Gaudefroy *et al.* Reply: Reference [1] aimed, in particular, at determining the variation of the neutron $p_{3/2} - p_{1/2}$ spin-orbit splitting (ΔSO) between $^{49}_{20}$Ca and $^{47}_{18}$Ar due to the removal of 2 protons. This was achieved by using the experimental energy difference between the $3/2^-_1$ and $1/2^-_1$ states in the two nuclei. However, as soon as one departs from a doubly magic nucleus the single-particle strength of the $p_{3/2}$ and $p_{1/2}$ states becomes fragmented as they couple to excitations of the core nucleus. Therefore, Signoracci and Brown [2] pointed out that the prescription of Baranger [3] should be used to determine the single-particle centroid energy by including both the particle and hole strengths for the $p_{3/2}$ and $p_{1/2}$ states. In practice, the full strength is rarely obtained experimentally and the observed states carry a various fraction of it. In ^{49}Ca$_{29}$, 85(12)% and 91(15)% of the single-particle strengths of the $p_{3/2}$ and $p_{1/2}$ states are contained in the first $3/2^-$ and $1/2^-$ states, respectively. In ^{47}Ar$_{29}$, these strengths are reduced to 61(5)% and 81(6)%, respectively. Therefore the determination of ΔSO requires an adjustment of the proton-neutron monopole matrix elements V^{pn} involving the p orbits to reproduce experimental data, after having included the proper nuclear correlations.

Shell model calculations using the $sdfp$ interaction by Nummela *et al.* [4] exhibit deviations of binding energies of up to 400 keV for the $3/2^-$ and $1/2^-$ states in the ^{45,46,47}Ar and ^{47,48,49}Ca nuclei. Therefore, contrary to Ref. [2], we have modified the relevant neutron-proton monopole interactions V^{pn} to reproduce the experimental binding energies and spectroscopic factors of the known p states in ^{45,47}Ar [1,5] and ^{47,49}Ca [6]. By this means, the particle strengths of the $\nu p_{3/2}$ and $\nu p_{1/2}$ orbits, $\sum C^2S^+$ (using the notation of [2]), agree with the results of the ^{46}Ar$(d, p)^{47}$Ar reaction [1]. Similarly the hole strength of the $\nu p_{3/2}$ orbital, $\sum C^2S^-$, is in accordance with the result of the 1-neutron knock-out reaction ^{46}Ar$(-1\ \mathrm{n})^{45}$Ar [7]. These features show that the shell model account well for the splitting of the single-particle strength due to correlations. Proton correlations are essentially due to the quasi-degeneracy between the $s_{1/2}$ and $d_{3/2}$ orbits. The vacancy numbers $[(2j + 1) -$ occupation number$]$ of the proton $s_{1/2}$, $d_{3/2}$, and $d_{5/2}$ orbits in the ground state of ^{46}Ar are 0.83, 1.05 and 0.12, respectively. In ^{48}Ca all sd orbits are fully occupied and vacancy values are null. The resulting ground-state wave function (WF) of ^{46}Ar contain equal mixing of $(\pi s_{1/2})^2(\pi d_{3/2})^2$ and $(\pi s_{1/2})^0(\pi d_{3/2})^4$ configurations. Neutron correlations are due to particle hole ($p - h$) excitations across the $N = 28$ shell gap. About 50% of the ground-state WF of ^{46}Ar correspond to $0p - 0h$ (or $f^8_{7/2}$) neutron closed-shell configuration. The $1p - 1h$ and $2p - 2h$ excitations correspond each to 20% of the WF. Higher order excitations provide the remaining strength. The $3/2^-_1$ state observed in ^{47}Ar exhibits about 55% of $1p - 0h$ neutron configuration. The $2p - 1h$ $(3p - 2h)$ neutron component represents 25% (15%) of the WF. In ^{45}Ar, the $3/2^-_1$ state has 30%, 40%, and 20% of $0p - 1h$, $1p - 2h$, and $2p - 3h$ neutron excitations, respectively. For both nuclei, correlations in the $3/2^-_1$ state mainly correspond to the coupling of the proton 2^+ excitation to neutrons in the $p_{3/2}$ or $f_{7/2}$ orbits.

According to the vacancy values determined in the sd orbits, this leads to

$$\begin{aligned}\Delta\mathrm{SO} = 1.05(&V^{\mathrm{pn}}_{d_{3/2}p_{3/2}} - V^{\mathrm{pn}}_{d_{3/2}p_{1/2}}) \\ &+ 0.83(V^{\mathrm{pn}}_{s_{1/2}p_{3/2}} - V^{\mathrm{pn}}_{s_{1/2}p_{1/2}}) \\ &+ 0.12(V^{\mathrm{pn}}_{d_{5/2}p_{3/2}} - V^{\mathrm{pn}}_{d_{5/2}p_{1/2}}). \qquad (1)\end{aligned}$$

From the new effective interaction depicted above, one obtains $(V^{\mathrm{pn}}_{s_{1/2}p_{3/2}} - V^{\mathrm{pn}}_{s_{1/2}p_{3/2}}) = -0.25$ MeV. Additional constraint to the monopole values is provided by the fact that the p SO splitting remains constant ($\simeq 1.7$ MeV) between $^{41}_{20}$Ca$_{21}$ [8] and ^{1637}S$_{21}$ [9] after the removal of four protons from the $d_{3/2}$ orbit. This implies that $(V^{\mathrm{pn}}_{d_{3/2}p_{3/2}} - V^{\mathrm{pn}}_{d_{3/2}p_{1/2}}) = 0$. The effect of the proton-neutron monopoles involving the $\pi d_{5/2}$ orbit on ΔSO is less than 20 keV.

By using these monopole differences in Eq. (1), a reduction of ΔSO by 207 keV is found. Identical reduction is obtained when using the prescription of Baranger [3] for the full p strengths, which is determined with the Lanczos strength function method [10]. When using the interaction of Ref. [4], which underestimated the energy spacing between the first $3/2^-_1$ and $1/2^-_1$ in ^{49}Ca, an *increase* of the SO splitting by 145 keV is obtained.

The present reduction of the neutron p SO splitting between ^{49}Ca and ^{47}Ar by 207 keV is weaker than the value reported in Ref. [1], which has neglected significant correlations. As this reduction is mainly due to the 0.83 protons removed from the $s_{1/2}$ orbit, a decrease by 500 keV ($\simeq 30\%$) of the p SO splitting is anticipated in the ^{35}Si or ^{42}Si nuclei in which the $2s_{1/2}$ orbit is likely to be unoccupied.

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