses the outside of the longitudinal waveguide section (3), the two arms (6a) of the outer contact element (6) each serving at least in sections as an outer ground contact,

wherein two inner contact elements (6) are provided, and one of the inner contact elements (6) is in contact with the one arm (5a) of the active element or of one of the active elements (5) and the other inner contact element (6) is in contact with the other arm (5a) of the active element or of one of the active elements (5).

7. The device (1) according to claim 6, **characterized in that** the longitudinal waveguide section (3) is part of a non-annularly closed waveguide (6).

8. The device (1) according to any of claims 5 to 7, **characterized in that** the cross-sectional area in the region of one arm (4a) of the waveguide (4) is larger than the cross-sectional area in the region of the other arm (4a) of the waveguide (4), the cross-sectional area being larger in the first arm (4a) as viewed in the light propagation direction.

9. The device (1) according to claim 6 or 7 or claim 8, as far as referred back to claim 6 or 7, **characterized in that** an outer contact element (6) is provided, which is in contact both with the one arm (5a) of the active element or of one of the active elements (5) and with the other arm (5a) of the active element or of one of the active elements (5),
or two outer contact elements (6) are provided, and one of the outer contact elements (6) is in contact with the one arm (5a) of the active element or of one of the active elements (5) and the other outer contact element (6) is in contact with the other arm (5a) of the active element or of one of the active elements (5).

10. The device (1) according to any of the preceding claims, **characterized in that** the device is formed as a photodetector and the interaction region or the respective interaction region (2) comprises exactly one active element (5), preferably, wherein the inner contact element or one of the inner contact elements (6) and the outer contact element or one of the outer contact elements (6) are in contact with the one active element (5), particularly preferably on opposite sides of the one active element (5).

11. The device (1) according to any of claims 1 to 9, **characterized in that** the device is formed as a modulator and the interaction region or the

respective interaction region (2) comprises two active elements (5), preferably, wherein the inner contact element or one of the inner contact elements (6) is in contact with the active element (5) of the interaction region or of the respective interaction region (2) and the outer contact element or one of the outer contact elements (6) is in contact with the other active element (5) of the interaction region or of the respective interaction region (2), or

the interaction region or the respective interaction region (2) comprises an active element (5) and an electrode, preferably, wherein the inner contact element or one of the inner contact elements (6) is in contact with the active element (5) of the interaction region or of the respective interaction region (2) and the outer contact element or one of the outer contact elements (6) is in contact with the electrode of the interaction region or of the respective interaction region (2) or vice versa.

12. The device (1) according to claim 11, **characterized in that** the two active elements (5) or the active element (5) and the electrode of the interaction region or of the respective interaction region (2) are spaced apart from one another and are arranged offset with respect to one another in such a way that they lie one above the other in sections in an overlap region.

13. The device (1) according to any of the preceding claims, **characterized in that** a waveguide bypass section (19) is provided, the waveguide bypass section (19) bridging the one interaction region (2) or the two interaction regions (2), so that light originating from the same source can be guided past the one interaction region (2) or the two interaction regions (2) through the waveguide bypass section (19.

14. The device (1) according to any of the preceding claims, **characterized in that** the longitudinal waveguide section (3) of the interaction region (2) or the longitudinal waveguide sections (3) of the interaction regions (2)

is or are part of a waveguide (4), at one end of which a coupling device (17) for coupling light in and/or out is provided or at both ends of which a coupling device (17) for coupling light in and/or out is provided respectively.

15. The device (1) according to any of the preceding claims, **characterized in that** the at least one electro-optically active material is a material which absorbs electromagnetic radiation of at least one wavelength and generates an electrical photosignal as a result of the absorption, and/or whose refractive index changes as a function of at least one of a voltage, a presence of charge and an electric field.

16. An electro-optical arrangement, comprising at least one electro-optical device (1) according to any of claims 1 to 15, and a connection device (20) for connecting to a coaxial and/or coplanar conductor, wherein the connection device (20) comprises one or more inner connection contact elements (21) serving as a ground contact and one or more outer connection contact elements (21) serving as a signal contact, and wherein the inner contact element(s) (6) of the electro-optical device (1) is/are or can be connected to the inner connection contact element(s) (21) of the connection device (20), and wherein the outer contact element(s) (6) of the electro-optical device (1) is/are or can be connected to the outer connection contact element(s) (21) of the connection device (20).

17. A semiconductor apparatus comprising a chip and at least one electro-optical device (1) according to any of claims 1 to 15.

18. The semiconductor apparatus according to claim 17, **characterized in that** the device or the respective device (1) is part of a photonic platform fabricated on the chip or bonded to the chip.

19. A semiconductor device comprising a wafer (8) and at least one device (1) according to any of claims 1 to 15.

20. The semiconductor device according to claim 19, **characterized in that** the device or the respective device (1) is part of a photonic platform fabricated on the wafer (8) or bonded to the wafer (8).

21. Use of the electro-optical device (1) according to any of claims 1 to 15 in such a way that the inner contact element or the inner contact elements (6) of the electro-optical device (1) is/are connected to the ground contact(s) of a coaxial or coplanar conductor or of a connection device (20) for connecting to a coaxial or coplanar conductor, and that the outer contact element or the outer contact elements (6) of the electro-optical device (1) is/are connected to the signal contact(s) of a coaxial or coplanar conductor or of a connection device (20) for connecting to a coaxial or coplanar conductor.