Electron capture on ^{20}Ne and the ultimate fate of stars in the mass range 8—10 M⊙

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Knowledge of the electron-capture rate on ^{20}Ne is of critical importance to understand the final evolution of stars in the mass range 8–10M⊙. A recent study has highlighted the importance of the second-forbidden transition between the ground states of ^{20}Ne and ^{20}F, which is believed to dominate the capture rate in an important temperature-density range. The strength of this transition is, however, not well constrained, neither experimentally nor theoretically, making an experimental determination highly desirable. The transition strength can be determined from the branching ratio of the inverse transition in the _ decay of ^{20}F, for which the experimental upper limit is 10^{-5}, while the most recent theoretical prediction is 1.3×10^{-6}. To facilitate an experimental determination of the branching ratio we are refurbishing an intermediate-image magnetic spectrometer capable of focusing 7 MeV electrons, and designing a scintillator detector surrounded by an active cosmic-ray veto shield, which will serve as an energy- dispersive device at the focal plane. In this contribution, GEANT4 simulations of the expected performance of the setup will be presented and the astrophysical motivation for the experiment will be discussed.