

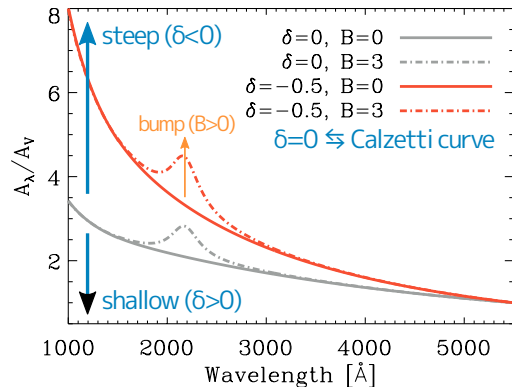
Dust Attenuation Curves in the Local Universe: Demographics and New Laws for Star-forming Galaxies and High-redshift Analogs

Samir Salim, M d ric Boquien, Janice C. Lee, Accepted to ApJ

We study dust attenuation curves of 230,000 individual galaxies in the local universe, ranging from quiescent to intensely star-forming systems, using *GALEX*, *SDSS*, and *WISE* photometry calibrated on *Herschel*-ATLAS. We use a new method of constraining SED fits with infrared luminosity (SED+LIR fitting), and parameterized attenuation curves determined with the CIGALE SED fitting code. Attenuation curve slopes and UV bump strengths are reasonably well constrained independently from one another. We find that A_V/A_V attenuation curves exhibit a very wide range of slopes that are on average as steep as the SMC curve slope. The slope is a strong function of optical opacity. Opaque galaxies have shallower curves—in agreement with recent radiate transfer models. The dependence of slopes on the opacity produces an apparent dependence on stellar mass: more massive galaxies having shallower slopes. Attenuation curves exhibit a wide range of UV bump amplitudes, from none to MW-like; with an average strength 1/3 of the MW bump. Notably, local analogs of high-redshift galaxies have an average curve that is somewhat steeper than the SMC curve, with a modest UV bump that can be to first order ignored, as its effect on the near-UV magnitude is 0.1 mag. Neither the slopes nor the strengths of the UV bump depend on gas-phase metallicity. Functional forms for attenuation laws are presented for normal star-forming galaxies, high- z analogs and quiescent galaxies. We release the catalog of associated SFRs and stellar masses (GSWLC-2).

Keywords: galaxies: fundamental parameters—dust, extinction

Figure 2. Parameterization of dust attenuation curves.



- GALEX, SDSS, WISE のレガシーカタログ (~230,000 obj; SF galaxy は ~114,000 obj.) を元に近傍銀河の attenuation curve を求めた。
- 先行研究との大きな違いは紫外・可視のデータだけでなく赤外線総光度も含めて一度に fitting するコードを作成したこと。
- attenuation curve の分散は大きい。UV の slope は A_V と強く相関 (減光量が大きいほど shallow) する。結果的に M_* と相関する。
- SF main sequence から外れると attenuation curve は steep になる。SB galaxy の attenuation curve は (平均的に) SMC 並に steep。
- attenuation curve の slope が Calzetti curve と似た範囲に入る銀河は $A_V > 0.8$ の銀河のみ。
- 2175Å bump の強度もさまざまだが傾向として main sequence にいない銀河のほうが bump が大きい。
- NUV bump の有無は SED 全体にはさほど影響がないので first order の近似では無視しても問題ない。
- Milky Way の "extinction curve" は近傍の似たような sSFR, M_* の銀河と比べると異質である。
- slope, bump とともにホスト銀河の gas metallicity とはまったく相関がなかった。
- high- z analogs の平均的な attenuation curve は Calzetti curve よりも有意に steep である。
- 今回の結果は最新の radiative transfer modeling による予測と一致している。また最近の $z \sim 2$ の銀河の IRX- β の結果とも矛盾しない。
- Calzetti curve との違いの一番の原因はおそらく導出手法。Calzetti curve は仮定に不備があり systematic error が乗っているのでは？

