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Experimental status and prospects of light pionic atoms

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Summary

High-resolution X-ray spectroscopy of light pionic atoms gives access to the pion-nucleon and pion-nucleus scattering lengths by of the energy shift and broadening of the X-ray transitions (np-1s) to the atomic ground state. The accuracy achieved is about 0.1% for the shift and 4% for the line width for the case pionic hydrogen. The large uncertainty of the line width is due to processes during the atomic de-excitation cascade, the knowledge of which actually constitutes the limits of this experimental technique. A further improvement may be obtained by constraints from results from pionic deuterium or helium, the optimization of the experiment for transitions with higher lying initial states with n=4 or 5, or an improved understanding of the de-excitation cascade.

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