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The Ramsey method in high-precision Penning trap mass spectroscopy

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The mass is a fundamental property of a nuclide. Its measurement contributes to a variety of fundamental studies including tests of the Standard Model and the weak interaction. The limits of mass measurements of exotic nuclei have been extended considerably by improving and developing the Penning trap mass spectrometer ISOLTRAP at the ISOLDE facility at CERN. The mass resolving power of ISOLTRAP reaches 107 and the uncertainty of the resulting mass values has been pushed down to 8*10-9. The mass is determined via a time-of-flight cyclotron resonance detection technique. To reduce the measurement uncertainty a number of improvements in ion detection and data taking have been developed. One of these is the use of the Ramsey method, i.e. time separated oscillating fields, for the excitation of the ions'motion. The advantage of this method is a reduction of the line width of the resonance. In addition the weights of the individual frequency points of the resonance curve are analyzed, which results in a step-size optimization. The methods as well as the results will be presented.

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