

Measurement of the ^{10}C Superallowed Branch with GAMMASPHERE

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The u-d element (V_{ud}) of the Cabibbo-Kobayashi-Maskawa (CKM) quark-mixing matrix is a fundamental parameter of the Standard Model of Electroweak Interactions. Its most precise determination comes from nuclear physics experiments, in particular, from measurements of superallowed Fermi beta decays. These measurements, requiring both precision nuclear physics experiments and state of the art theoretical nuclear physics calculations, have been made for a variety of nuclei ranging from ^{14}O to ^{54}Co [1]. The u-d element obtained from these measurements is in statistical agreement and the average value obtained implies a non-unitary CKM matrix, which if correct, would require exotic extensions to the Standard Model. Unfortunately the theoretical calculations of the isospin breaking corrections, necessary for extracting V_{ud} , are controversial. For example, Wilkinson [2] has suggested that these calculations are incomplete and that the isospin breaking corrections must be extracted empirically. In order to resolve this controversy, much effort has recently been invested in measuring V_{ud} from the superallowed decay of ^{10}C , where the isospin breaking corrections are expected to be small and any residual charge dependent corrections will be apparent. This is a very challenging measurement, since the beta decay of ^{10}C has a small superallowed branching ratio, which has to be precisely determined in a high background environment. We are currently engaged in series of experiments to measure the superallowed branching ratio of ^{10}C beta decay using the GAMMASPHERE facility at the LBNL 88-inch Cyclotron. The first data run resulted in a branching ratio of $(1.4665 \pm 0.0038) \times 10^{-2}$ [3]. A second high statistics run was made in July 1997. Unfortunately, a software filter, which was left

over from an earlier experiment, caused the corruption of the critical calibration data and the resultant systematic error prevented us from achieving the desired precision. In May 2000, the 88-Inch Cyclotron Program Advisory Committee has approved a third run for this experiment which will take place in the summer of 2001. Precautions, such as fast online diagnostic data analysis, will be made to ensure the integrity of the data. We are confident that we will achieve a precision of better than 10^{-3} .

Footnotes and References

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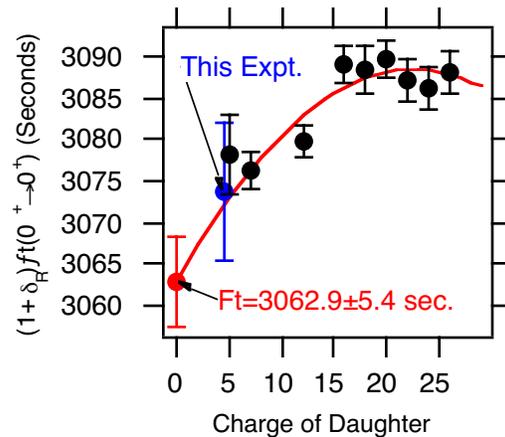


Fig. 1. The radiatively corrected ft values for superallowed beta decays plotted against the charge of the daughter nucleus. The solid curve is a fit to the data assuming a hypothetical quadratic Z dependent isospin breaking correction proposed by Wilkinson [2]. Recent results from this experiment on ^{10}C , taken with previous experiments, tend to support such dependence.