

星族分析算法及星族模版库 的不确定性分析

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Outline

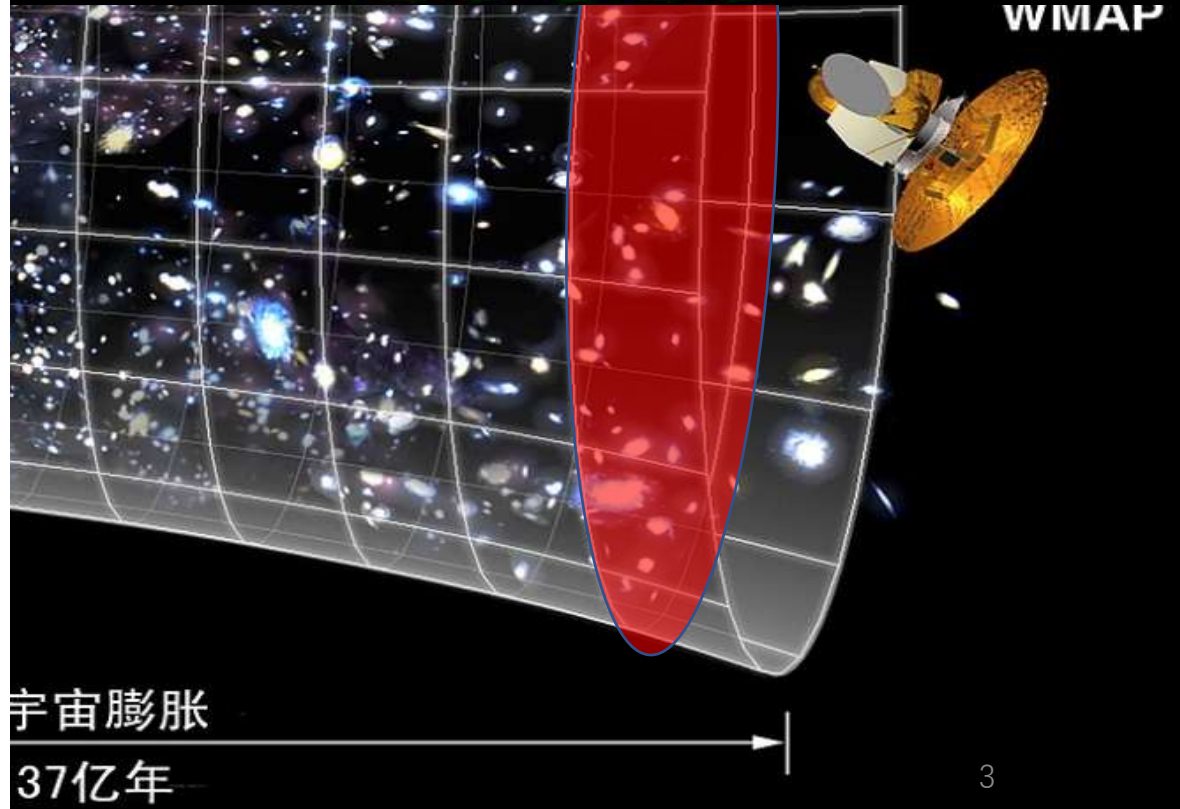
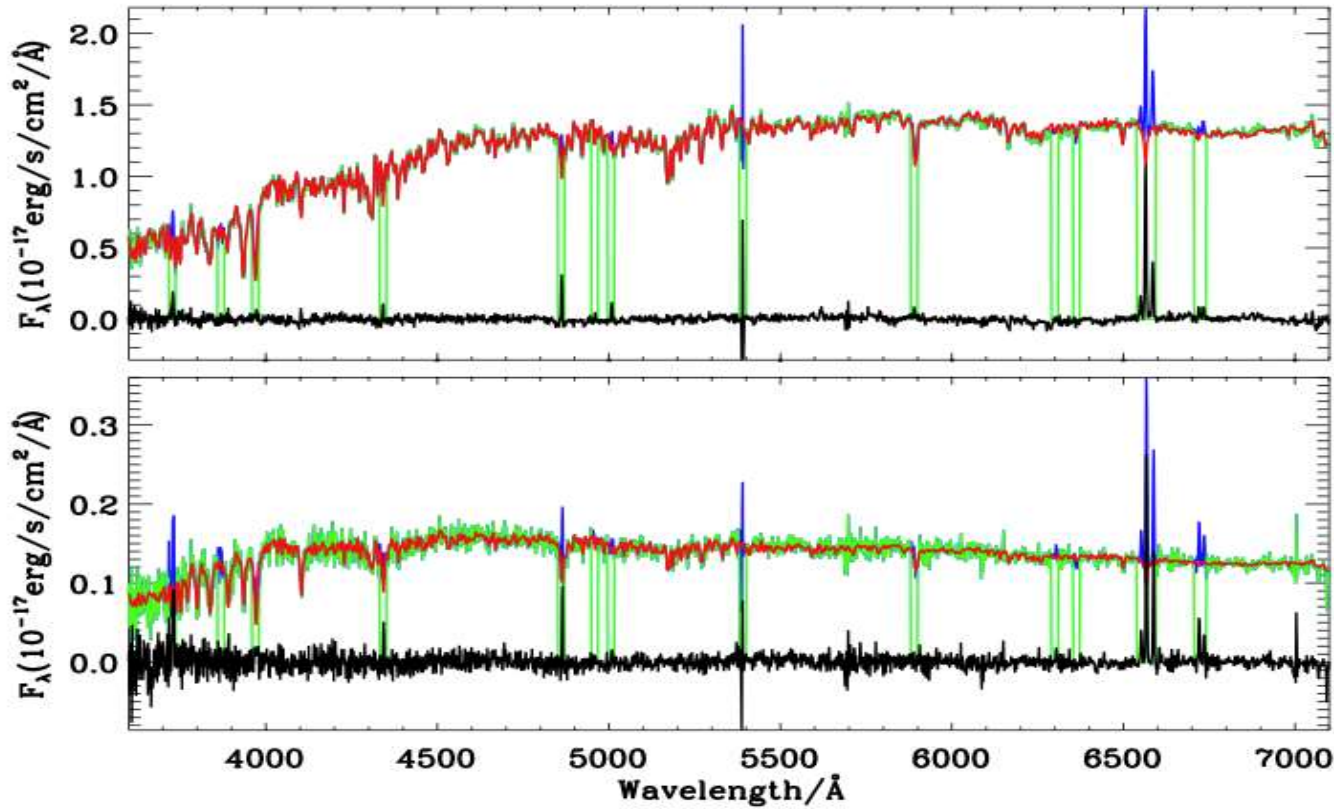
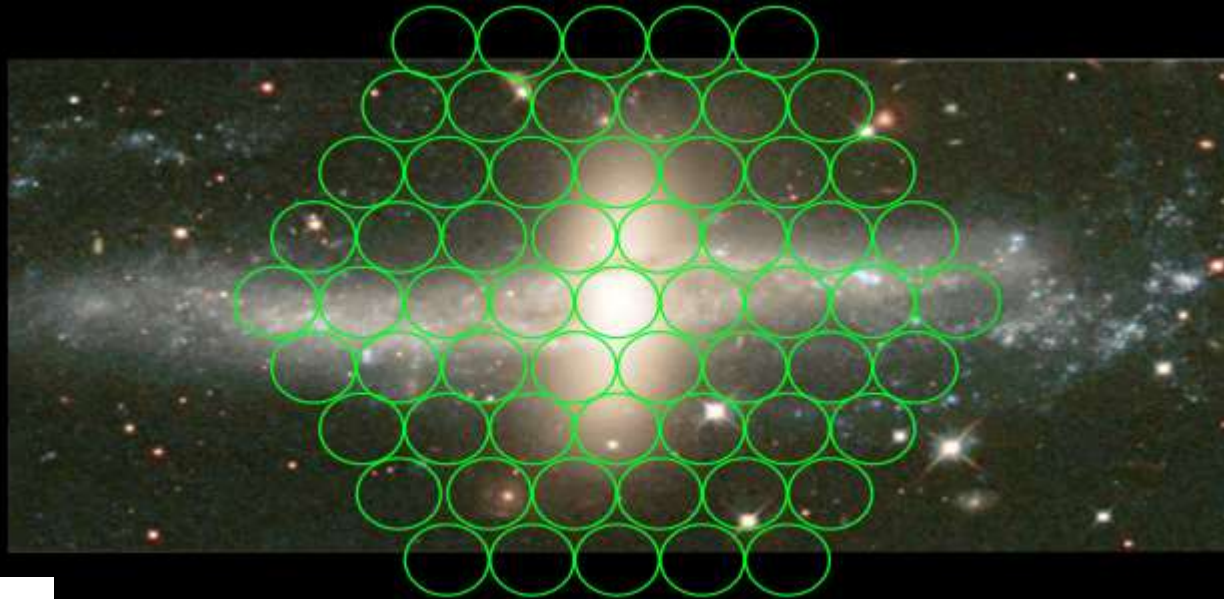
- **背景简介**
- **星族分析算法对比**
- **探索和近邻星系匹配的星族模版库**
- **光谱星族分析科学应用示例**
- **总结和展望**

