Reply to "Comment on 'Neutron knockout of ^{12}Be populating neutron-unbound states in ^{11}Be' "

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(Received 6 December 2011; revised manuscript received 1 May 2012; published 6 July 2012)

In the preceding Comment, Fortune argues that, in our original paper [Peters *et al.*, Phys. Rev. C **83**, 057304 (2011)], we did not or could not separate the two neutron-unbound states in ^{11}Be near 4 MeV. However, including the suggested contribution of the 3.887-MeV state decaying via 18 keV to the 2^+ state in ^{10}Be does not fit the data; neither do any other attempts incorporating any contribution of this decay channel. The best fit was achieved with a single resonance of decay energy 80(2) keV.

DOI: 10.1103/PhysRevC.86.019802 PACS number(s): 29.38.−c, 29.30.Hs, 21.10.Pc, 21.60.Cs

In his Comment [1], Fortune discusses the possibility that the decay-energy spectrum of ^{11}Be from the original paper (Ref. [2]) could be described with contributions from two states at excitation energies of 3.887 and 3.955 MeV decaying to the 2^+ excited state in ^{10}Be. This would correspond to decay energies of 18 and 86 keV. In our original paper, we fitted the data with a single resonance at 80(2) keV. Unfortunately, the error bars shown in the inset of Fig. 2 in Ref. [2] were incorrectly too large, especially for the lowest decay-energy points. This might have given the impression that a lower decay-energy channel could have a significant contribution on the data without degrading the overall fit. The data from the inset of Fig. 2 from Ref. [2] with the correct (statistical) error bars are shown in Fig. 1, demonstrating the quality of the original single-component fit.

Nevertheless, following the suggestion of Fortune, we tried to fit the data with an additional contribution of an 18-keV decay channel from the $5/2^-$ state ^{11}Be*(3.887) to the 2^+ excited state in ^{10}Be. The data from the inset of Fig. 2 in Ref. [2] was fit with results from MoNA-Sweeper simulations for decay energies of 86 and 18 keV as suggested by Fortune. The relative amplitudes of the two decay channels were fixed at 0.85 and 0.15, respectively. The nonresonant background is unchanged because these parameters are determined by fitting the data over the full decay-energy range from Fig. 2 of Ref. [2]. The result of this fit, shown in Fig. 2, does not describe the data, which have a reduced-χ^2 value of 11.2. In addition, we attempted to fit the data by varying the width of the 86-keV decay channel and the relative amplitude of the 18-keV decay channel. None could describe the data well with the best fit, which leads to a relatively poor reduced-χ^2 value of 1.67 containing only a 2.4(6)% contribution from the 18-keV decay channel. When the simulations were repeated with various decay energies for the 86-keV decay channel, the minimum χ^2 fit was for a single resonance at 80 keV as presented in the original paper with no contribution of the 18-keV decay channel. The reduced-χ^2 value for this best fit was 1.04. Any changes to these optimized parameters quickly increase the χ^2 value and confirm that there is almost no overlap between the $5/2^-$ ^{11}Be*(3.887) state and the ground state of ^{12}Be through the single neutron-knockout reaction.

As Fortune states, there are two papers that report a decay branching ratio (BR) from the ^{11}Be*(3.949)-MeV state to the ground state and first excited 2^+ state of ^{10}Be. If the values of Hirayama *et al.* [3] are used instead of the values of Haigh *et al.* [4] and Ref. [5] that were used in the original paper, then the cross section for populating the 3.949-MeV state from the single neutron-knockout reaction on ^{12}Be changes from 30(6) to $19(\pm^9_6)$ mb. The alternate spectroscopic factor would be $0.6(\pm^3_2)$ compared to 1.0(2). Both values are reasonably consistent with the shell-model calculation of 0.69 listed in Table I in Ref. [2]. The discussion about the differing branching ratios and concerns about the results of Ref. [4] mentioned in the Comment had already been published by Fortune and Sherr in a separate paper [6] (which was submitted for publication concurrently with our paper [2]). Therein, they calculate spectroscopic factors using both BR values and call for "a better understanding of the discrepancy between results of Refs. [3] and [4]."

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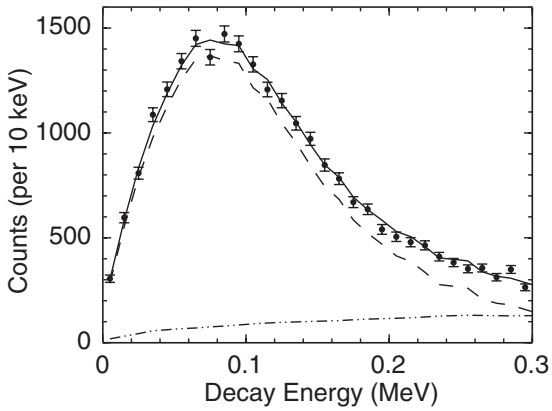

FIG. 1. Data from the inset of Fig. 2 of original paper [2] with correct statistical error bars. The data are fit with one 80-keV decay channel (dashed line) and the nonresonant background (dot-dashed line) from Ref. [2]. The reduced-χ^2 value for the fit (solid line) is 1.04.

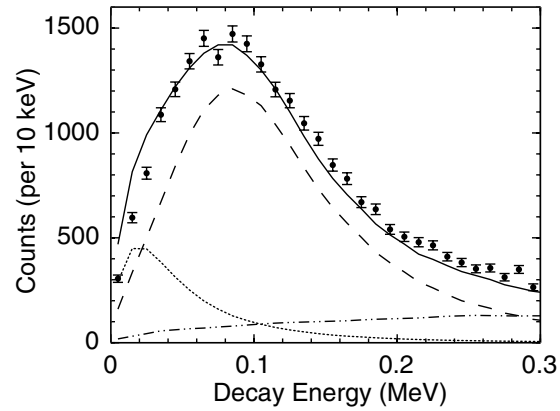

FIG. 2. Data from the inset of Fig. 2 in Ref. [2] and a fit using parameters suggested by Fortune in the Comment with a fixed ratio between the intensities of an 18-keV decay-energy channel (dotted line) to an 86-keV decay-energy channel (dashed line) of 0.15:0.85 along with the background (dot-dashed line) from Ref. [2]. The reduced-χ^2 value for this fit (solid line) is 11.2.

We would like to thank Fortune for pointing out the following errors in our original paper. When we incorporated the new binding energy of ^{11}Be (0.501 MeV), we edited the values in Fig. 1 of the original paper [2] but neglected to change the text, thus, as pointed out by Fortune, the 14-keV decay energy in the text should, of course, be 18 keV. Also, we inadvertently dropped Ref. [7] from the final paper submitted for publication. It should have been included and cited.

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