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Total absorption gamma spectroscopy study of the beta decay of 100Sn

The study of the beta decay of 100Sn can be considered a flagship experiment of fragmentation facilities of new generation. The reasons are clear. The production of this isotope is very challenging, requiring very high primary beam intensities and the related physics is very interesting. On one hand, 100Sn is the last accessible N=Z double magic nucleus that is stable from the perspective of particle emission. On the other hand, its decay is considered of great relevance from the perspective of nuclear structure [Fae13]. Due to the double magic character, shell model calculations are possible, and predict that most of the BGT is concentrated in one 1+ level in 100In, and a very limited population to additional states in 100In is expected. This has important consequences, because this decay is also expected to be the one of the smallest Log ft of all the beta transitions in the nuclide chart, and if the BGT is properly determined experimentally, it can provide means to study the quenching of the gA constant in the nuclear medium (quenching of the Gamow Teller strength, see for example [Gys19] and references therein).
Previous beta decay studies of 100Sn have suffered from limited statistics. The first spectroscopic study employing the RISING Ge array was performed at GSI [Hin12] and the decay level scheme was deduced by placing the identified gamma rays in a pattern similar to a level scheme deduced from theory. The study was revisited at RIKEN (see [Lub19], and even though limited coincidence relations were found, it was not possible to unambiguously place the 1+ state in their work. In the study they keep the same level scheme proposed by Hinke et al. [Hin12]. The problem arises because there are three possible level scheme arrangements depending on which theory is assumed.
If one considers the nearly 100 % efficiency of the TAS technique for detecting gamma cascades, a total absorption spectrometer measurement should be sufficient (if enough statistics is collected) to unambiguously place the 1+ state in 100In. In addition, a high statistics study could also make possible the identification of additional 1+ states populated in the decay, making possible a better estimation of the Gamow-Teller quenching for this relevant decay.
The measurement will be carried out using the upgraded hybrid TAS array, which has been developed within the (NA)2STARS project and will be installed at DESIR. The new hybrid TAS will consist of either DTAS [Tai15, Gua18] or Rocinante [Val17], which was refurbished recently [Orr25], together with new LaBr3(Ce) modules arranged in a star-shaped configuration. Please also note that total absorption measurements also require additional measurements of the daughter activity.

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