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Cover story: First measurement of the ground-state mass of ^{22}Al helps to evaluate the *ab-initio* theory

How the strong interaction binds the ingredients (proton and neutron) of atomic nuclei, is the central quest of nuclear physics. Nuclear physicists have been addressing this question with different experimental techniques and theoretical approaches. Among them, the mass or binding energy of a nucleus, reflecting the interplay of all forces at work within the nucleus, has played a key role in the journey of understanding the nucleus and testing the theories.

In a recent study [1] published by the group in Lanzhou, the ground-state mass of ^{22}Al, the known lightest bound Al isotope, has been measured for the first time with a precision of 10 keV. Such high precision was achieved by using the newly developed Bρ-defined IMS technique at CSRe. With the new mass, they determined the mirror energy differences (MEDs) of the $1^+_{1,2}$ states in ^{22}Al and ^{22}F, the so-called mirror partners, with the uncertainty of about 50 keV. This precise value allows a crucial test of the state-of-the-art *ab initio* calculations in an odd-odd mirror pair. They concluded that the substantial occupation of $s_{1/2}$ orbit is vital in understanding the significant isospin symmetry breaking, and supports the suggested halo structure in the 1^+_1 state of ^{22}Al.

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References

[1] M.Z. Sun et al., Chinese Physics C **48**, 034002 (2024)
