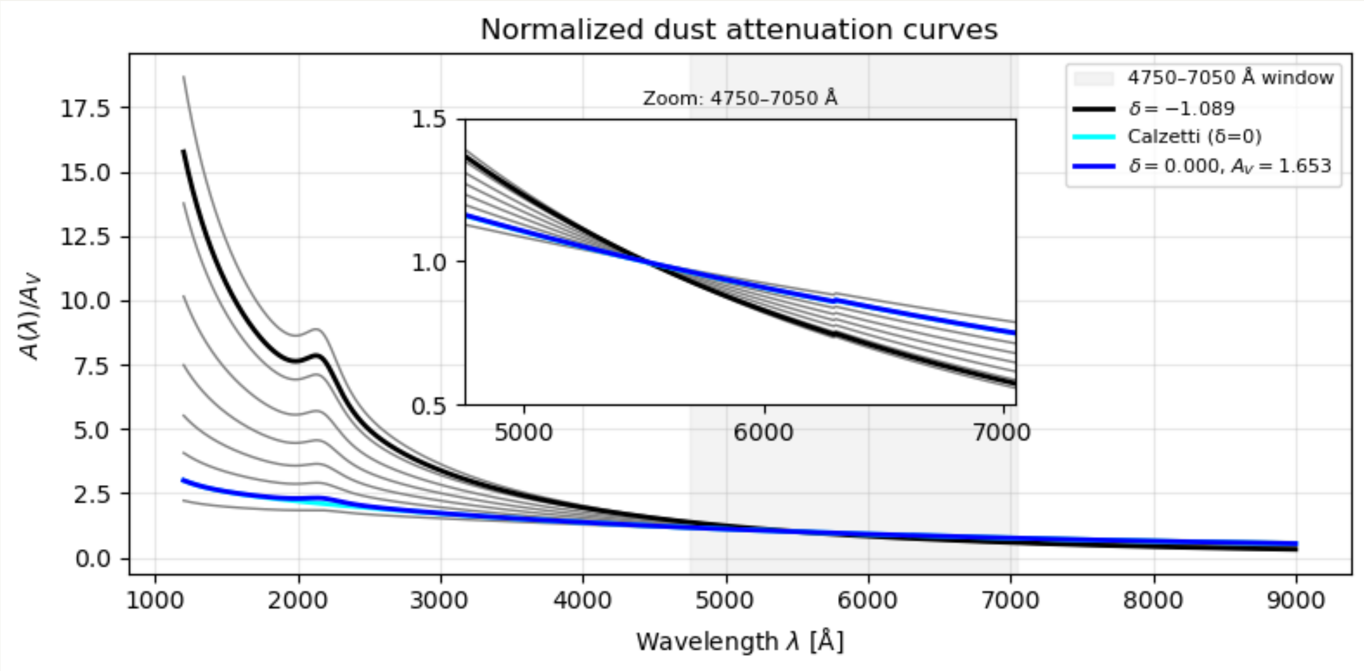
20250515 Dust and Lee et al. 2025

Dust

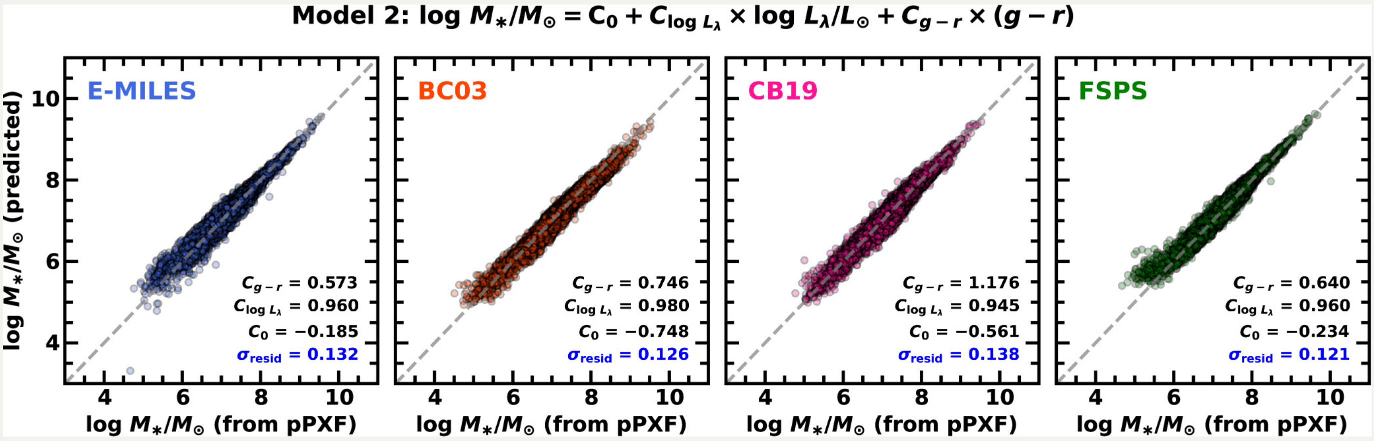
As mentioned yesterday, the `dust` parameters actually converge to $A_V = 0.897$ and $\delta = -1.089$. Now I explore how dust attenuation curves vary with δ:



Here, all gray curves are dust attenuation curves with δ from -1.2 to 0.2 (steeper $\rightarrow$ smaller δ), the black curve is $\delta = -1.089$, the blue curve is $\delta = 0$, and cyan one is from Calzetti et al. 2000 ($\delta = 0$ but no bump at $2175\mathring{A}$). Clearly, since we are only interested in optical band so there is no significant difference for choosing difference . Hence, for simplicity, from now on I will fix $\delta = 0$ (main-sequence galaxy).

Compare stellar mass with Lee et al. 2025

In Figure 13 of Lee et al. 2025, they compare stellar masses obtained from `pPXF` with best-fit models with linear combinations of specific luminosity (at $1.63\mu m$, one of the channels in simulated SPHEREx data) and SDSS $g-r$ color for different SPS templates:



However, in legacy data, I only have h-band ($1.66\mu m$) from 2MASS, so I take it as the λ here. By running my previous pipeline, I get log $L_h/L_\odot = 9.43$ (h-band magnitude is 11.427, which is the same as the data in NED). Now with $g - r = 12.658 - 11.958 = 0.7$, I can estimate the stellar mass by model 2 and compare with those obtained by `pPXF`:

	MODEL 2	PPXF
E-MILES	9.269±0.132	9.355
BC03 (GALAXEV)	9.015±0.126	9.314
FSPS	9.267±0.121	9.385

As mentioned in Lee et al. 2025 that "BC03 and CB19 yield mass-to-light ratios on average $\sim$0.2–0.3 dex lower than those from E-MILES and FSPS", we do observe that BC03 is ~ 0.25 dex lower than E-MILES and FSPS with my legacy data using model 2. On the other hand, we can see that results using E-MILES and FSPS obtained from `pPXF` are still within uncertainty ranges of those from model 2. Again, BC03 systematically underestimates M_*/L than E-MILES and FSPS, especially using M_*/L vs color relation.