Erratum: Cross sections of neutron-induced reactions [Phys. Rev. C 82, 044613 (2010)]

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The first equation of Eqs. (3) in [1] was used to describe the mass number and energy dependence of experimental total neutron cross sections for the first time in [2], while the second and third ones were used for scattering and reaction cross sections in [3]. The omissions of these two references were unintended. We derived these equations and Eq. (4) of Ref. [4] (Ref. [12] of our paper [1]) as follows. From partial wave analysis of scattering theory, we know the standard expressions for scattering $\sigma_{\rm sc}$ and reaction σ_r cross sections as

$$\sigma_{\rm sc} = \frac{\pi}{k^2}\Sigma_l(2l+1)|1-\eta_l|^2, \qquad \sigma_r = \frac{\pi}{k^2}\Sigma_l(2l+1)[1-|\eta_l|^2], \tag{1}$$

where the quantity $\eta_l = e^{2i\delta_l}$. With the assumption that the phase shift δ_l is independent of l and the summation over partial waves l is up to kR only, it follows that $\sigma_{\rm sc} = \pi(R+\bar{\lambda})^2(1+\alpha^2-2\alpha\cos\beta)$, $\sigma_r = \pi(R+\bar{\lambda})^2(1-\alpha^2)$, and $\sigma_{\rm tot} = \sigma_{\rm sc}+\sigma_r = 2\pi(R+\bar{\lambda})^2(1-\alpha\cos\beta)$, where $\bar{\lambda} = 1/k$, R is the channel radius beyond which partial waves do not contribute, $\beta = 2{\rm Re}\delta_l = 2{\rm Re}\delta$, $\alpha = e^{-2{\rm Im}\delta_l} = e^{-2{\rm Im}\delta}$, and summing over l from 0 to kR yielded $\Sigma_l(2l+1) = (kR+1)^2$.

We used the name "nuclear Ramsauer model" from Ref. [12] of our paper [1]. Carpenter and Wilson [5] were the first to call the structure found in total neutron cross sections the nuclear Ramsauer effect. This name was adopted by subsequent authors, although the nature of the oscillation in fast-neutron cross sections is essentially different from that observed for slow electrons by Ramsauer. In other works the names "semiclassical optical model" [3] or "diffraction effect" [6] were used, which are more appropriate. From the model of [1] one cannot expect the accuracy of a complete quantum-mechanical optical model. However, the simple semiclassical optical model [1] obtained to calculate cross sections up to 600 MeV are of relevance as phenomenological optical model potentials are limited up to 150–200 MeV.

In fact, the radius of the potential well is just $r_0A^{\frac{1}{3}} = r_1A^{\frac{1}{3}+\gamma}$ and r_1= constant. The parameter γ is a very small number (0.00793) compared to the $\frac{1}{3}$ needed for fine tuning. It should, therefore, be emphasized that, as mentioned in our paper [1], it is r_0 which is used for fixing β_0. It is the channel radius which is energy dependent. Channel radius is the radius [appearing in Eqs. (3) of our paper] beyond which no partial waves contribute. It is well known from R-matrix theory that the channel radius is less than the nuclear (potential) radius, which is precisely the case here.

Obviously, these omissions do not affect the results and conclusion of the original manuscript [1].

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[1] T. Mukhopadhyay, J. Lahiri, and D. N. Basu, Phys. Rev. C **82**, 044613 (2010).
[2] I. Angeli and J. Csikai, Nucl. Phys. A **158**, 389 (1970).
[3] I. Angeli, J. Csikai, and P. Nagy, Nucl. Sci. Eng. **55**, 418 (1974).
[4] J. D. Anderson and S. M. Grimes, Phys. Rev. C **41**, 2904 (1990).
[5] S. G. Carpenter and R. Wilson, Phys. Rev. **114**, 510 (1959).
[6] J. D. Lawson, Philos. Mag. **44**, 102 (1953).

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