大爆炸后约四十万年
量子涨落遗迹

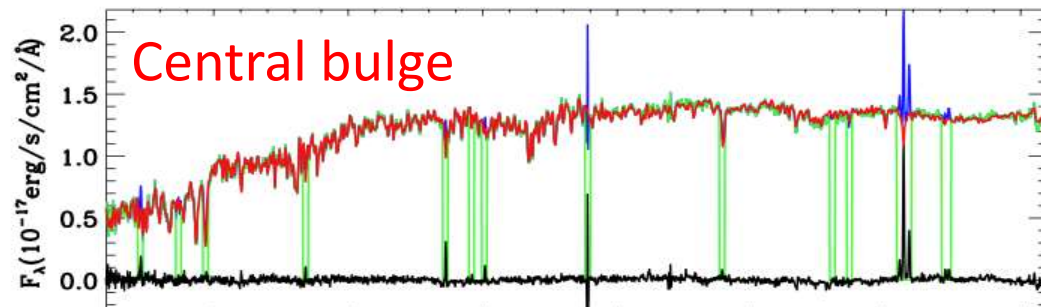
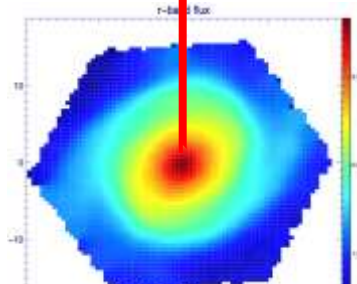
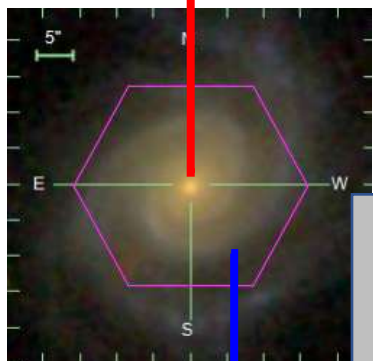
黑暗时期

暴涨

演化
天体



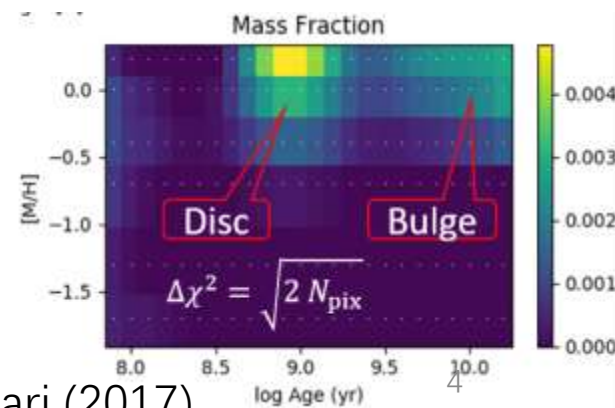
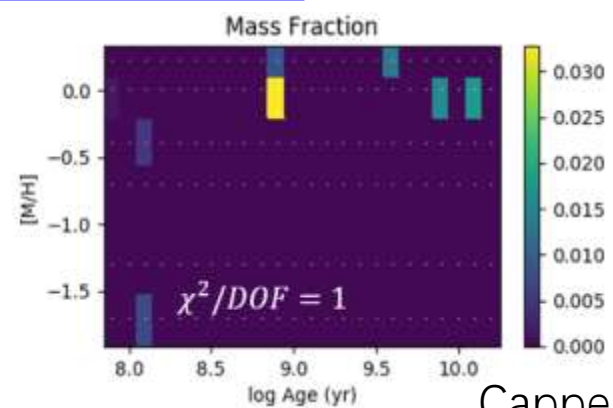
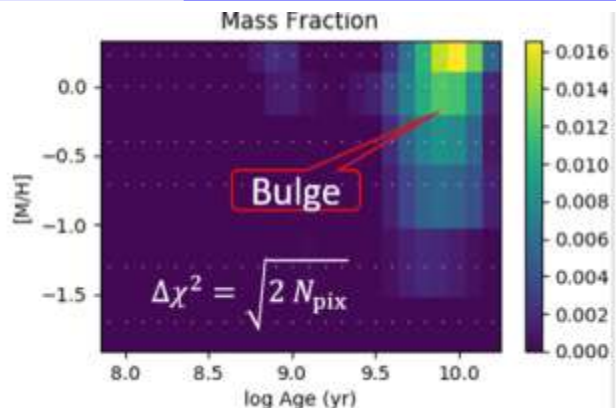
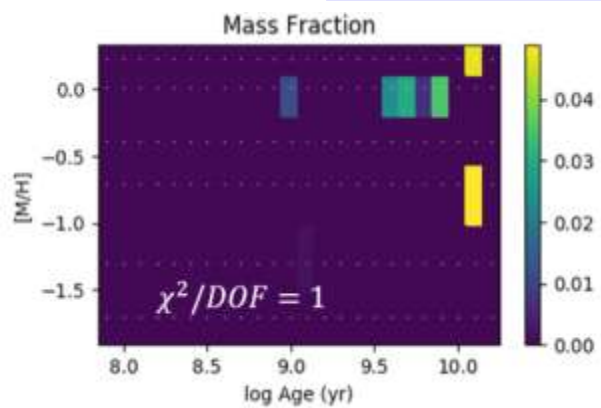
积分场光谱观测及光谱星族分析



