

# PROSPECT: generating spectral energy distributions with complex star formation and metallicity histories

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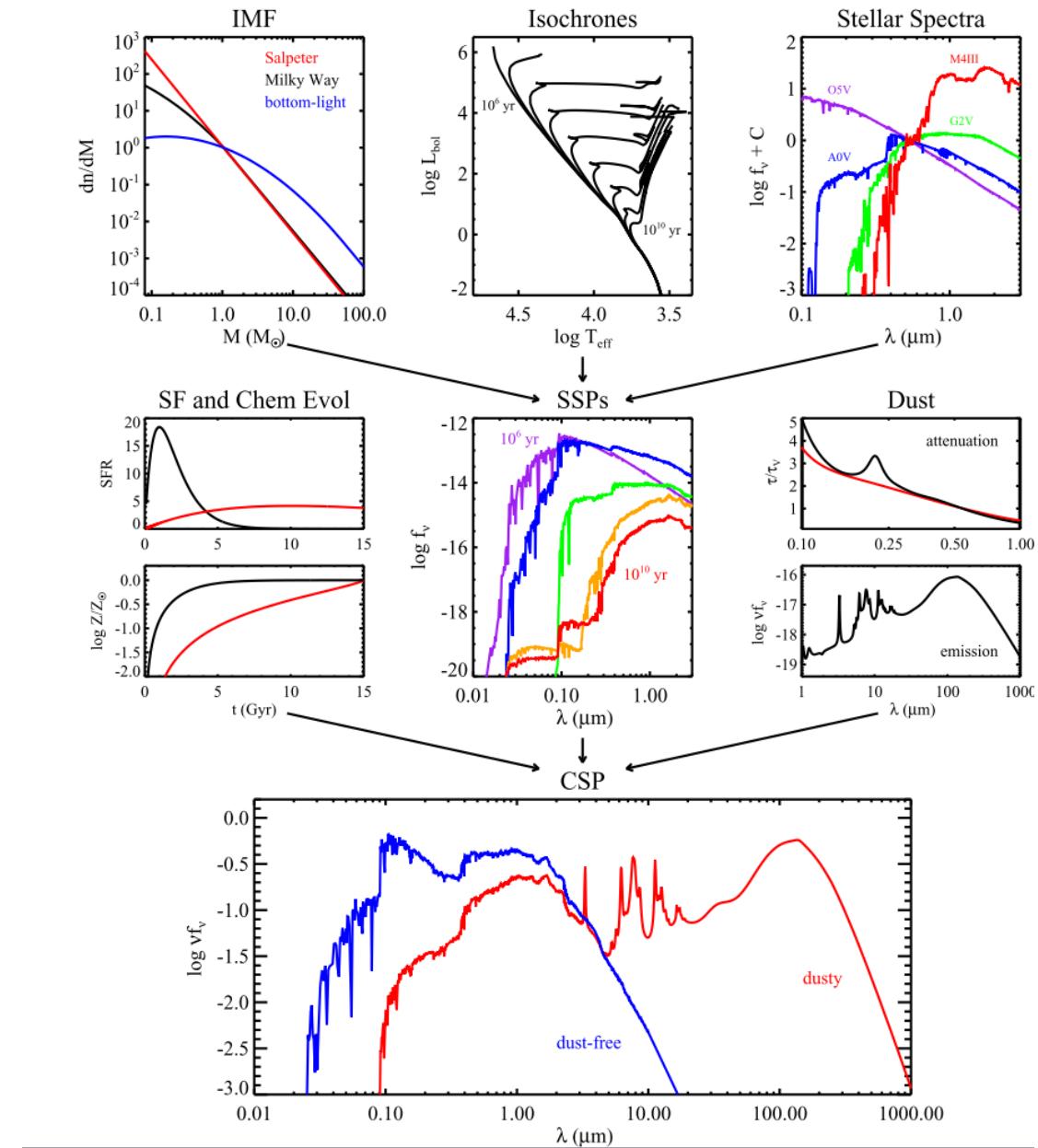
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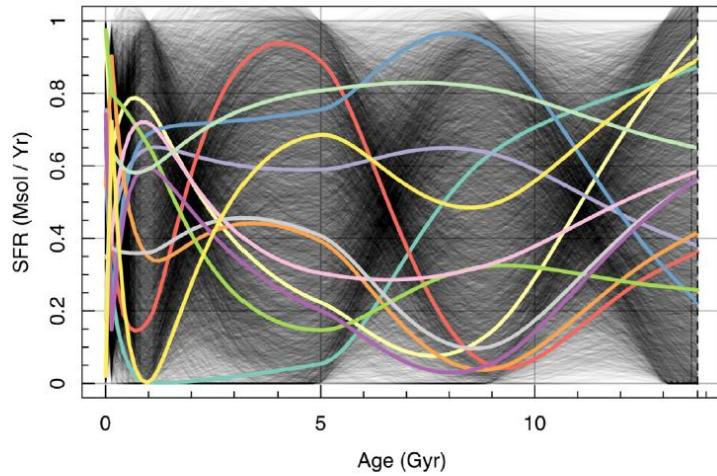
<https://github.com/asgr/ProSpect> (R language)

