Determining the specific charge of the electron (P 6.1.3.1)

P 6.1.3

Specific electron charge

P 6.1.3.1 Determining the specific charge of the electron

Cat. No.	Description	P 6.1.3.1
555 571	Fine beam tube	1
555 581	Helmholtz coils with holder and measuring device	1
521 65	DC power supply 0....500 V	1
521 545	DC power supply 0....16 V, 5 A	1
531 120	Voltmeter, DC, $U \leq 300$ V, e. g. Multimeter LD analog 20	1
531 120	Ammeter, DC, $I \leq 3$ A, e. g. Multimeter LD analog 20	1
531 835	Universal Measuring Instrument Physics	1*
524 0382	Axial B-Sensor S	1*
501 11	Extension cable, 15-pole	1*
311 77	Steel tape measure, 2m	1
500 614	Safety connection lead, 25 cm, black	3
500 624	Safety connection lead, 50 cm, black	3
500 644	Safety connection lead, 100 cm, black	7

* additionally recommended

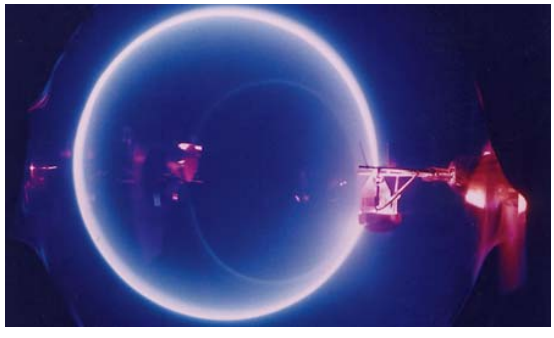
The mass m_e of the electron is extremely difficult to determine in an experiment. It is much easier to determine the specific charge of the electron

$$\varepsilon = \frac{e}{m_e}$$

from which we can calculate the mass m_e for a given electron charge e.

In this experiment, a tightly bundled electron beam is diverted into a closed circular path using a homogeneous magnetic field in order to determine the specific electron charge. The magnetic field B which diverts the electrons into the path with the given radius r is determined as a function of the acceleration voltage U. The Lorentz force caused by the magnetic field acts as a centripetal force. It depends on the velocity of the electrons, which in turn is determined by the acceleration voltage. The specific electron charge can thus be determined from the measurement quantities U, B and r according to the formula

$$\frac{e}{m_e} = 2 \cdot \frac{U}{B^2 \cdot r^2}.$$



Circular electron path in fine beam tube