Log(Age) = 9.72;
 [Z/H] = -0.20;
 E(B-V) = 0.06;
 M*/L_r = 3.72

Age) = 9.29;
 [Z/H] = -0.52;
 E(B-V) = 0.03;
 M*/L_r = 2.99

**IFU时代面临的最大问题：
 星族分析结果不确定性太高！！！！**



Cappellari (2017)

星系演化求真之路：解决星族分析不确定的问题

光谱星族分析的完成条件

- **星族分析拟合算法/软件**

- pPXF (惩罚最大似然法)
- STARLIGHT (MCMC)

- **星族模版库**

- 恒星演化模型 (Galaxev, Vazdekis, M11, FSPS, ...)
- 恒星初始质量函数 (Salpeter, Chabrier, ...)
- 恒星光谱库 (STELIB, MILES, ...)

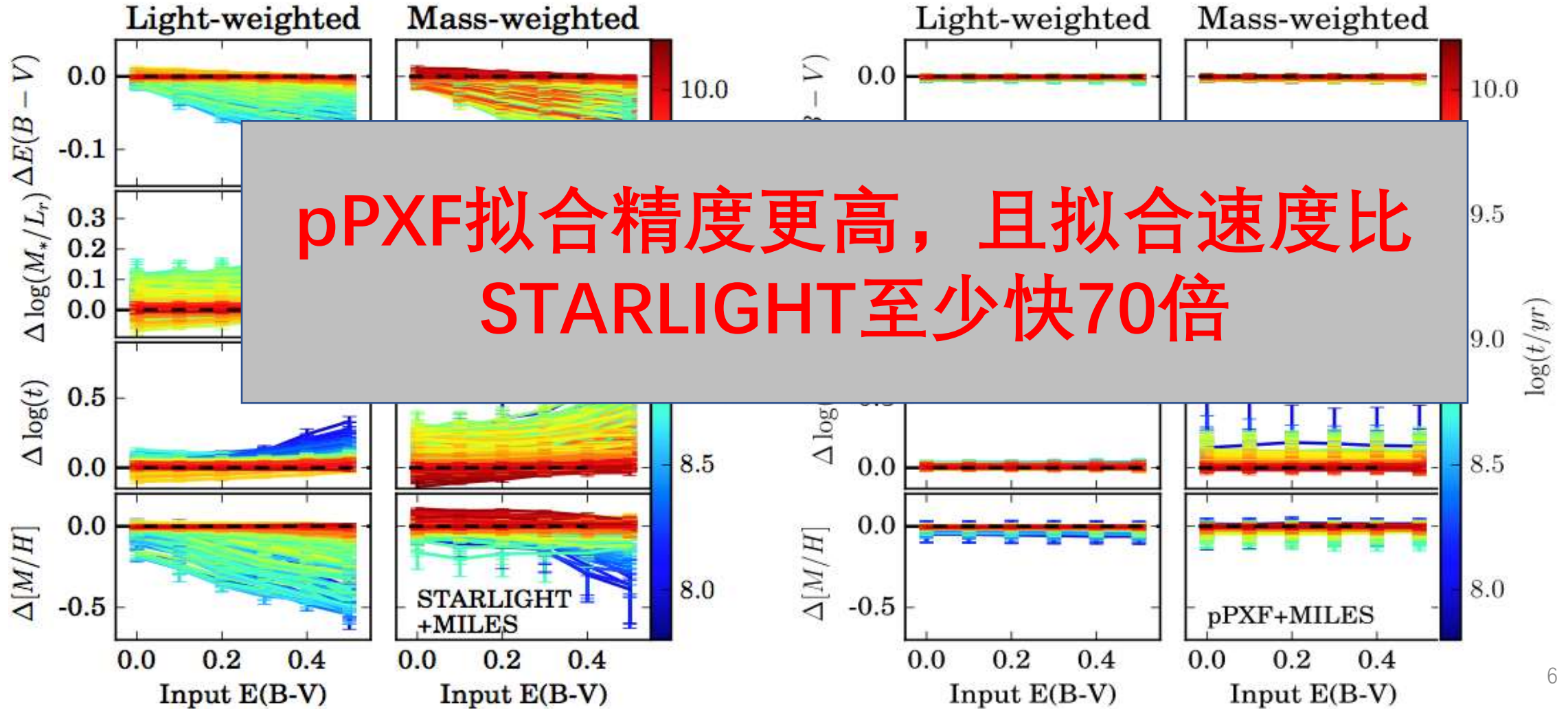
- **尘埃消光曲线 (CAL, CCM)**

星族分析算法检验

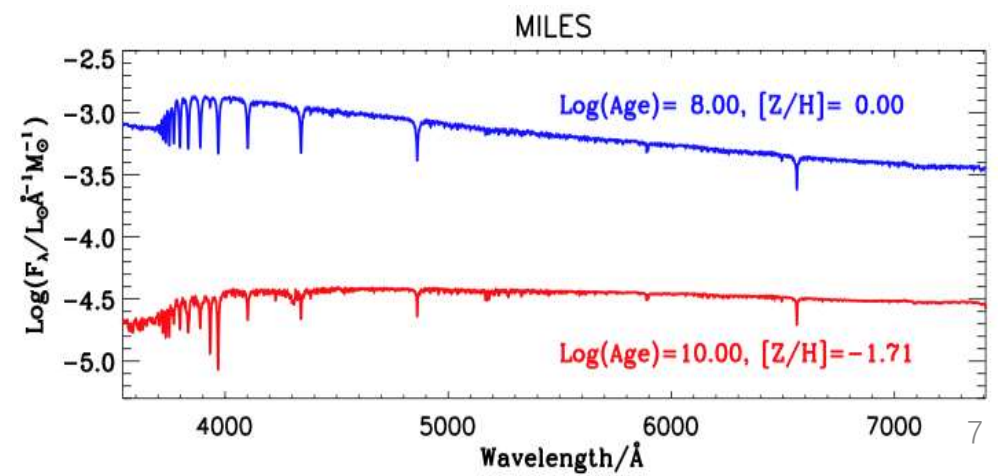
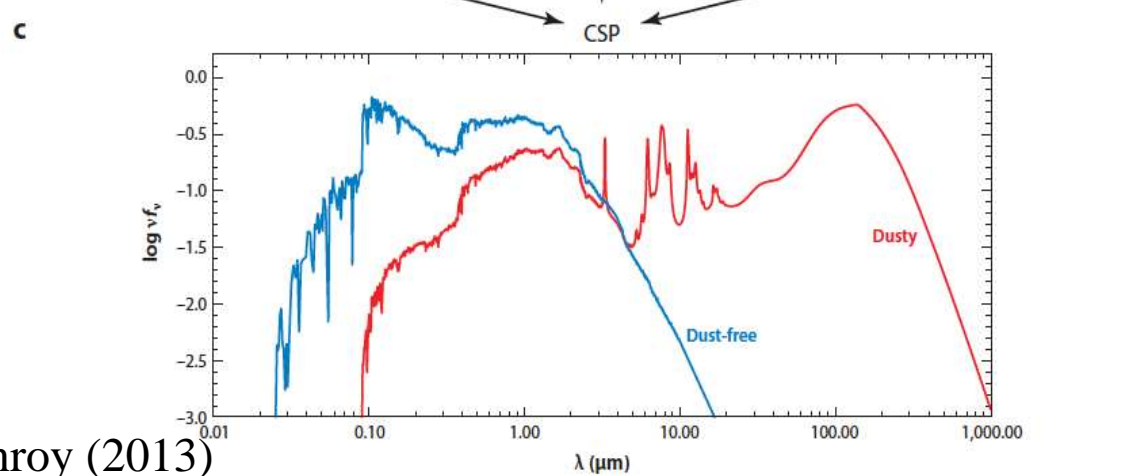
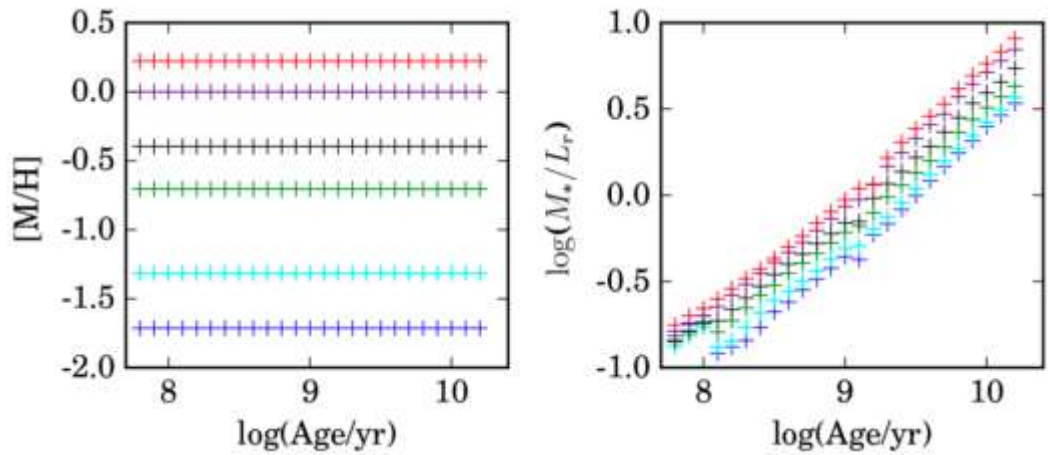
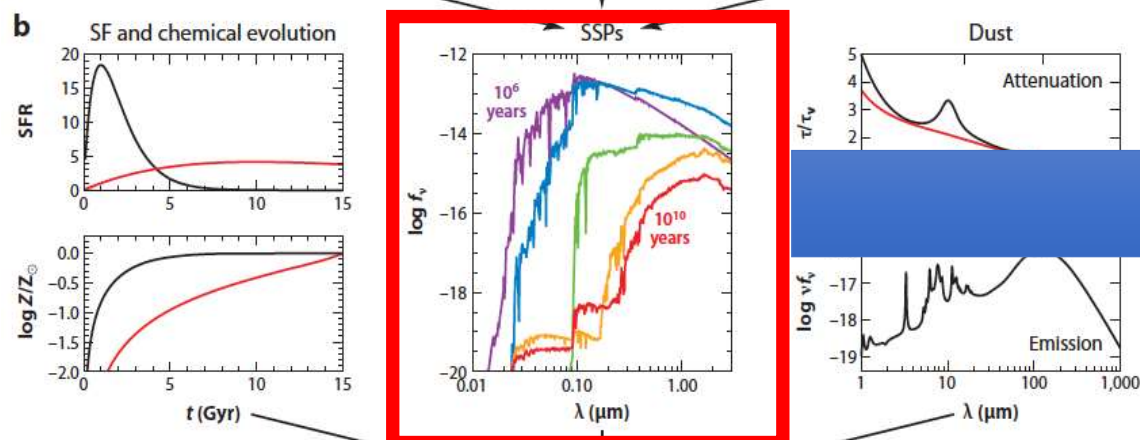
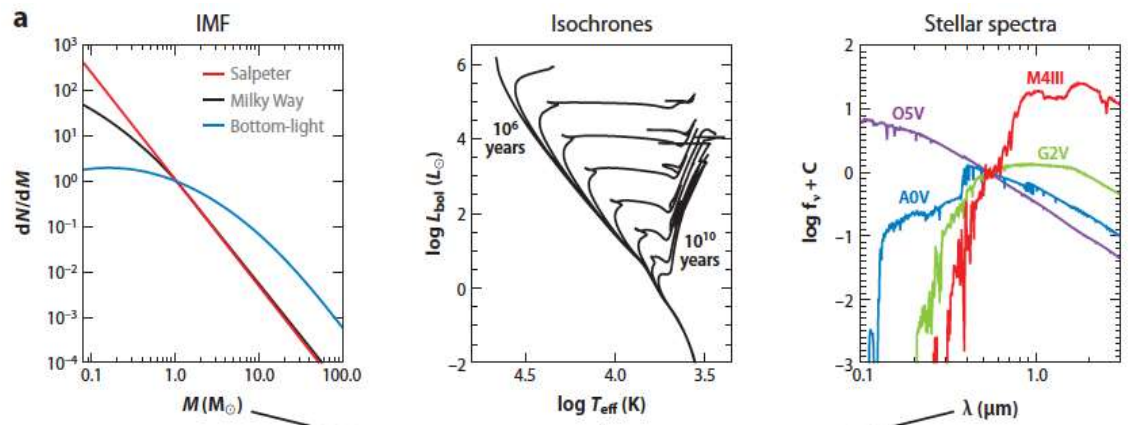
--Ge, Yan, Cappellari et al. 2018, MNRAS, 478, 2633