Web interface: <https://prospect.icrar.org/>

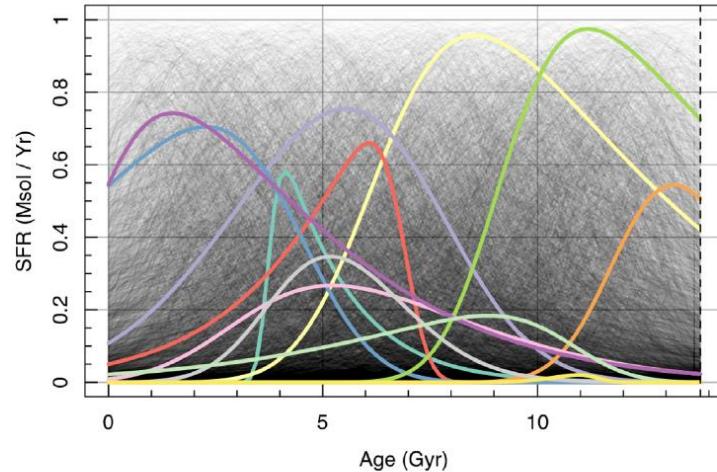
- **发射线**
  - 电离气体
  - HII区
- **AGN**
  - 连续谱, 发射线, 尘埃
- **星族**
  - 化学演化模型
- **SSP模板**
  - IMF
  - 恒星演化
- **尘埃**
  - 物化性质
    - 消光曲线
  - 几何模型
  - 温度 (发射)



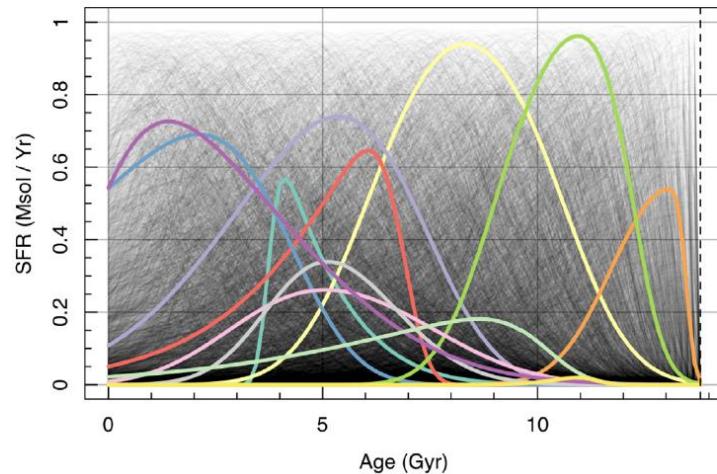
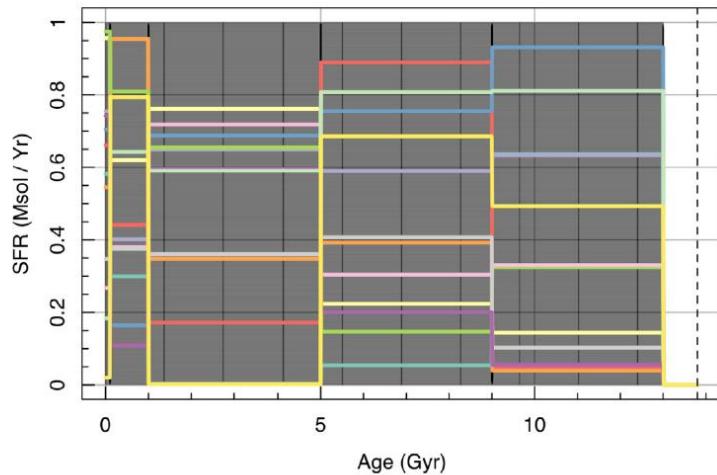
# Prospect: 各种各样的SFH



