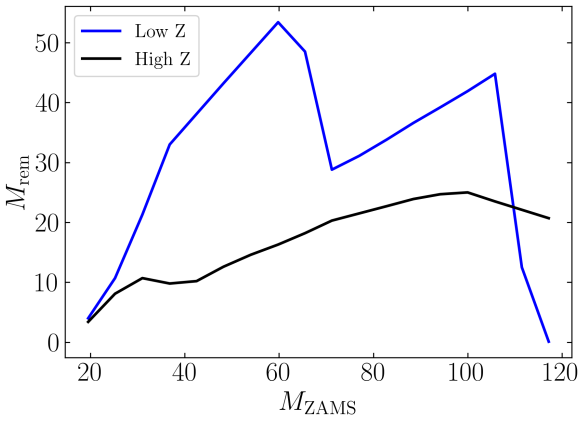

Figure 1: SNe mass transfer function

We want to answer what the primordial BH q distribution is in a few simplified cases if:

- The ZAMS masses are randomly drawn Salpeter IMF $P(M) \propto M^{-2.35}$, then go supernova following `https://ui.adsabs.harvard.edu/abs/2017MNRAS.470.4739S/abstract` (bounded by large/small Z)
- The ZAMS mass ratio is uniform.
- The ZAMS mass ratio is uniform in $\log q$.

For reference, the supernova mass transfer function is shown in Fig. 1

1 Corrections to Appendix A

I found Appendix A is wrong: $P(q) \propto q^{-p}$ using the convention $q \geq 1$, but not in our convention! See Fig. 2. To draw the distributions, I use either

$$q = \min\left(\frac{m_2}{m_1}, \frac{m_1}{m_2}\right) \leq 1, \tag{1}$$

or max and ≥ 1, where $m_{1,2}$ are drawn from $P(m) \propto m^{-2.35}$. I double checked the Moe & di Stefano paper, and under their (2) they really assume that $P(q \leq 1) \propto q^{-p}$ as well, so I think this might be a misconception?

Note that in my Appendix, the calculation doesn't change if we take $m_2 \geq m_1$! But clearly, using $m_2 \geq m_1$ and the calculation in the text is the correct calculation, and the calculation is incorrect as is. Why?

2 Histograms

The three requested plots are shown in Fig. 3. For (i), I just took the masses from the previous section and sent them through the SNe transfer function (Fig. 1). For (ii) and (iii), the procedure is somewhat more complicated; for each value of q at ZAMS: choose $m_2 \in [M_{\rm min}, qM_{\rm max}]$ and $m_1 = m_2/q$. Compute the BH value of $q_{\rm BH}$ by sending it through the SNe transfer function, and weight it by $P(m_1)P(m_2)$. Repeat for a grid of q and m_2, and histogram it all.

