

I have a confusion about how the heavy quark propagators are constructed in HQET and how the loops (in the included figure) are constructed. A standard sort of introduction and motivation to HQET (as in reviews and texts like Manohar and Wise and M.D Schwartz) is as follows :

The momentum of a heavy quark interacting with soft particles is  $p^\mu = Mv^\mu + k^\mu$  and the derivation of the heavy quark propagator from its corresponding form in QCD is thus :

$$\frac{\not{p} + \not{k} + M}{(p - k)^2 - M^2} \sim \frac{M(1 + \not{v})}{2Mv \cdot k}$$

. The thing which makes it tick is the fact that  $k^\mu$  is soft and  $M$  is hard. This is all fine but I dont understand how we can apply the same logic to get the following loop correction in the figure (which is also solved in multiple sources).

$$\Sigma \sim \int d^D q \frac{1}{[q^2][v \cdot (p + q)]}$$

If we write the same quark propagator from QCD and work onwards from that :

$$\frac{\not{p} + \not{q} + M}{(p + q)^2 - M^2} \sim \frac{M(1 + \not{v}) + \not{q}}{q^2 + 2Mv \cdot q}$$

Here we cant take  $q$  to be soft can we, as its spans all regions of the loop momentum.

This does not look like the propagator  $\frac{1}{v \cdot (q+p)}$