**Figure 6.** `massfunc_p6` SFHs from 10 000 samples of the  $m1/m2/m3/m4/m5/m6$  [0, 1] parameters, with 12 reference SFHs in bold colour. Note that given the flexibility to adjust all age nodes, a more diverse range of SFHs is in practice possible.



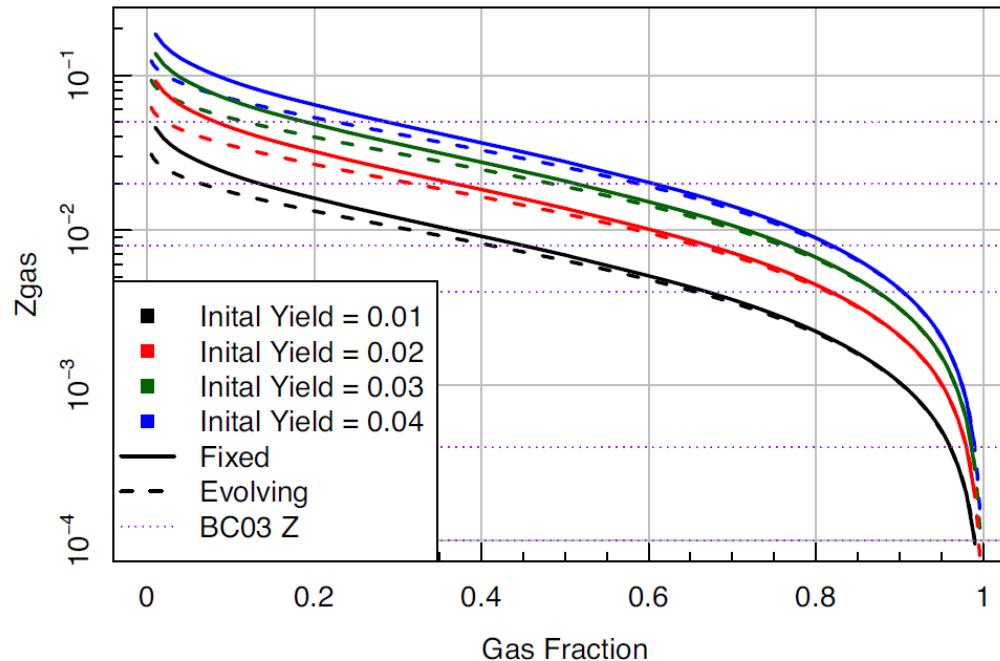
**Figure 9.** `massfunc_snorm` SFHs from 10 000 samples of the  $mSFR$  [0, 1],  $mpeak$  [0, 13.8],  $mperiod$  [0.5, 3.5], and  $mskew$  [-0.5, 0.5] parameters, with 12 reference SFHs in bold colour.



