

Claims

1. Ion trap (2), comprising:
a first ring-shaped end cap electrode (4a) and a second ring-shaped end cap
5 electrode (4b), between which is formed a ring-shaped ion storage cell (5),
characterised by
a plurality (N) of radially inner disk-shaped ring electrodes ($E_{1,i}$) and a plurality (N) of
radially outer disk-shaped ring electrodes ($E_{2,i}$) that delimit the ring-shaped ion
storage cell (5).
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2. Ion trap according to claim 1, in which the inner ring electrodes ($E_{1,i}$) and the outer
ring electrodes ($E_{2,i}$) are arranged at a constant radial distance ($2 r_0$) from one
another.
- 15 3. Ion trap according to claim 1 or 2, in which a radial distance ($2 r_0$) between the inner
ring electrodes ($E_{1,i}$) and the outer ring electrodes ($E_{2,i}$) is smaller than a radius (R) of
the ring-shaped end cap electrodes (4a, 4b).
4. Ion trap according to one of the preceding claims, in which in each case an inner ring
20 electrode ($E_{1,i}$) and an outer ring electrode ($E_{2,i}$) are arranged on a common plane (X,
Y) perpendicular to an axial direction (Z).
5. Ion trap according to one of the preceding claims, in which in each case an inner ring
electrode ($E_{1,i}$) and an outer ring electrode ($E_{2,i}$) are connected to one another in an
25 electrically conductive manner.
6. Ion trap according to one of the preceding claims, in which for a width b of a
respective disk-shaped first or second ring electrode ($E_{1,i}$, $E_{2,i}$) and a distance d in the
axial direction (Z) between, respectively, two adjacent first or second ring electrodes
30 ($E_{1,i}$, $E_{1,i+1}$; $E_{2,i}$, $E_{2,i+1}$), the following applies: $d / b < 1 / 4$.
7. Ion trap according to one of the preceding claims, which has a number N of radially
inner ring electrodes ($E_{1,i}$) and a number N of radially outer ring electrodes ($E_{2,i}$), for
which the following applies: $10 < N < 200$.

8. Ion trap according to one of the preceding claims, in which the first end cap electrode (4a) and/or the second end cap electrode (4b) are divided into at least two ring-shaped segments (Q1, Q2, Q3, Q4) in the circumferential direction.

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9. Ion trap according to one of the preceding claims, further comprising:
at least one injection device (9) for the preferably tangential, particularly pulsed,
injection of ions (6) and/or of an electron beam (10) into the ring-shaped ion storage
cell (5).

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10. Mass spectrometer (1), comprising:
an ion trap (2) according to one of the preceding claims, as well as a control device
(3) that is designed to actuate the disk-shaped ring electrodes ($E_{1,i}$, $E_{2,i}$) and the end
cap electrodes (4a, 4b) for the storage, selection, excitation and/or detection of ions
(6) in the ring-shaped ion storage cell (5).

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11. Mass spectrometer according to claim 10, in which the control device (3) is arranged
at least partially within a volume area (7) that is surrounded by the ring-shaped ion
storage cell (5).

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12. Mass spectrometer according to claim 10 or 11, in which the control device (3) is
designed to actuate the disk-shaped ring electrodes ($E_{1,i}$, $E_{2,i}$) to produce a respective
HF storage voltage ($V_{RF,i}$) to store ions (6) in the ion storage cell (5).

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13. Mass spectrometer according to one of the claims 10 to 12, in which the control
device (3) is designed, on the basis of ion signals (S1, S2) recorded at different
segments (Q1, Q2, Q3, Q4) of the end cap electrodes (4a, 4b), to determine a time-
related dispersion of the ions (6) that are injected in a pulsed manner into the ion
storage cell (5).

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14. Mass spectrometer according to one of the claims 10 to 13, in which the control
device (3) is designed to divert the electron beam (10) injected tangentially into the
ring-shaped ion storage cell (5) along a circular trajectory (11).