

For the Harmonic Oscillator Basis, the standard deviation of the wavefunction is proportional to both the $\sqrt{2^n q}$ and $1/\sqrt{\text{frequency}}$. This is because if you include more states the basis extends further on the x axis and if you increase the frequency the wave function shrinks.

Therefore because the Phi Max set by JLP and the $\sqrt{2^n q/w}$ for the HO basis are determining the same concept: how far into the phi and pi space the basis extends. These must be proportional to each other and a scaling factor can be used to align them