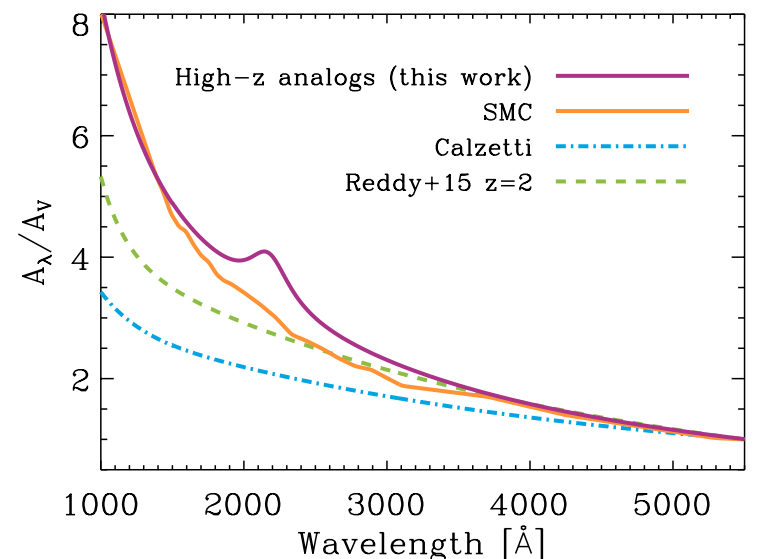
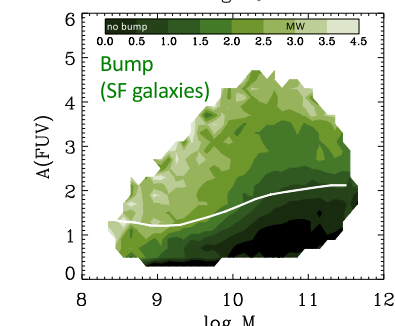
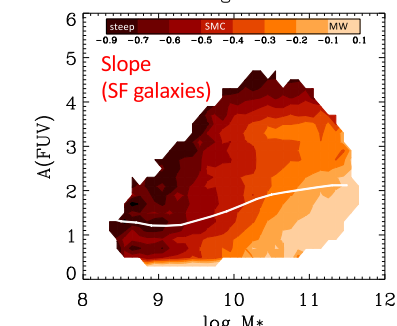
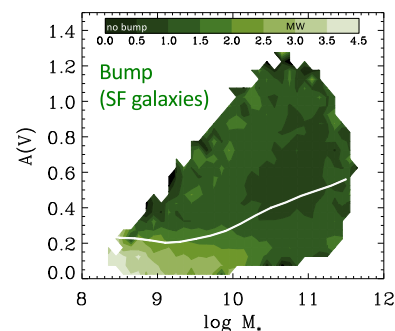
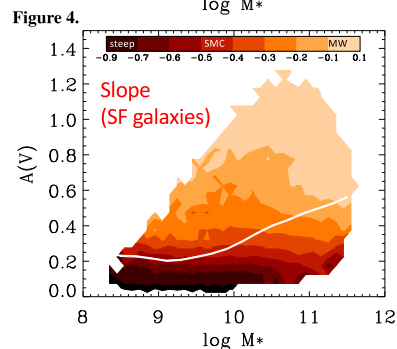
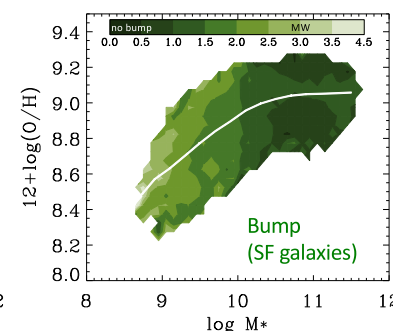
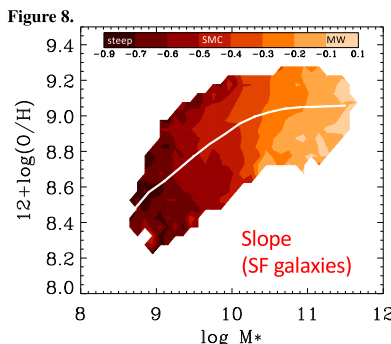
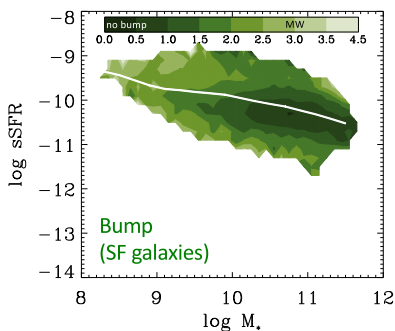
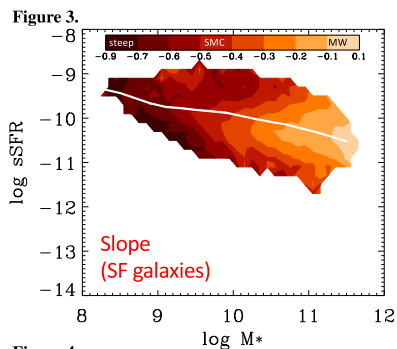


Figure 11. Comparison of average dust attenuation curves for our sample of high-redshift analogs.