STARLIGHT(MCMC)

pPXF (惩罚最大似然法)



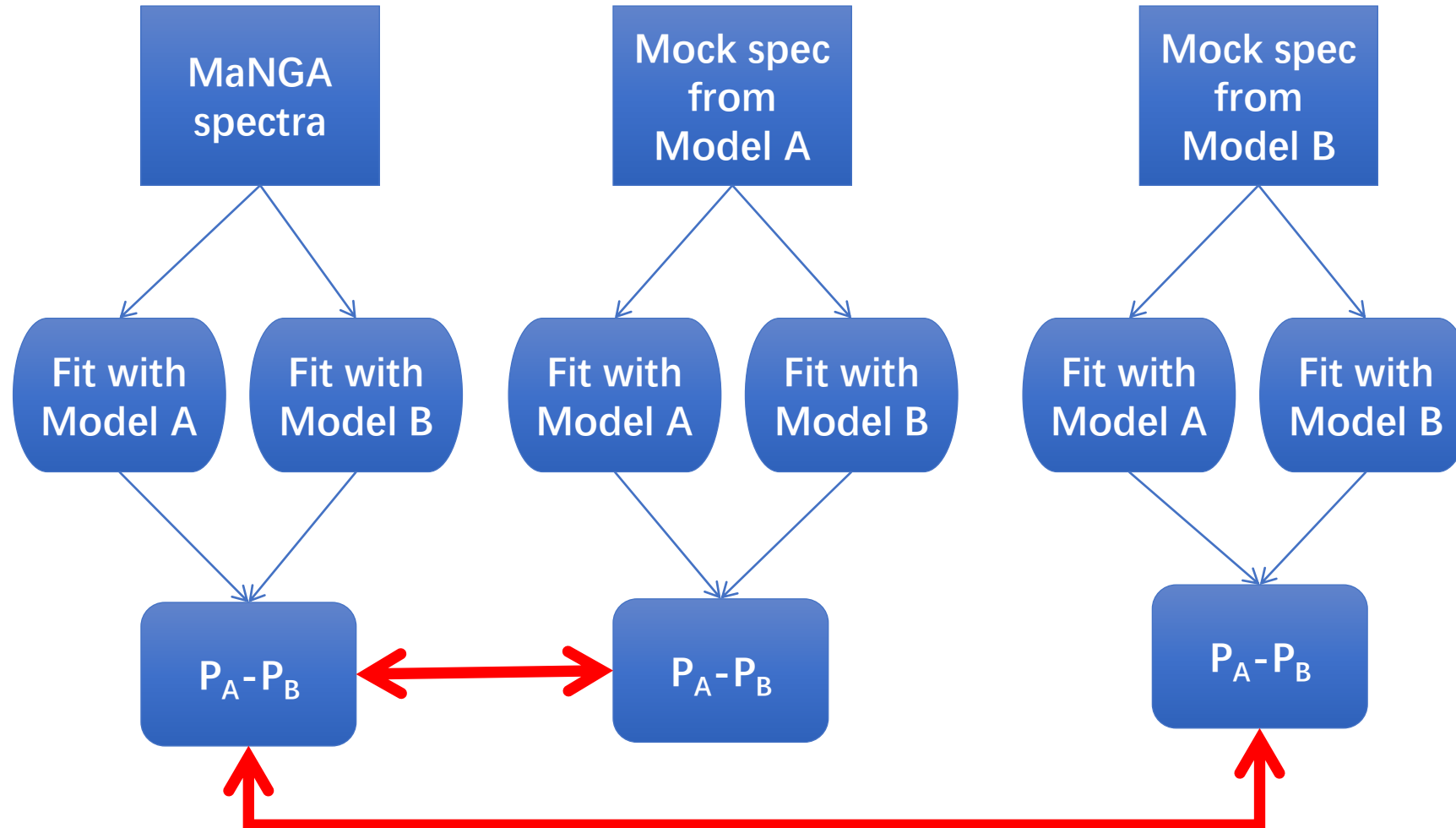
生成星族模版库的三要素



Conroy (2013)

