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The evolution of star formation rate and dust extinction in disk galaxies at high *z*

Kabanov[1] A.A., Tutukov[1] A.V., Shustov[1] B.M.

[1] Institute of astronomy of RAS

Abstract

We use multizone model for studying the evolution of star formation rate (SFR) and dust extinction in disk galaxies. Evolution of disk galaxies was studied taking into account the «mass-radius» relation. The model history of SFR and extinction is close to observed one.

Introduction

Recent observations of distant galaxies (up to z=7-8) provide good opportunities for investigation of early evolution of galaxies. The SFR history is the most important galaxy parameter, because star formation is the main galactic driver. We use simple multizone model of disk galaxy evolution for investigation of SFR and dust extinction evolution.

The main features of the model are described in [1], [3].

«Mass-radius» relation

«Mass-radius» relation, i.e. α in commonly used form $M = K \times R^{\alpha}$ for disk galaxies is not well defined (see Fig.1). Influence of «mass-radius» relation on the evolution of disk galaxies is illustrated in Fig.2. We found that α = 2.5 is the best-fit parameter for most of the galaxies (see [3]), so results presented below were obtained for α = 2.5.

In [3] we argue that «mass-radius» relation and SFR is defined by the initial «mass-angular momentum» relation. A galaxy with higher angular momentum has the bigger radius, and smaller thickness.

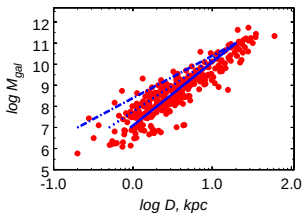

Fig.1«Mass-radius» relation for disk galaxies. Solid line corresponds to α=3.0, dashed line - α=2.5 and dashed-dot line - α=2.0.

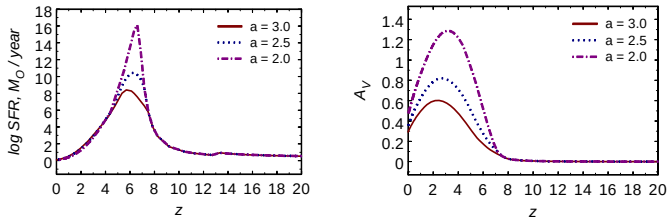

Fig.2 SFR and extinction history for various α. Solid line corresponds to α=3.0, dashed line - α=2.5 and dashed-dot line - α=2.0.

Results

SFR History

We studed SFR history in galaxies of various masses. In Fig.3 we present obtained results for SFR history:

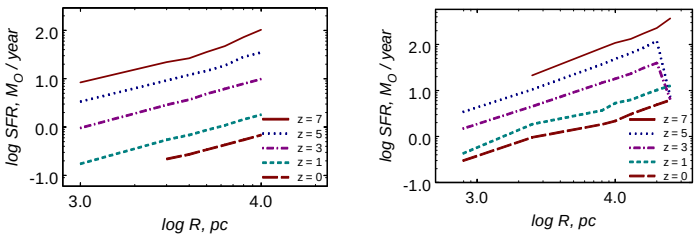

Fig.3 Radial distributions of SFR history for galaxies of $10^{11}M_{\odot}$ (left) and $10^{12}M_{\odot}$ (right) at various *z*.

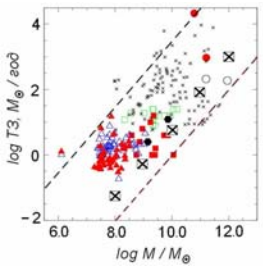

Fig.4 SFR vs. galaxy mass diagram. Our model result are presented by big crosses overimposed on observations, which are taken from paper [2].

Extinction

We investigate dust extinction in galaxies in z-direction. We assume that half of mass of heavy elements produced by stars is concentrated in the dust component.

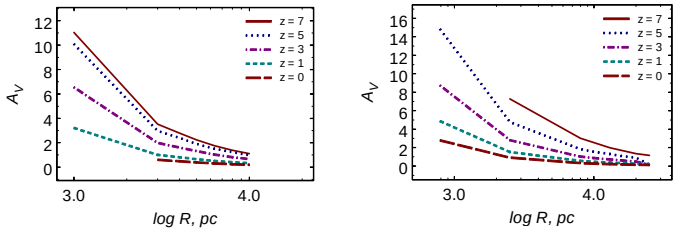

Fig.5 Radial distributions of dust extinction for galaxies of $10^{11}M_{\odot}$ (left) and $10^{12}M_{\odot}$ (right) at various *z*.

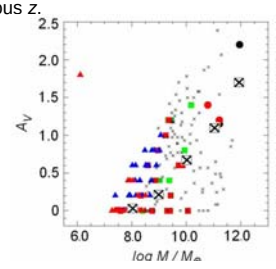

Fig.4 A_V vs. galaxy mass diagram. Our model result are presented by big crosses overimposed on observations, which are taken from paper [2].

Conclusions

1) Galaxy evolution depends on the form of «mass-radius» relation though this dependence is not very strong.

2) Our model reasonably well describes the history of star formation rate and extinction in disk galaxies.

References

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E-mail for any questions: artkabanov@inasan.ru