Erratum: Towards storage rings as quantum computers [Phys. Rev. Accel. Beams **23**, 054701 (2020)]

K. A. Brown and T. Roser

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In this paper, Eq. (3) is incorrect. A correct expression is [1],

$$T_{||}[K] = \left(\frac{2}{k_B}\right) \left(\frac{\delta p}{p_0}\right)^2 E_0[\text{eV}]. \quad (3)$$

This correction does not require any changes in the rest of the paper except for quantities given in the text and Fig. 3 of the paper that are based on Eq. (3). These changes are listed below: (1) Section VI, paragraph 5: sentence 5 should read “... the product $(\frac{\delta p}{p_0})^2 E_0 = 2.3 \times 10^{-5} / 2.32 \times 10^4 \approx 1 \times 10^{-9}$.” (2) Section VI, paragraph 5: sentence 6 should read “A beam with $E_0 = 1$ [eV], corresponding to a velocity of 2818 m/s, would have to be cooled to have a $\delta p/p_0 = 3.16 \times 10^{-5}$...” (3) Section VI, paragraph 5: sentence 7 should read “... a beam with $E_0 = 10^{-4}$ [eV], with a velocity near 28 m/s, would

FIG. 3. The surface of values of the $\log_{10} \Lambda_p$ versus momentum spread and voltage for ${}^7\text{Li}^+$ ions with $v_0 = 100$ m/s, at $f_{\text{rf}} = 12.6$ Mhz.

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have to be cooled to have a $\delta p/p_0 = 3.16 \times 10^{-3}$.” (4) Section VI, paragraph 6: With respect to Table 1, sentence 2 should read “The assumption is we can cool the beams to a level where the $\delta p/p_0$ is 3.16×10^{-4} .” (5) Table 1 caption: “... assume cooling has achieved $\delta p/p_0$ of 3.16×10^{-4} .” (6) Section VI, paragraph 11: sentence 3 should read “For the $v=100$ m/s ions, the range of $\delta p/p_0$ must be less than 3.16×10^{-3} .” (7) Section VI, paragraph 14: sentence 2 should read “The laser cooling will need to reduce the $\delta p/p_0$ to less than 3.16×10^{-3} .”

Included is an updated version of Fig. 3, with correct parameter ranges.

With this change in the fundamental relation between longitudinal temperature and $\delta p/p_0$, numerical values of quantities change in directions that make it easier to reach the conditions for quantum entanglement.

This correction does not change the thesis or conclusions of the paper.

ACKNOWLEDGMENTS

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- [1] M. Steck, K. Beckert, H. Eickhoff, B. Franzke, F. Nolden, H. Reich, B. Schlitt, and T. Winkler, Anomalous Temperature Reduction of Electron-Cooled Heavy Ion Beams in the Storage Ring ESR, *Phys. Rev. Lett.* **77**, 3803 (1996).