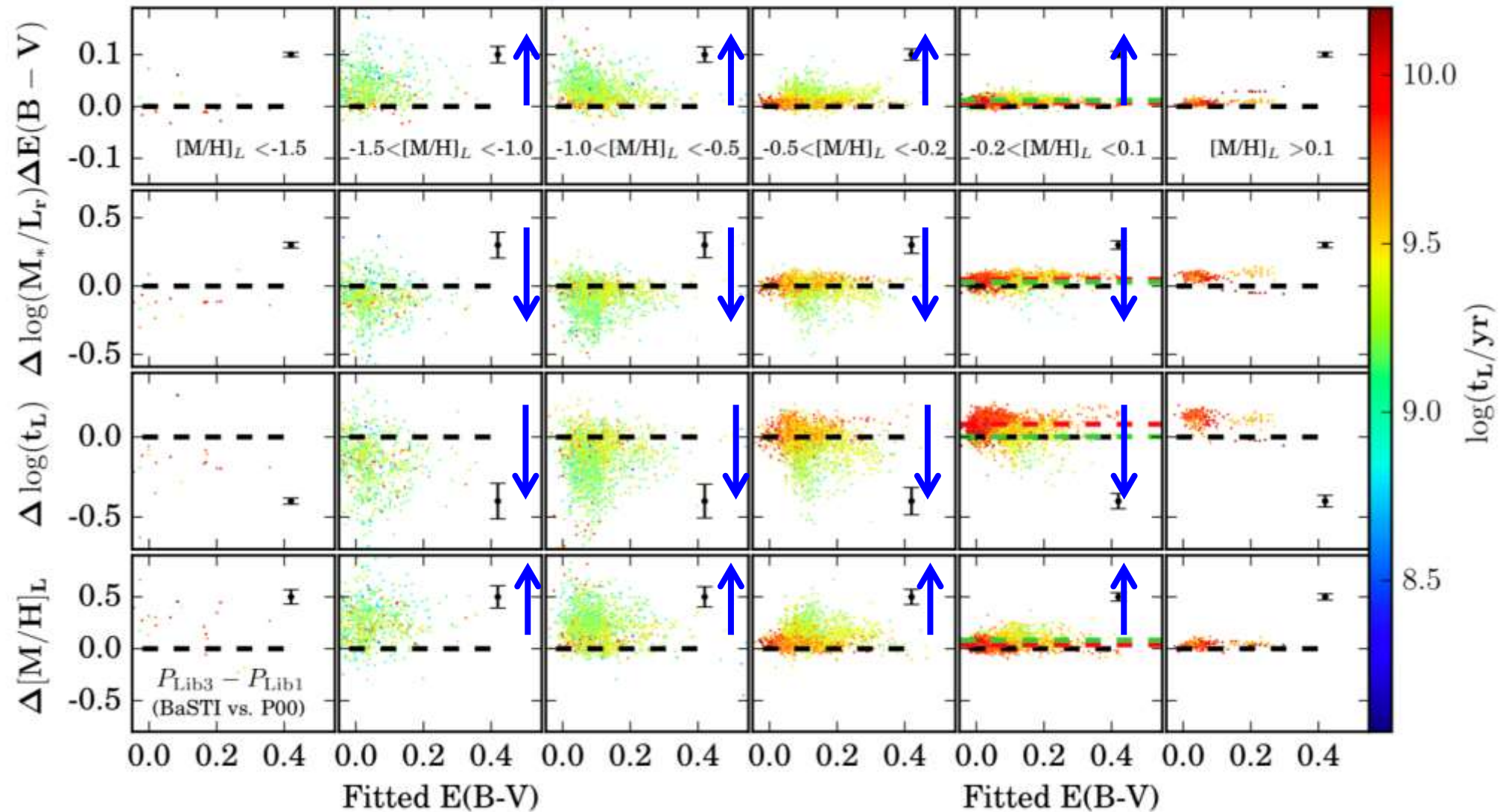
星族模版库检验思路

--Ge, Mao, Lu, Cappellari, Yan, 2019, MNRAS, 485, 1675

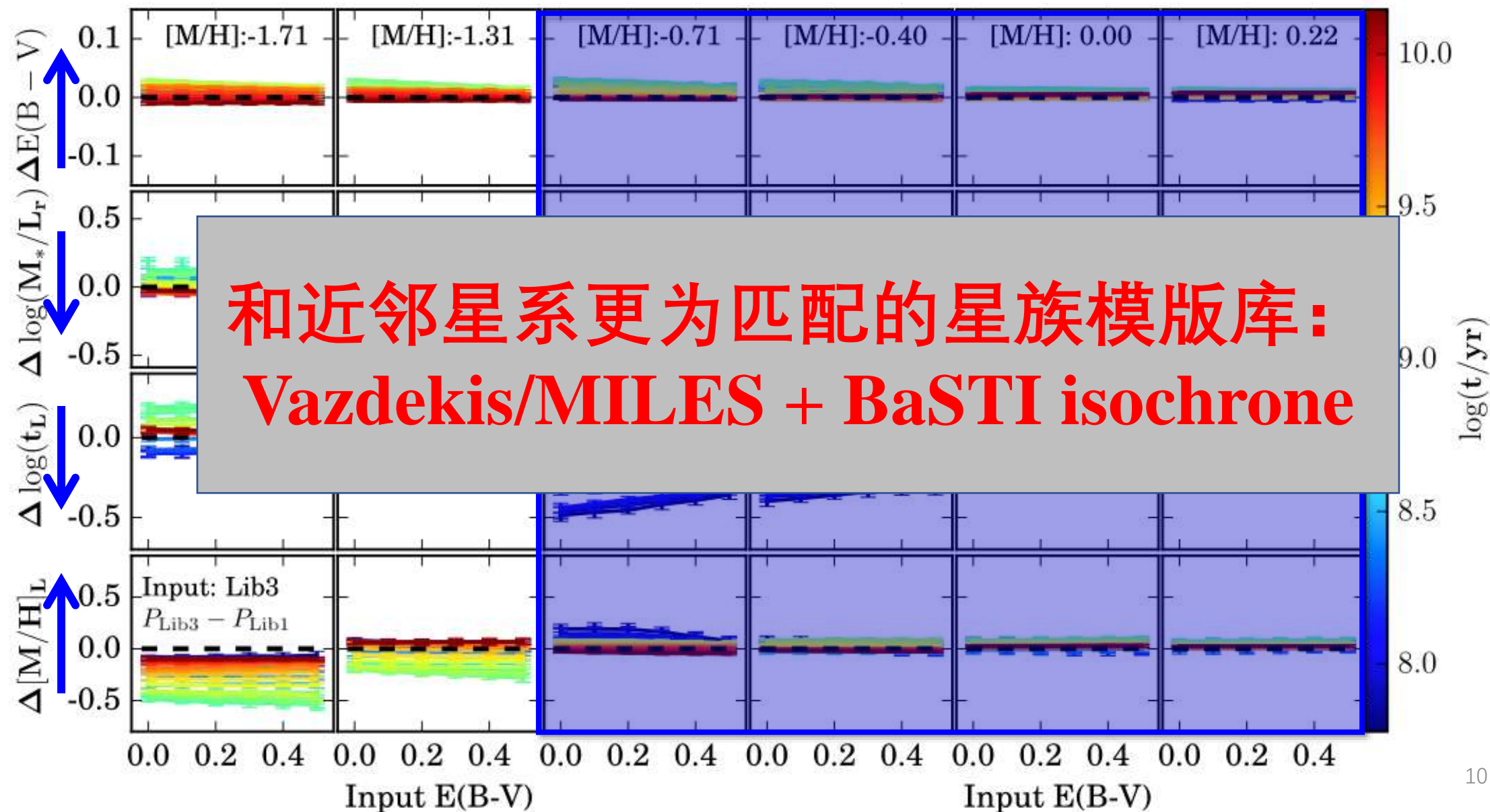


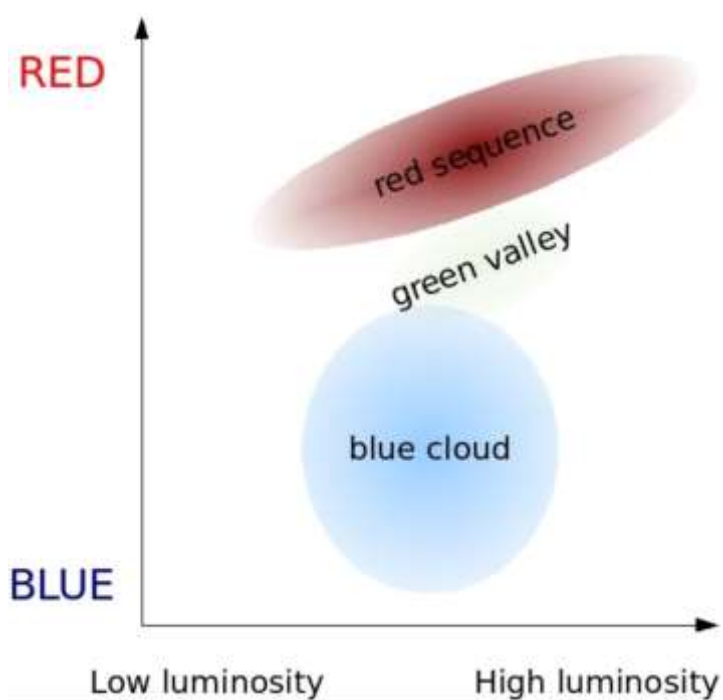
Padova2000 vs. BaSTI isochrones