# Prospect: 化学演化

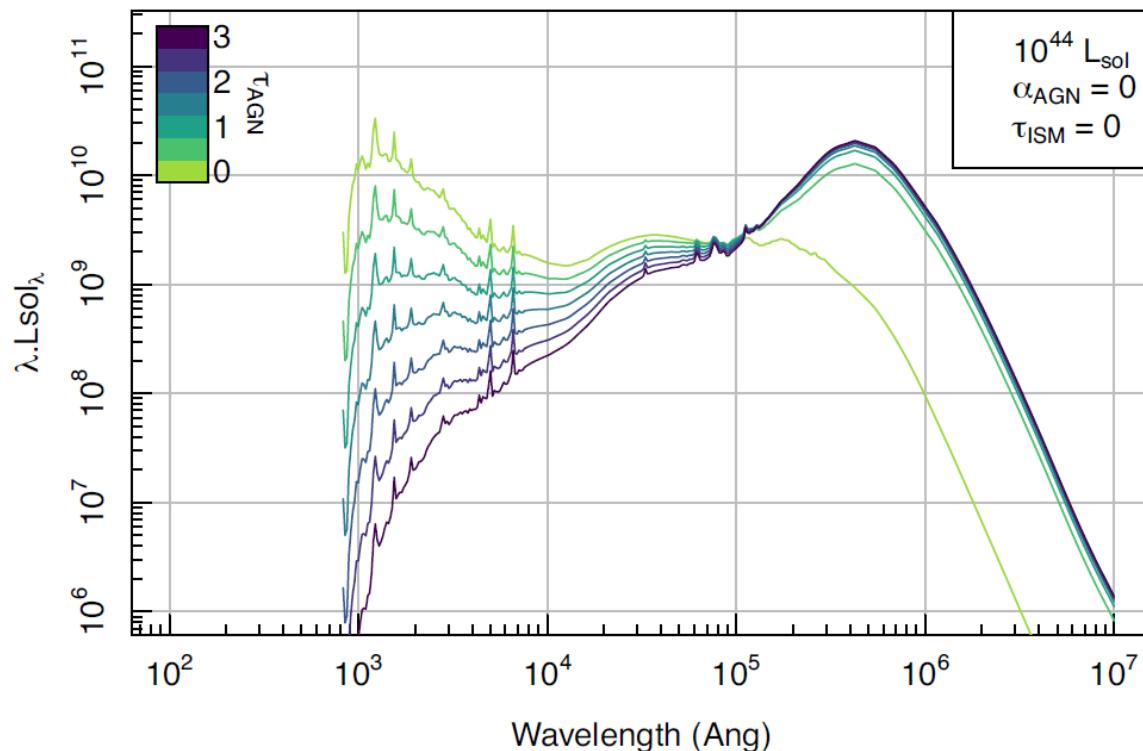
- 不同年龄的SSP的丰度
  - 金属丰度线性正比于恒星形成的比例
  - Close-box模型：产额为定值

