Comparing the simple stellar population models and reaching consistence

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1. Abstract: **We compare six popular stellar population synthesis models, including BC03, CB07, Vazdekis/Miles, Maraston05, GALEV and GRASIL, by using them to analyze six good quality spectra of galaxies from SDSS. These 6 working spectra are combined ones: 4 of them are produced from the 849 emission-line galaxies (Chen et al. 2009: 419 star-forming galaxies, 326 composite galaxies, 35 Seyfert 2s and 69 LINERs), the 5th and 6th are from the 502 E+A galaxies (Goto et al. 2007) and 754 early-type galaxies (Hao et al. 2006), respectively.**

STARLIGHT code is used to do stellar population analyses. The resulted light fractions of young populations in these galaxies decrease from star-forming, composite, Seyfert 2, LINER to early-type galaxies, which could be an evolutionary sequence, and the E+A galaxies maybe lie between composite galaxies and Seyfert 2s. Among these 6 models, the resulted numerical values of light fractions of the SSPs in different age-bins change obviously, but the dominant populations are consistent.

2.Stellar population models

Table 1 Comparisons among 6 SSP models. Each column represents one model, and each line represents one parameter. References for each model are given in the end of this poster. IB means instantaneous-burst.

models	BC03	CB07	Vazdekis/Miles	Maraston05	GALEV	GRASIL
library	STELIB/BaSeL3.1	STELIB/?	Miles2006	BaSeL98	BaSeL2.0	Kurucz1992
resolution(Å)[a]	3	3	2.3	20	20	20
wavelength (Å)	91-1.6x10^6	91-3.6x10^8	3540-7410	91-1.6x10^6	91-1.6x10^6	91-1.2x10^7
N_λ	6900	6917	4300	1221	1221	1264
age(Gyr)(Number)	0-20(221)	0-20(221)	0.1-18(46)	10^{-6}-15(67)	4x10^{-3}-16(4000)	10^{-4}-20(55)
Z(Number)	0.0001-0.05(6)	0.0001-0.05(6)	0.0004-0.03(6)	0.0001-0.07(6)	0.0004-0.05(5)	0.0001-0.1(7)
IMF	Salpeter	Chabrier	Salpeter	Salpeter	Salpeter	Salpeter
track	Padova94	Padova94+Marigo07	Padova00	Cassisi+Padova00	Padova99+TP-AGB	Padova94
SFR	IB	IB	IB	IB	IB	

3. Sample selection

3.1 emission-line galaxies (from Chen et al. 2009):

- **4 classes: star-forming, composite galaxies, Seyfert 2s, LINERs; also see poster No.553 by Chen et al.**

3.2 E+A galaxies (from Goto et al. 2007):

- **base on SDSS DR5 galaxy sample;**
- **Hδ equivalent width (EW) >4Å , [OII] EW >-2.5Å, Hα EW >-3.0Å ;**

3.3 early-type galaxies (from Hao et al. 2006):

- **base on SDSS DR4 photometric catalogue;**
- **morphology of E/S0;**
- **no contamination from companion galaxies or bright stars;**

5. Conclusions:

- **among 6 different SSP models, the numerical values of light fractions of SSPs at different ages change obviously, but the dominant populations are consistent.**
- **there is a possible evolutionary sequence: from star-forming, composite, Seyfert 2, LINER to early-type galaxies; E+A galaxies may lie between composite galaxies and Seyfert 2s.**

6. References

Anders et al. 2003, A&A, 401, 1063 (GALEV); Asari et al. 2007, MN, 381, 263; Baldwin et al. 1981, PASP, 93, 5: Bruzual & Charlot, 2003, MN, 344, 1000 (BC03); Charlot & Bruzual 2007, in preparation (CB07); Chen et al. 2009, 495, 457; Cid Fernandes et al. 2005, MN, 358, 363 Goto, T. 2007, MN, 381, 187; Hao et al. 2006, MN, 370, 1339; Maraston, C. 1998, MN, 300, 872 (Ma05); Silva et al. 1998, ApJ, 509, 103 (GRASIL); Vazdekis et al. 2003, MN, 340, 1317 (Vazdekis/Miles).

4. Spectral synthesis results

4.1 method:

- **code: STARLIGHT** (Asari et al. 2007; Cid Fernandes et al. 2005).
- **IMF (initial mass function): Salpeter** (except for CB07).
- **bases: 9 SSPs** (9 ages: 0.1~13 Gyr; metallicity: $Z_\odot$) in each of the 6 SSP models are adopted to match their ages.

4.2 results:

1)among different SSP models:

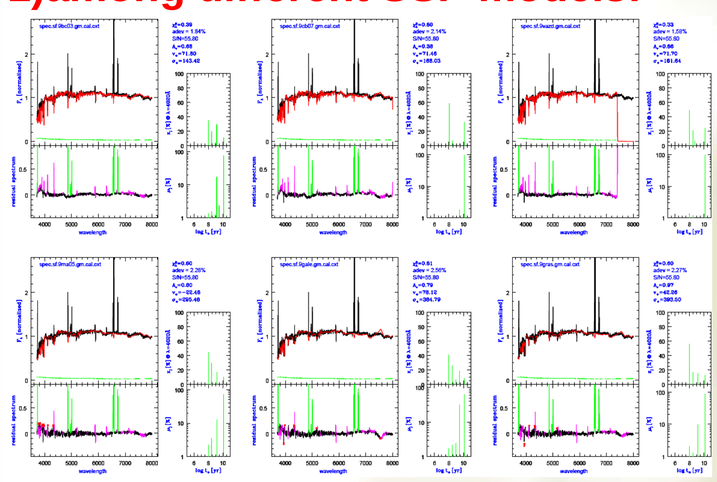

Fig. 1 The spectral analysis results on star-forming galaxies by using 6 SSP models: BC03 (top-left), CB07 (top-middle), Miles (top- right), Ma05(bottom-left), GALEV(bottom-middle), GRASIL(bottom-right). 4 panels: top-left: comparison of synthesis spectra (red) with observed spectra (black); bottom-left: residual spectra (black) and mask regions (color); top-right: fraction of light associated to each age of SSP; bottom-right: fraction of mass as function of each age of SSP (log-scale).

		BC03	CB07	Vazdekis/Miles	Ma05	GALEV	GRASIL
star-forming	Y	34.8	58.6	49.04	44.32	40.84	55.53
	I	52.88	6.39	26.82	45.89	32.68	31.8
	O	12.31	35.01	24.14	9.8	26.49	12.68

Table 2 Stellar populations in each age-bin from 6 SSP models. The numerical values change obviously among different models, but the dominant populations are consistent (young: <0.2Gyr; old: >2Gyr; intermediate: between them).

2) among different galaxy types:

Fig.2 & Table 3 Stellar populations in each age-bin for 6 galaxy types. There is a possible evolutionary sequence: from star-forming, composite, E+A, Seyfert 2, LINER to early-type galaxies.

	star-forming			composite			Seyfert 2				LINER				E+A			early type		
BC03	Y	I	O	Y	I	O	Y	I	O	PL	Y	I	O	PL	Y	I	O	Y	I	O
	34.8	52.88	12.31	23.45	52.3	24.24	2.85	48.07	22.34	26.74	0.	39.66	47.31	13.03	11.3	74.57	14.13	0.	13.65	86.34