High-precision mass measurement of ^{17}Ne

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Accurate mass measurements of short-lived nuclides can contribute to tests of nuclear-structure models. With the Penning-trap mass spectrometer ISOLTRAP at ISOLDE/CERN (see Fig. 1) nuclear masses can be determined with an uncertainty in the order of $\delta m/m = 1 \times 10^{-8}$. To this end, radionuclides from the continuous ISOLDE beam are cooled and bunched in a radiofrequency quadrupole trap. After removal of isobaric contaminants in a first Penning trap, the cyclotron frequency $\nu_c = qB/(2\pi m)$ is probed by use of a second Penning trap and a time-of-flight detection technique [1], where B is the magnetic field and q/m the charge-over-mass ratio of the ions. The comparison of ν_c to the cyclotron frequency of a stable and well-known reference ion yields the requested mass value.

Recently, the mass of ^{17}Ne has been determined, which is the so far lightest short-lived nuclide measured at ISOLTRAP. A typical cyclotron resonance curve is shown in the inset of Fig. 1. ^{17}Ne is a possible two-proton halo [2] and thus, it is important to measure the proton separation energy. Furthermore, the mass of ^{17}Ne is required for the calculation of the mass shift in the isotope-shift analysis in collinear laser spectroscopy experiments with the aim to determine the charge radius of the nucleus. This will be a further approach to probe the halo properties of ^{17}Ne. In addition, the mass value can be applied for a test of the isobaric multiplet mass equation for the isospin quartet $A = 17$ and $T = 3/2$.

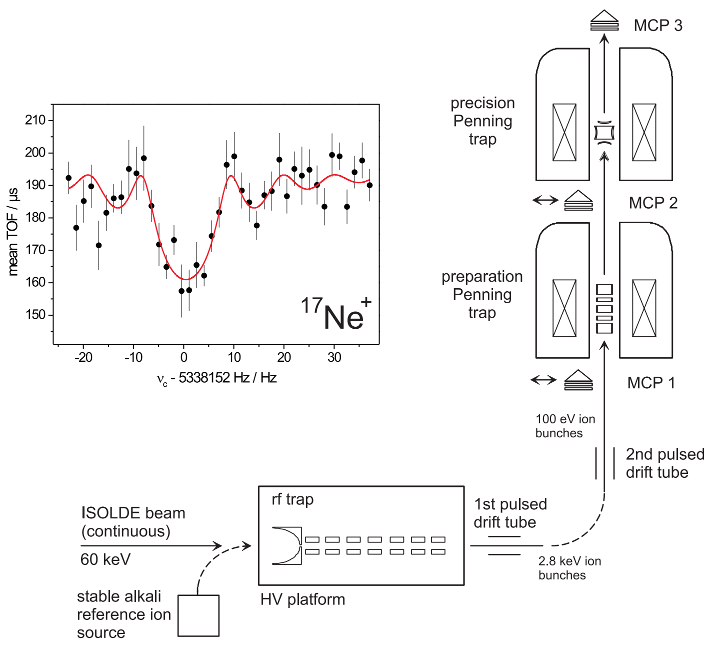

Figure 1: *Schematic experimental setup and cyclotron resonance of* $^{17}Ne^{+}$.

[1] G. Gräff, H. Kalinowsky, J. Traut, Z. Phys. A **297**, 35 (1980).
[2] M.V. Zhukov, I.J. Thompson, Phys. Rev. C **52**, 3505 (1995).