$$Z_{\text{final}} = Z_{\text{start}} - \rho \ln(\mu),$$



# Prospect: AGN

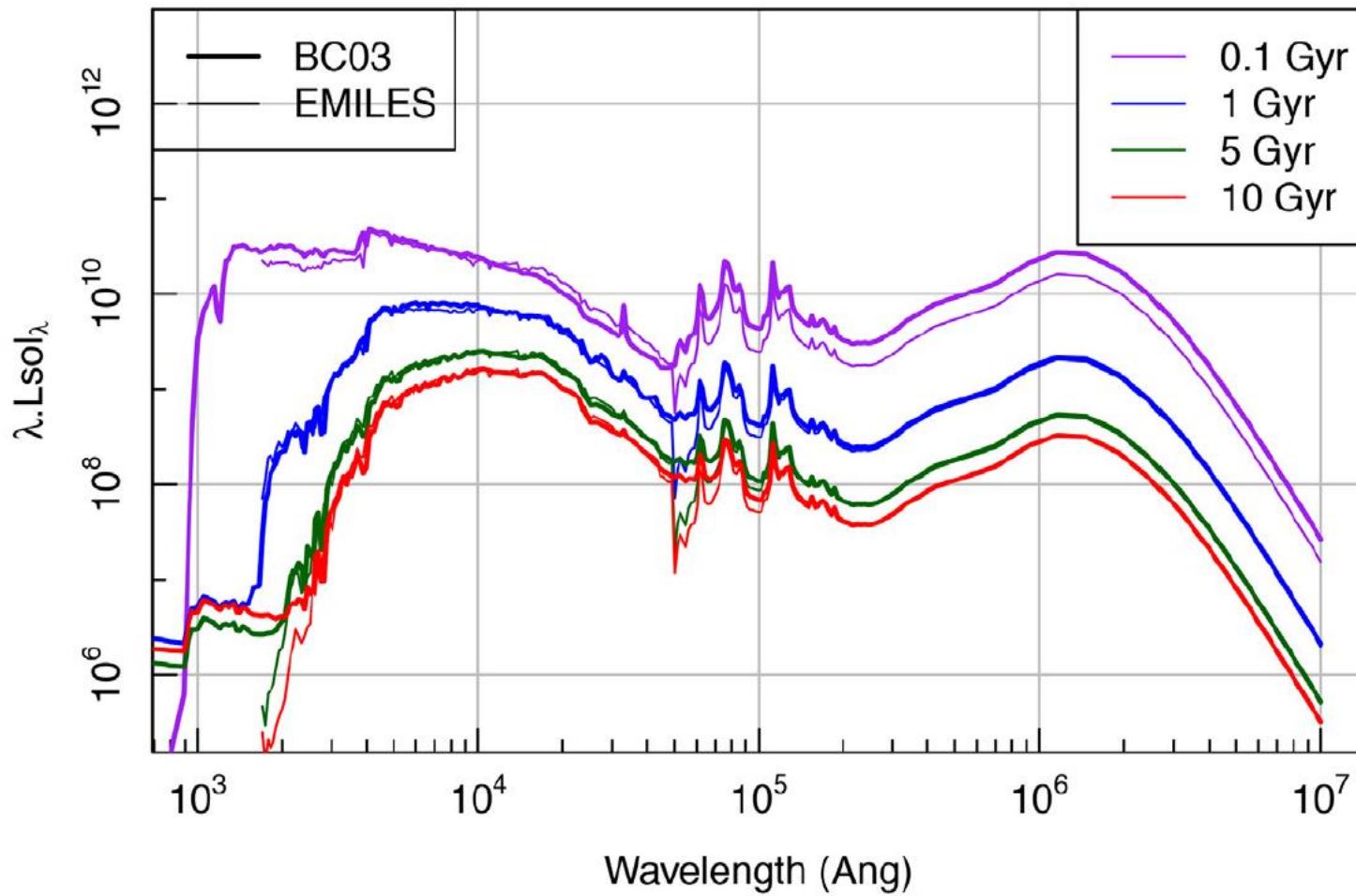
- Andrews (2018) 模板
  - 尘埃消光 (dust torus + ISM )
  - UV-FIR (不包括X-ray radio)



