

CLAIMS

1. A laser device (10) adapted to emit a coherent optical radiation, **characterized in that** it comprises:

- 5 - an optical beam amplifier system (12), comprising a single interferometric optical amplification arrangement (20) or a plurality of interferometric optical amplification arrangements (20, 20', ..., 20n) in series, wherein each interferometric optical amplification arrangement (20) includes input beam splitting means (BS), adapted to spatially separate an incident optical beam (B_i) into a first beam portion (B1) and a second beam portion (B2),
10 downstream of which an amplification arm (20a) of the first beam portion (B1), including an active gain region (G) capable of emitting photons coherent with the first beam portion, and a propagation arm (20b) without amplification of the second beam portion (B2), extend, which meet at the output of the interferometric optical amplification arrangement (20);
- beam combining means (BC) different from said input beam splitting means (BS) and
15 adapted to gather the first amplified beam portion (B1) and the second beam portion (B2) propagated without amplification of the single interferometric optical amplification arrangement (20) or of the last interferometric optical amplification arrangement (20', 20n) of the series, into an optical beam (B_o) emerging from the amplifier system;
- a return optical path (14) for the beam (B_o) emerging from the amplifier system (12),
20 comprising optical reflector means (M1-M6) adapted to conduct said emerging optical beam (B_o) at the input to the amplifier system (12) forming an optical ring resonant structure therewith; and
- radiation output means (16), arranged to extract a portion of the beam (B_o) emerging from the amplifier system (12) and deliver said beam portion as the radiation (B_L) of the laser
25 device (10),

and in that the power of the first beam portion (B1) routed in the amplification arm (20a) is less than the power of the second beam portion (B2) routed in the propagation arm without amplification (20b).

- 30 2. The laser device (10) according to claim 1, wherein the amplification arm (B1) includes an active gain region (G) of semiconductor material capable of emitting photons coherent with the first beam portion (B1) following the attainment of a population inversion

condition of the charge carriers confined therein and consequent radiative recombination, said active region (G) being associated with an electrical excitation system adapted to alter the thermodynamic equilibrium of the populations of the charge carriers in order to determine said inversion condition of the population.

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3. The laser device (10) according to any of the preceding claims, wherein in a series of interferometric optical amplification arrangements (20, 20'; 20, 20', ..., 20ⁿ) the input beam splitting means (BS_i) are adapted to spatially separate the interfering first beam portion and second beam portion of the preceding interferometric optical amplification arrangement.

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4. The laser device (10) according to any of claims 1 or 2, wherein in a series of interferometric optical amplification arrangements (20, 20'; 20, 20', ..., 20ⁿ) each intermediate interferometric optical amplification arrangement has at its input beam splitter means (BS_i) that are adapted to spatially split only the first beam portion of the preceding interferometric optical amplification arrangement, and not the recombined beam of the preceding

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5. The laser device (10) according to any of the preceding claims, wherein said portion of the beam (B_o) emerging from the amplifier system (12) delivered as the output radiation (B_L) of the laser device (10) is a loss beam of said beam combining means (BC) adapted to bring together the first amplified beam portion (B1) and the second beam portion propagated without amplification (B2) into the optical beam (B_o) emerging from the amplifier system (12).

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6. The laser device (10) according to claim 3, wherein said portion of the beam (B_o) emerging from the amplifier system (12) delivered as the output radiation (B_L) of the laser device (10) is a loss beam of one of said optical reflector means (M4) of the return optical path (14).

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7. The laser device (10) according to any of the preceding claims, wherein the amplification arm (20a) includes optical coupling and collimation means (22, 24) coupled to said active region (G), comprising a pair of dioptric systems arranged respectively to focus the

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first beam portion (B1) entering the active region (G) and to collimate the amplified beam portion exiting the active region (G).

8. The laser device (10) according to any of the preceding claims, wherein the
5 propagation arm without amplification (20b) comprises a catoptric system or a dioptric system adapted to control the addressing or distribution of the transverse power of the second beam portion (B2).

9. The laser device (10) according to claim 3, wherein said optical reflector means (M1-
10 M6) include a plurality of totally reflective catoptric systems.

10. The laser device (10) according to any of the preceding claims, wherein said return
optical path (14) of the beam (B_o) emerging from the amplifier system (12) includes optical
elements adapted to shape the distribution of the transverse power of the beam.

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11. The laser device (10) according to any of the preceding claims, wherein said optical
resonant structure includes an optical isolator (26) adapted to allow the propagation of a beam
in a single predetermined direction.

20 12. The laser device (10) according to any of the preceding claims, wherein the optical
length of the amplification arm (20a) and the optical length of the propagation arm without
amplification (20b) of each interferometric optical amplification arrangement (20) are
equivalent.

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