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Combined mass method for study of exotic nuclei

Precise measurement of the continuum energy spectra is often needed for nuclear structure studies. The problem of two-proton decay of 17Ne first excited state is a good example of such situation. First excited state of the 17Ne 3/2- is located only 344 keV above 2p-decay threshold and it 2p-decay partial width is greatly lesser then gamma-decay partial width. The existing experimental threshold for the 2p/gamma ratio (0.77 %) [1] is a few order of magnitude greater than theoretical predictions for the value (2.5e-6)[2]. At the same time one should needs in high beam integral (to populate 2p-channel) and in high energy resolution (to suppress background from states above) to observe such rare decay branch. These requirements are usually contradict each other.

In the recent experiment at the ACCULINNA [3] fragment-separator (Flerov Lab. JINR) the two-proton decay of the low-lying states of 17Ne populated in the p(18Ne,d)17Ne transfer reaction was studied. An original method of the combined mass was used in the experiment. This method allows to get relatively good energy resolution (R.M.S. ~130 keV) without serious restriction on luminosity.

As result new 2p/gamma ratio threshold for (3/2-) state equal to 0.016(3) % was achieved, that is about fifty times lesser than existing value. The proposed method is promising for study of other exotic nuclei continuum.

[1] [M. J. Chromik, et. al., Phys.Rev. C55 (2002) 024313]

[2] [L. V. Grigorenko, M. V. Zhukov, Phys.Rev. C76 (2007) 014008]

[3] http://aculina.jinr.ru/

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