# Prospect：发射线

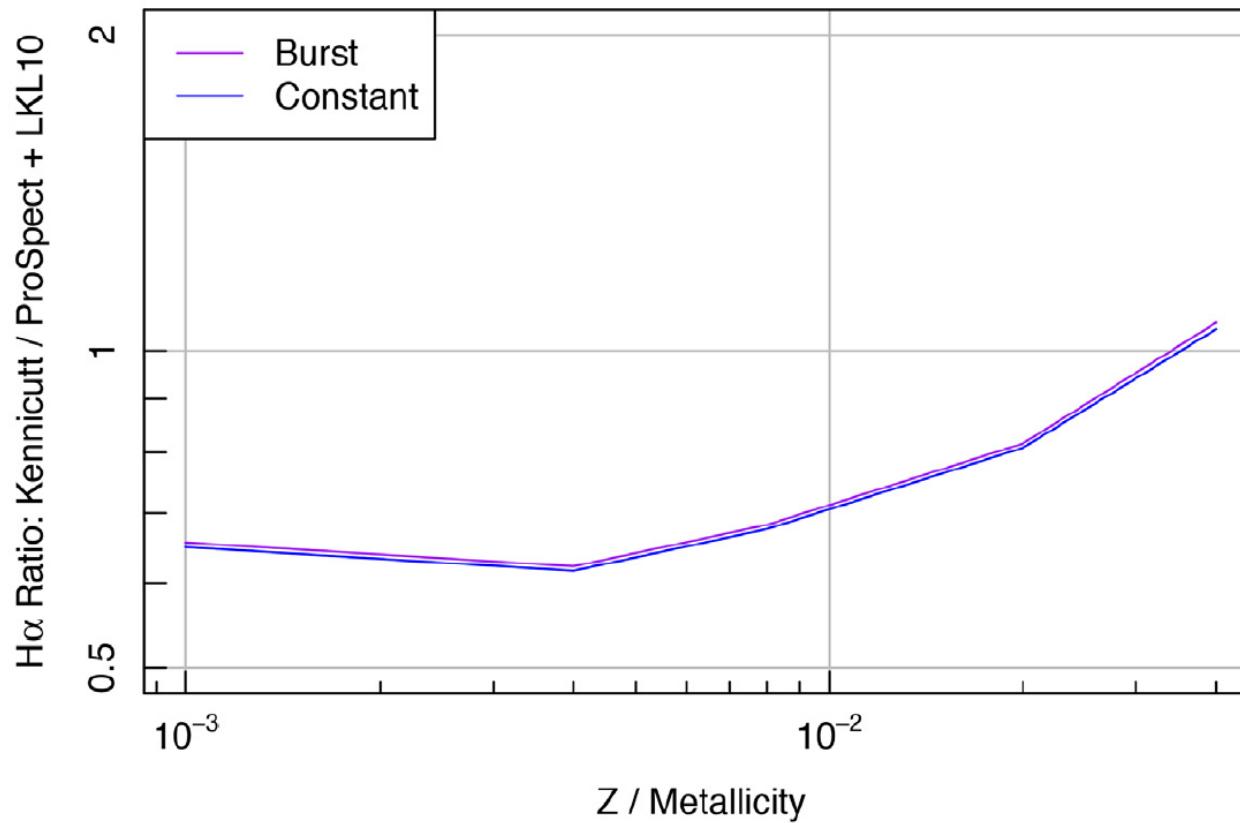
- 波长小于912Å的紫外光子被气体吸收，再有复合辐射
  - 多少比例被吸收（自由参数） escape fraction
- 能量平衡，气体辐射
  - 电子密度  $100 \text{ cm}^{-3}$
  - 电离连续谱形状： $q$ 
    - 金属丰度的函数，反比于金属丰度
  - Determined by Mapping-III as per the tables provided by Levesque Kewley & Larson (2010).

# 不同SSP的紫外光子



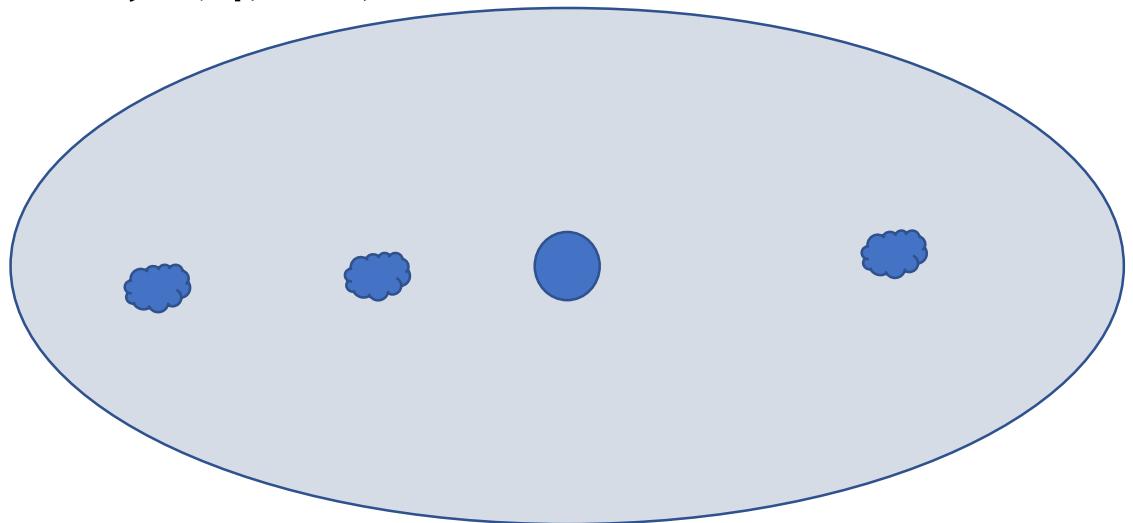
# 经验方法的发射线强度 (K98)