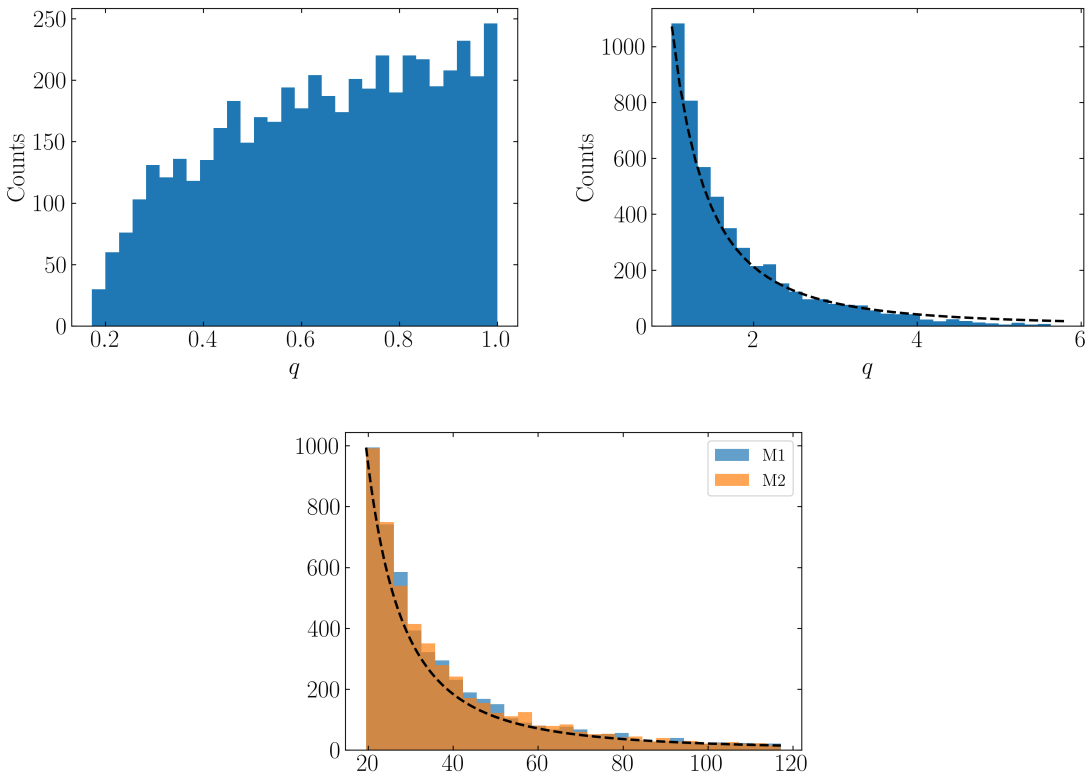

Figure 2: (i) Histogram of $q \leq 1$ with random pairings from Salpeter IMF, (ii) histogram of $q \geq 1$ with random pairings from Salpeter IMF, with $q^{-2.35}$ overlaid, and (iii) histogram of masses, with $M^{-2.35}$ power law overlaid, as a sanity check.

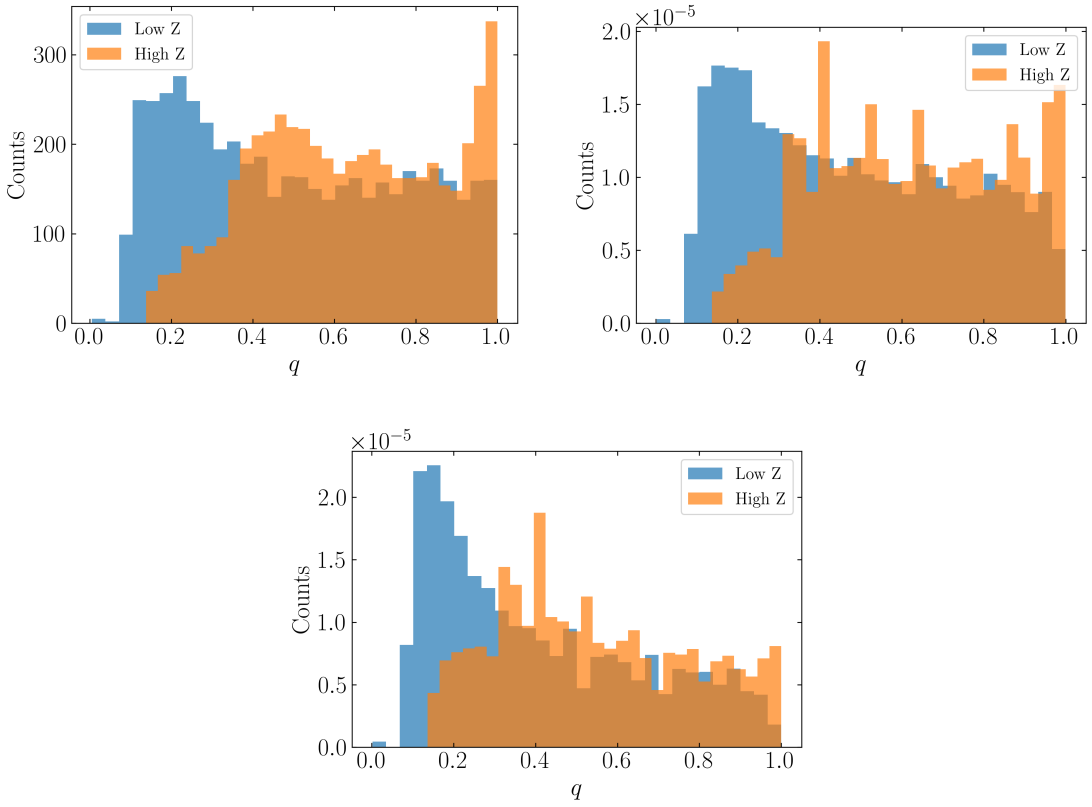

Figure 3: Distribution of q after (i) random pairings Salpeter IMF + supernovae, (ii) uniform $q_{\rm ZAMS}$, and (iii) uniform $\log(q_{\rm ZAMS})$.