Comment on "Stellar Reactions with Short-Lived Nuclei: $^{17}F(p,\alpha)^{14}O$"

Harss *et al.* [1] used the $p(^{17}\mathrm{F},\alpha)$ reaction on a thick target to look for resonances of astrophysical interest in ^{18}Ne. In the region studied, they located three resonances at excitation energies of 7.16 ± 0.15, 7.37 ± 0.06, and 7.60 ± 0.05 MeV in ^{18}Ne. They state that the J^π assignments for the observed resonances can be, respectively, $(1^-;4^+;1^-)$, $(1^-;4^+;2^+)$, or $(1^-;1^-;2^+)$. For reasons we make clear below, neither of the upper two levels can be the mirror of the 7.11 MeV, 4^+ state in ^{18}O, and neither of the lower two are likely 1^-.

The 7.11 MeV, 4^+ level of ^{18}O is dominantly of four-particle, two-hole ($4p$-$2h$) character [2], loosely described as ($^{14}\mathrm{C} + \alpha$), where the four nucleons that make up the α particle are all in the $2sld$ shell. The observed α width of this state, 91 ± 13 meV, corresponds [3] to an α spectroscopic factor of 0.30 ± 0.05, very close to the maximum of 0.287 expected for a pure ($^{14}\mathrm{C} + \alpha$) state. A recent calculation [4] of Coulomb energies in ^{18}Ne, using microscopic wave functions [2], obtained 7.086 ± 0.040 MeV for the expected position of the mirror of $^{18}\mathrm{O}\ (7.11, 4^+)$. The uncertainty in this predicted energy is 0.04 MeV, and energies of all of the other lower-lying even-J positive-parity states are predicted to within 0.07 MeV (all but one to within 0.04 MeV). If the state were pure $4p$-$2h$, its excitation energy in ^{19}Ne would be only 7.155 ± 0.048. Any other reasonable configuration admixtures we can think of only lower this number. Thus, a state at 7.37 MeV (or higher) is not a candidate for the missing 4^+ mirror. Hahn *et al.* [5] suggest a state at 7.07 ± 0.01 or 7.05 ± 0.03 MeV as the 4^+ mirror. If the lowest state in Ref. [1], at 7.16 ± 0.15, is this state, the results of Ref. [1] provide $\Gamma_\alpha^{\mathrm{expt.}} = 100 \pm 27$ eV, not very different from the 48 eV computed in Ref. [5].

All of the low-lying negative-parity levels in ^{18}O are primarily of single-hole character and thus have very small E_x shifts. For six lower negative-parity states, the average absolute value of the shift is 60 keV. Thus, it is very unlikely that either of the two lower resonances of Ref. [1] could be negative parity. The most likely conclusion is that 7.60 ± 0.05 MeV level is the mirror of the 1^- state at 7.616 MeV in ^{18}O. The measured [1] $\omega\gamma(p,\alpha) = 300 \pm 40$ eV agrees reasonably well with the value 375 eV expected [5] for this level.

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Received 9 August 1999
PACS numbers: 25.60.Je, 21.10.Hw, 26.30.+k, 27.20.+n

[1] B. Harss *et al.*, Phys. Rev. Lett. **82**, 3964 (1999).
[2] R. D. Lawson, F. J. D. Serduke, and H. T. Fortune, Phys. Rev. C **14**, 1245 (1976).
[3] H. T. Fortune and D. Koltenuk, Phys. Rev. C **51**, 1859 (1995).
[4] R. Sherr and H. T. Fortune, Phys. Rev. C **58**, 3292 (1998).
[5] K. I. Hahn *et al.*, Phys. Rev. C **54**, 1999 (1996).

