The first experimental determination of the second-forbidden transition between the ground states of ^{20}F and ^{20}Ne

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The final evolution of 8 - 10 $M_\odot$ stars depends sensitively on the electron capture rates in the ONe core. In particular, electron captures on ^{20}Ne, dominated by the second-forbidden, non-unique transition to the ground state of ^{20}F, have been shown to play a key role [1, 2]. The strength of the transition can be determined from the branching ratio of its inverse transition, the ground state to ground state β-decay of ^{20}F. We have determined this rare second-forbidden, non-unique transition for the first time at the IGISOL-4 facility in the JYFL Accelerator Laboratory.

^{20}F was produced via ^{19}F$(d,p)^{20}$F reactions using a 6 MeV deuteron beam on a BaF_2 target. The produced $^{20}F^+$ ions were implanted on a thin carbon foil at the experimental setup which consisted of a refurbished Siegbahn-Slätis type intermediate-image magnetic spectrometer, and a plastic scintillator for detecting the β particles for the branching ratio determination. The detector was divided into three parts: two inner detectors in a ΔE-E configuration surrounded by an outer detector for vetoing cosmic rays. The plastic scintillator was protected by a positron shield, and a $LaBr_3$ detector was used for measuring the 1.6 MeV γ-rays from the ^{20}F β-decay to the first excited state in ^{20}Ne. The deduced branching ratio of the second-forbidden transition was $0.99(25) \cdot 10^{-5}$ leading to $\log ft = 10.51(11)$. This is the strongest measured second-forbidden, non-unique transition so far. The impact on related stellar evolution models will be presented in another contribution in this conference.

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[1] G. Martinez-Pinedo *et al.*, Phys. Rev. C **89**, 045806 (2014).

[2] J. Schwab *et al.*, MNRAS **453**, 1910-1927 (2015).