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## 10C Superalowed Beta Decay Measurement with AGATA: CKM Matrix Unitarity Test

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The CKM matrix, associated with quark mixing, is expected to be unitary within the framework of the Standard Model. Violation of the unitarity for the CKM matrix would provide a hint such as the existence of fourth-generation quarks [1] or leptoquarks [2,3]. In other words, precise test for the CKM matrix unitarity is one of the precision frontiers in the search for physics beyond the Standard Model. The square sum of the first column elements of the CKM matrix,  $|V_{ud}|^2 + |V_{us}|^2 + |V_{ub}|^2$ , is a good probe for the unitarity test.  $V_{ud}$  dominates the square sum, and it can be precisely measured by superallowed beta decay. Recently, theoretical uncertainty in the  $V_{ud}$  has been reduced [4], providing motivation to further improve from the experimental side. Half-life,  $Q$  value, and decay branching ratio directly determine the  $V_{ud}$ , and for  $^{10}\text{C}$  superallowed beta decay, the branching ratio dominates the experimental uncertainty [5].  $^{10}\text{C}$  is also important for the Fierz interference term search since  $^{10}\text{C}$  is the lightest nuclei exploited for superallowed beta decay measurements. We performed a new experiment aimed at reducing the uncertainty in the  $^{10}\text{C}$  branching ratio. Moreover, the half-life of the  $^{10}\text{C}$  superallowed beta decay can be obtained simultaneously from the experiment.

In the experiment, we used (p,n) and (p,p') reactions between 10-MeV proton beam accelerated from the INFN-LNL Tandem and a 1-mg/cm<sup>2</sup> thick  $^{10}\text{B}$  target. The AGATA HPGe tracking array was employed to measure the gamma rays from the reactions, and it was the first AGATA experiment for fundamental symmetries. As a preliminary result, we got the half-life for the  $^{10}\text{C}$  superallowed beta decay, which shows consistency with the reference value. Thus far, no significant systematic uncertainties have been identified for the half-life; however, a detailed analysis of a potential systematic effect is ongoing. Additionally, the analysis of the branching ratio is also in progress. We will introduce the experimental setup and current status of the analysis in this presentation.

### References:

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