- K98: H $\alpha$ 的强度正比于小于10Myr的SF



# Prospect: 尘埃模块

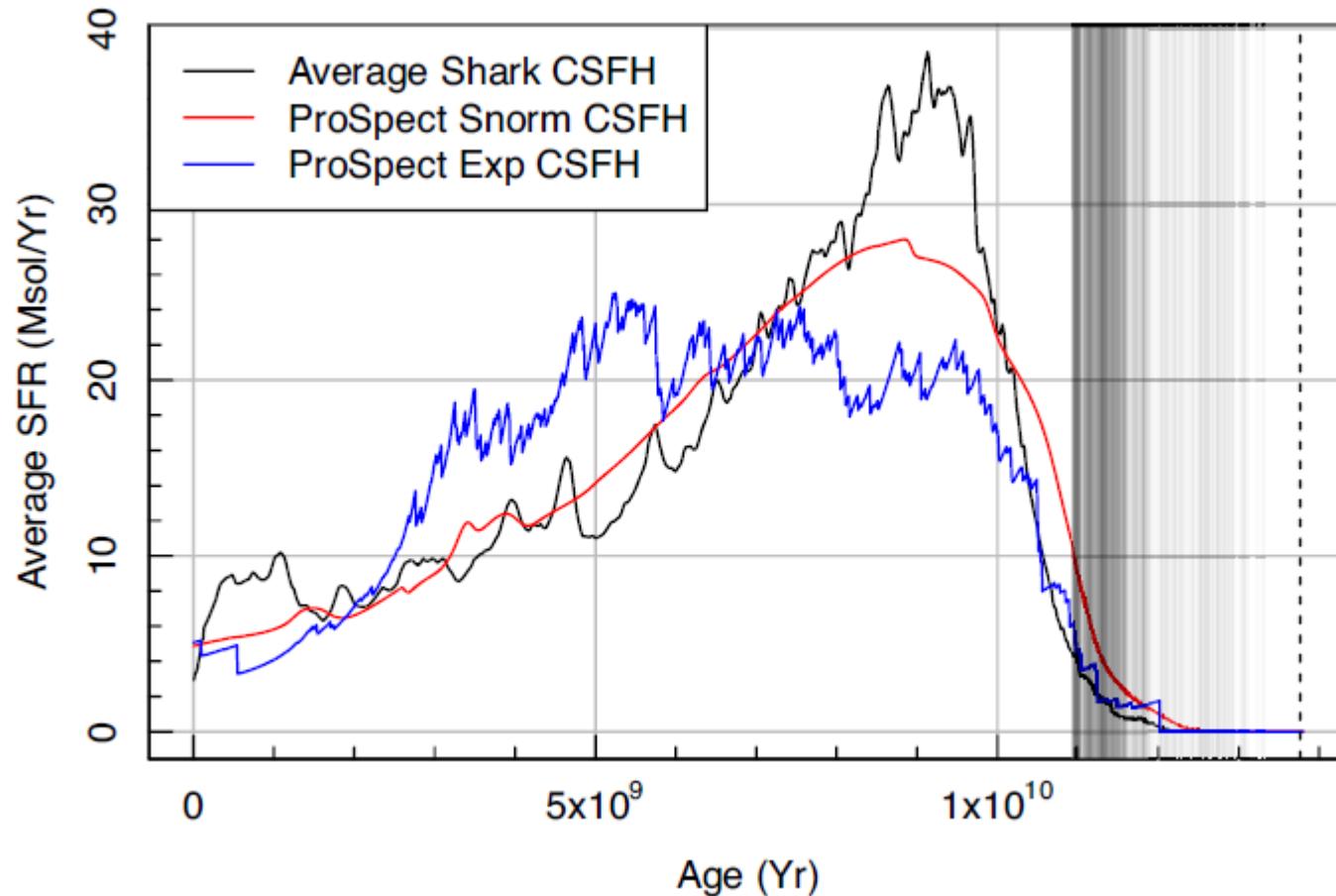
- 尘埃屏消光
  - 消光曲线  $\lambda^{-0.7}$
- 三组尘埃
  - ISM
  - Birth cloud
  - AGN torus
- 尘埃发射
  - 能量平衡
  - 谱形: Dale et al. (2014) library of FIR templates
    - a free parameter  $\alpha$  that specifies the power law of the radiation field heating the dust, where lower values of  $\alpha$  roughly correspond to hotter dust.



