Contribution ID: **31** Type: **not specified**

Beta-decay studies of extremely proton-rich nuclei from Mg to S

Friday, 11 October 2019 11:30 (20 minutes)

Extremely proton-rich nuclei 20,21Mg, 22Al, 22,23Si, 26P and 27,28,29S have been produced by fragmentations of 28Si and 32S primary beams impinged on a 9Be target at the HIRFL-RIBLL1 of the Institute of Modern Physics, Lanzhou, China. Beta-decay studies have been performed using silicon arrays [1] and clover-type HPGe detectors and brand new results have been obtained: 1, 20Mg [2], a new proton group was observed and the corresponding excited state in 20Na was proposed; 2, 22Si [3], a charged-particle group at 5600 (70) keV in the decay-energy spectrum was identified experimentally as β-delayed two-proton emission from the isobaric analog state of 22Al. The ground-state mass of 22Si was obtained in the experiment for the first time. Two-proton separation energy for 22Si is deduced to be -108 (125) keV, which indicates that it is a very marginal candidate for two-proton ground-state emission. Moreover, a large mirror asymmetry for the first 1+ excited state of 22Si was observed in comparison with the mirror nucleus 22O. 3,27S[4] and other nuclei, the experimental data are being analyzed and more interesting decays of these nuclei will be investigated in future. For example, proton and gamma emissions from the excited state (1120 keV, 3/2+) of 27P were observed at the same time in the beta decay of 27S in our measurements, which can be used to calculate the astrophysical reaction rate for the 26Si (p, γ) 27P reaction and study the nucleosynthesis of 26Al in the Milky Way.

References

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Abstract Type

Talk

Primary authors: Dr LEE, J. (The University of Hong Kong); Dr XU, Xinxing (The Institute of Modern Physics); 林, 承键 (中国原子能科学研究院)

Presenter: Dr XU, Xinxing (The Institute of Modern Physics)

Session Classification: S2: 核反应、核天体物理

Track Classification: 核反应、核天体物理