Erratum: Detecting floating black holes as they traverse the gas disc of the Milky Way

by Xiawei Wang* and Abraham Loeb

Department of Astronomy, Harvard University, 60 Garden St, Cambridge, MA 02138, USA

Key words: errata, addenda – black hole physics – Galaxy: disc – radio continuum: ISM.

The paper ‘Detecting floating black holes as they traverse the gas disc of the Milky Way’ was published in MNRAS, 441, 809 (2014).

There is an additional constraint on the maximum Lorentz factor $\gamma_{\text{max}}$, obtained by equating the acceleration time of the electrons and the dynamical time, which was previously not included. When we incorporate this constraint, the modified result is $\gamma_{\text{max}} = 1.2 \times 10^5 B^{-5} M_5^{1/2} V_{200}^{3/2}$. The modified plot is attached. There was a numerical error in the break Lorentz factor $\gamma_b$. The corrected value is $\gamma_b = 5.0 \times 10^9 B^{-2} M_5^{-1} V_{200}^{3/2}$, and the corresponding break frequency is $\nu_b = 4.2 \times 10^{10} B^{-5} \gamma_b^{2.9}$ GHz, which has no effect on our calculation and conclusion.

The detectability of the floating BHs in the radio frequency is not affected. The synchrotron emission can also be detected in the mm/sub-mm band by the Atacama Large Millimeter/sub-millimeter Array (ALMA). The revised version of the paper can be found on arXiv:1402.5975v3.

Figure 1. Synchrotron power and flux from non-thermal electrons accelerated by the bow shock of floating BHs, in units of $M_5^2$, for $n_0 = 1$, $V_{200} = 1$, $L_{\text{BH}} = 3.0 \times 10^{30}$ erg s$^{-1}$, $B = 3.5$, $\gamma_{\text{min}} \sim 1$ and $\gamma_{\text{max}} \sim 4.2 \times 10^5$.

The upper panel shows synchrotron flux while the lower panel shows the corresponding power. The left-hand label of the vertical axis marks synchrotron luminosity per unit frequency (upper panel) or power per log $\nu$ (lower panel) while the right-hand one marks the corresponding flux at a distance of $d = 10$ kpc. The black, blue, red and green lines correspond to power-law indices $p = 2.0, 2.2, 2.5, 2.7$, respectively, in the electron energy distribution. Synchrotron self-absorption is significant at a frequency $\lesssim$ MHz and the cooling break corresponds to a frequency $\sim 10^{19}$ Hz, which are outside the frequency range of interest.

*E-mail: xiawei.wang@cfa.harvard.edu

This paper has been typeset from a \TeX/La\TeX file prepared by the author.