$P_{\text{BaSTI}} - P_{\text{P00}}$ for MaNGA spectra



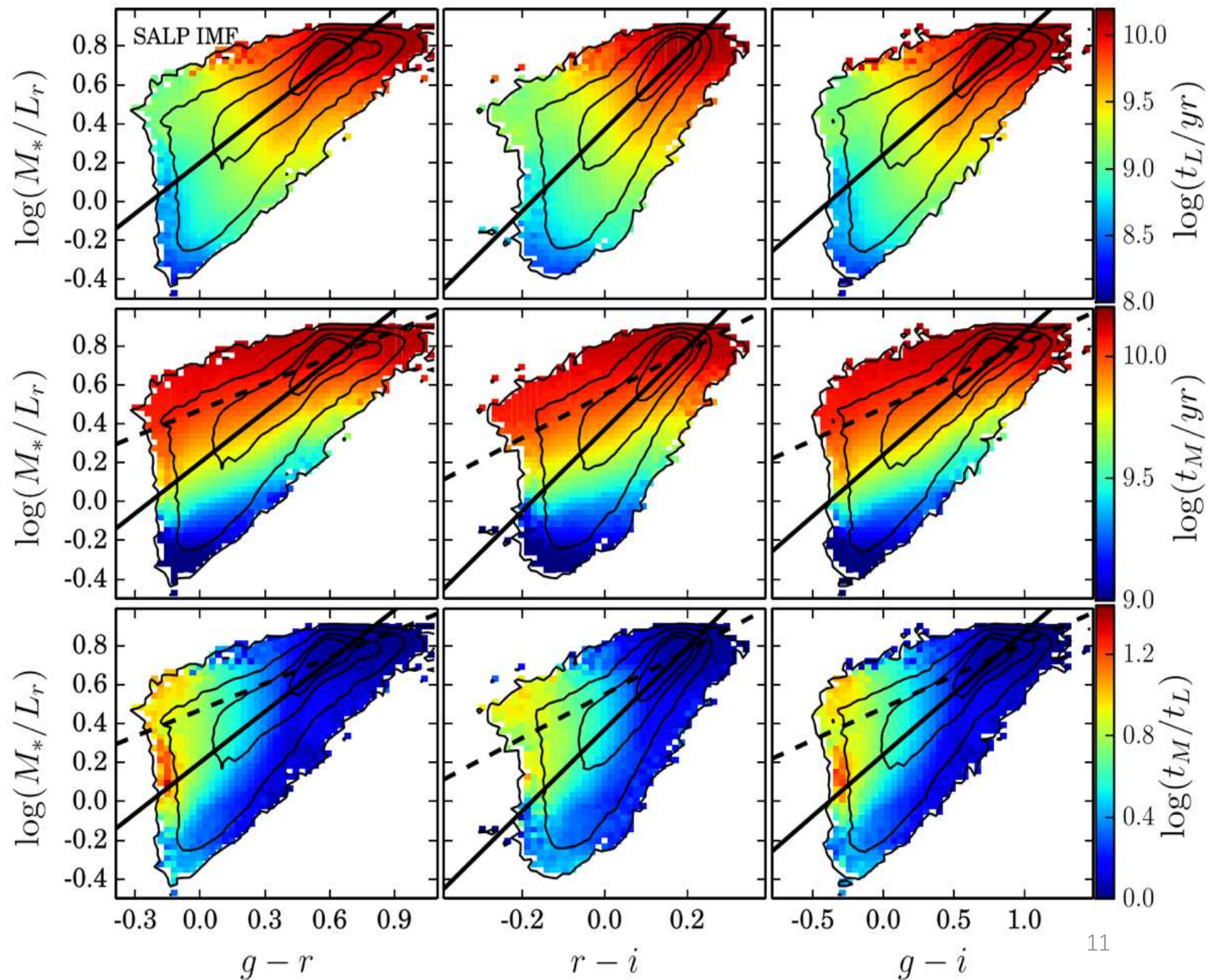
Lib3 (BaSTI) for generating mock spectra





当前研究的主要问题：
 基于IFU可得星系真实的
 M^*/L ，但是，
 星系动力学模型通常由光
 度转恒星质量， M^*/L —
 color关系使用需谨慎！

Ge, Mao, Lu et al. (2021)



