**Determination of the ANC for $^{14}C+n\rightarrow{}^{15}C$, the $^{14}C(n,\gamma)^{15}C$ reaction rate, and the evaluation of a new method to determine spectroscopic factors**

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The $^{14}C+n\leftrightarrow{}^{15}C$ system has been used as a test case in the evaluation of a new method to determine spectroscopic factors that uses the ANC. The method proved to be unsuccessful for this case. As part of this experimental program, the ANCs for the $^{15}C$ ground state and first excited state were determined using a heavy ion neutron transfer reaction as well as the inverse kinematics (d,p) reaction, measured at the Texas A&M Cyclotron Institute (TAMU-CI). The values $C^2_{2s1/2} = 1.88 \pm 0.18 \text{fm}^{-1}$ for the ground state and $C^2_{1d5/2} = 4.25 \pm 0.38 \text{fm}^{-1}$ for the first excited state ($E_{ex}$= 740 keV) were obtained. The ANCs were used to evaluate the astrophysical direct neutron capture rate on $^{14}C$, which was then compared with the most recent direct measurement and found to be in good agreement. A study of the $^{15}C$ SF via its mirror nucleus $^{15}F$ and a new insight into deuteron stripping theory are also presented. The work has been published in Phys. Rev. C **89**, 044605 (2014).