Redistribution of Stars and Gas in the Star Formation Deserts of Barred Galaxy

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ABSTRACT

Bars strongly influence the distribution of gas and stars within the central regions of their host galaxies. This is particularly pronounced in the star formation desert (SFD) which is defined as two symmetrical regions either side of the bar that show a deficit in young stars. Previous studies proposed that, if star formation is truncated because of the influence of the bar, then the age distribution of stars within the SFD could be used to determine the epoch of bar formation. To test this, we study the properties of SFDs in 6 galaxies from zoom-in cosmological re-simulations. Age maps reveal old regions on both sides of the bars, with a lack of stars younger than 10 Myr, confirming the SFD phenomenon. Local star formation is truncated in the SFDs because after the bar forms, gas in these regions is removed on 1 Gyr timescales. However, the overall age distribution of stars in the SFD does not show a sharp truncation after bar formation but rather a gradual downturn in comparison to that of the bar. This more subtle signature may still give information on bar formation epochs in observed galaxies, but the interpretation will be more difficult than originally hoped. The gradual drop in the SFD age distribution, instead of a truncation, is due to radial migration of stars born in the disk. The SFD is thus one of the only regions where an uncontaminated sample of stars only affected by radial migration can be studied.

- 82以外はbar形成と同時にSFDがdrop
- 下段：bar形成により負から正へ→SFDでの星形成が抑圧される
- SFDはgradualな変化

Fig. 3

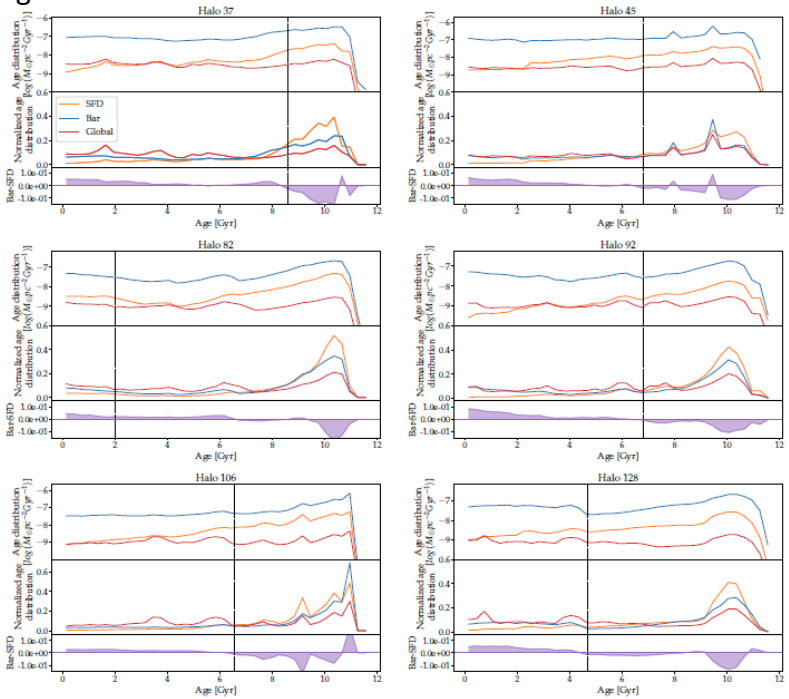
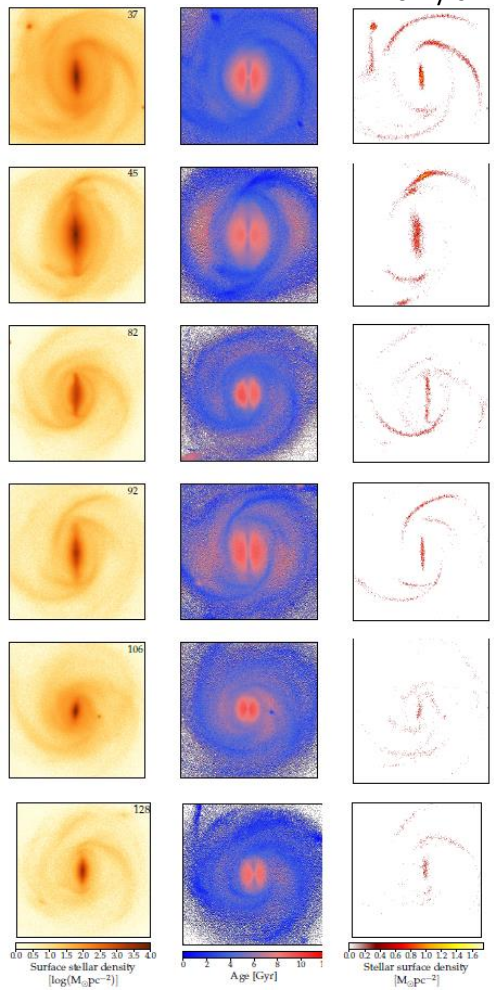
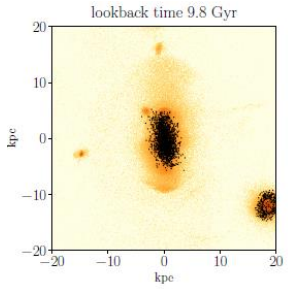


Fig. 1



- 6つの銀河について、z=5から再シミュレーション
- Star Formation Desert(SFD)がbarの両側に出現
- BarはSFDより若く、diskやringよりも古い
- 星形成はbar、spiral armで活発



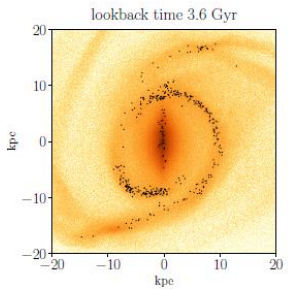
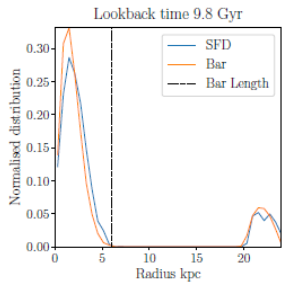


Fig. 5



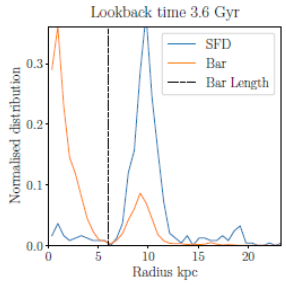


Fig. 6

- 図5：z=0でのSFD内にある星の生成位置
  - Bar形成前は銀河全体
  - Bar形成後はinner ringとspiral armで形成
- 図6：生成位置のradial profile
  - SFDはinner ring以外の若い星で補填

- SFD内の星をtrack
  - Bar, ring → arm → ring内 → bar端 → SFD
- Radial migrationの存在
- Barができるとガスを除去する
- Gradualな変化から、若い星をSFD外から補填していると推測