总结

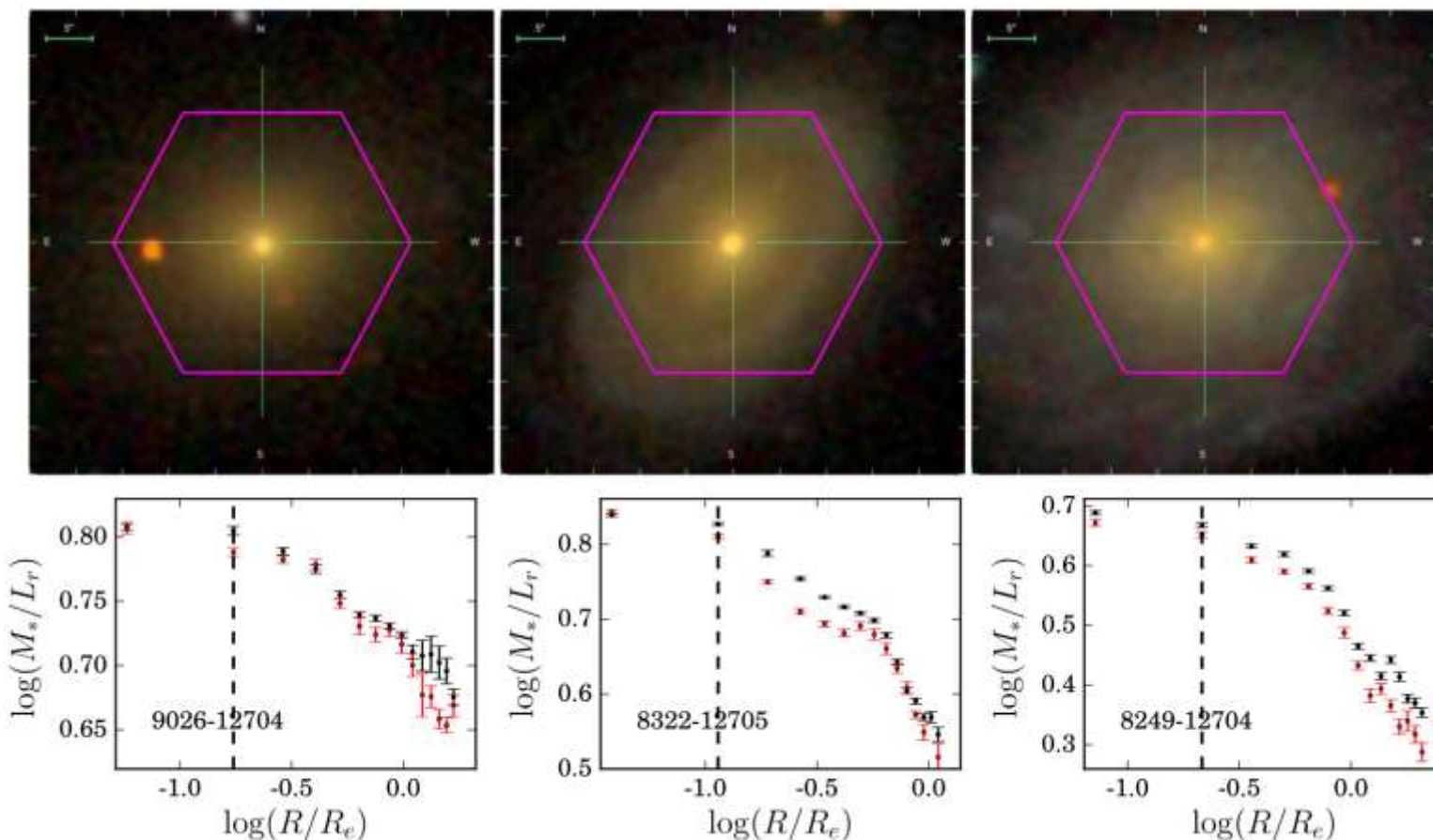
- 光谱星族分析是研究星系演化的重要手段，但拟合误差太大
- 因此我们分析得到更加高效且准确的星族分析算法
 - pPXF code in Python
- 和近邻星系演化更为匹配的星族模版库
 - Vazdekis/MILES SSP library
 - BaSTI isochrones
- 应用于近邻星系光谱分析发现：
 - 不同恒星形成历史的 M^*/L —color相关系数不一样
 - 我们可以通过 $\log(t_M/t_L)$ 作为指示器进行SFH差异区分

未来工作展望

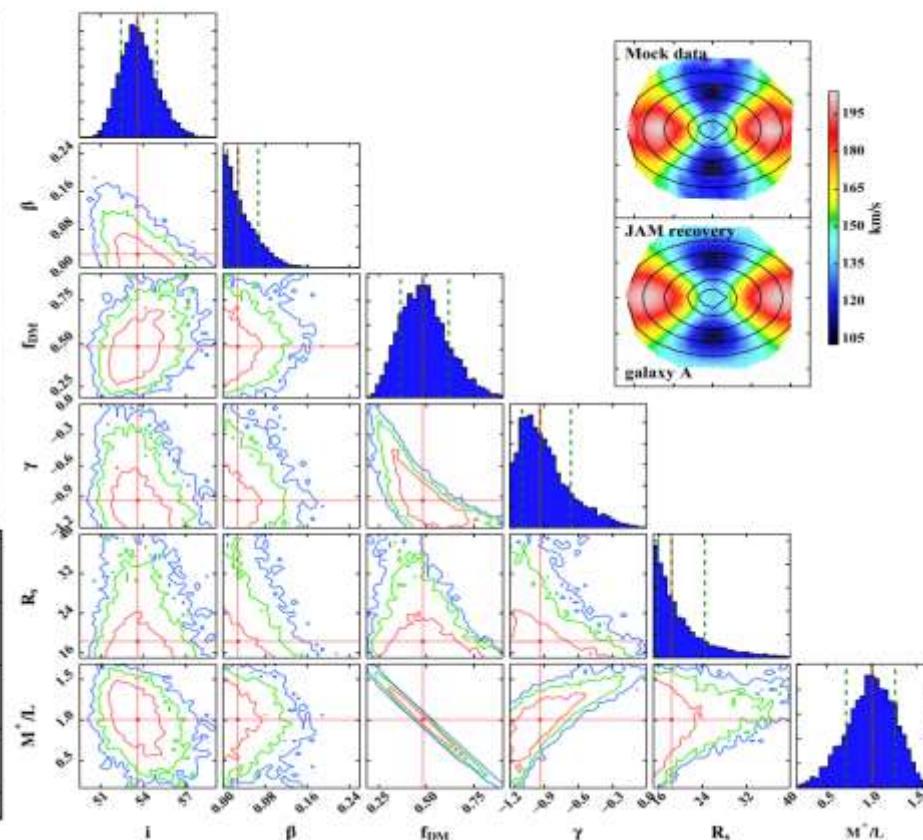
谢谢大家!

星系不同结构成分的恒星形成历史解析

星系动力学模型—降低恒星质量
测量和暗物质简并的影响



Ge, Mao, Lu et al. (2021)



Li et al. (2016)