# Prospect能做什么

- 输出SED (simple and interactive)
- 可以和SAM无缝衔接
  - a binding interface (VIPERFISH) was built that allows for the rapid generation of photometry from the HDF5 outputs generated by SHARK, which works both on the individual snapshots and lightcones generated by STINGRAY

# 可以做SED fitting



# 从测光估算星系恒星质量

$$B_{\text{ab}} = B_{\text{ap}} - \mu - 5 \log_{10} h_{67.8} - 2.5 \log_{10}(1 + z),$$

$$\log_{10}(M/\text{M}\odot) = \alpha B_{\text{ab}} + \beta C + \gamma z + \delta \pm \sigma,$$

**Table 4.** Formula terms for SHARK-derived observed frame apparent magnitude photometry using two bands.

| <i>B</i>             | <i>C</i>                            | $\alpha$ | $\beta$ | $\gamma$ | $\delta$ | $\sigma$ | <i>z</i> max |
|----------------------|-------------------------------------|----------|---------|----------|----------|----------|--------------|
| <i>z</i>             | ( <i>g</i> – <i>z</i> )             | –0.459   | 0.310   | –1.093   | 0.234    | 0.269    | 1.5          |
| <i>Y</i>             | ( <i>g</i> – <i>Y</i> )             | –0.440   | 0.261   | –1.064   | 0.574    | 0.212    | 1.5          |
| <i>J</i>             | ( <i>g</i> – <i>J</i> )             | –0.423   | 0.194   | –1.007   | 0.899    | 0.194    | 1.5          |
| <i>H</i>             | ( <i>g</i> – <i>h</i> )             | –0.404   | 0.143   | –0.960   | 1.275    | 0.173    | 1.5          |
| <i>K<sub>s</sub></i> | ( <i>g</i> – <i>K<sub>s</sub></i> ) | –0.393   | 0.117   | –1.005   | 1.546    | 0.164    | 1.5          |
| <i>WI</i>            | ( <i>g</i> – <i>WI</i> )            | –0.393   | 0.093   | –1.454   | 1.976    | 0.175    | 1.5          |
| <i>W2</i>            | ( <i>g</i> – <i>W2</i> )            | –0.387   | 0.107   | –1.553   | 2.329    | 0.174    | 1.5          |
| <i>SI</i>            | ( <i>g</i> – <i>SI</i> )            | –0.395   | 0.093   | –1.500   | 1.993    | 0.173    | 1.5          |
| <i>S2</i>            | ( <i>g</i> – <i>S2</i> )            | –0.389   | 0.105   | –1.560   | 2.263    | 0.172    | 1.5          |

*Note:* *i* and (*g* – *i*) and *r* and (*g* – *r*) fits are presented in Tables 2 and 3, respectively (see equation 4).