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A Precise Benchmark for Cluster Scaling Relations: Fundamental Plane, Mass Plane and IMF in the Coma Cluster from Dynamical Models

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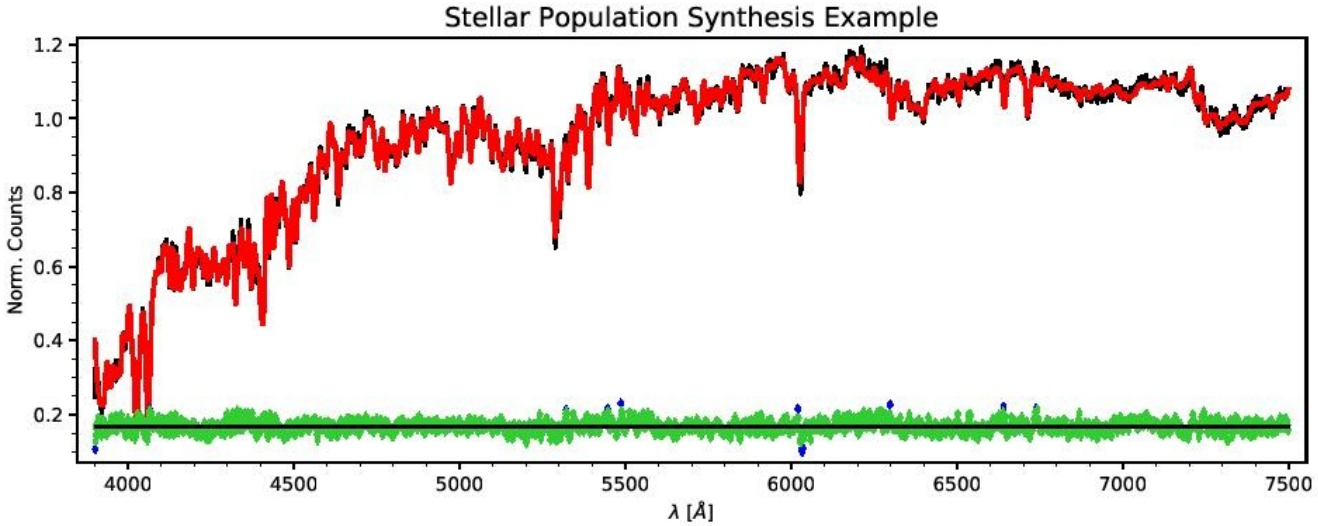
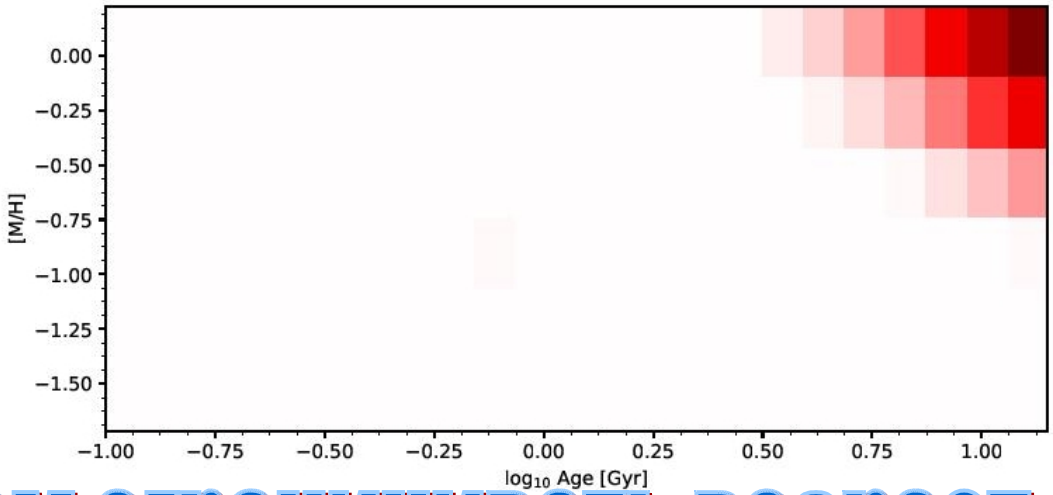
Выборка

- 148 галактик ранних типов из скопления Coma
- Для 53 получена звездная кинематика с SAURON: 41’’x33’’
- Для остальных – SDSS, фибер 2’’ -3’’
- Далее – сплошная эмселлемо-каппеларщина, испорченная аспирантами
- Например, для кинематики – Indo-US, а для звездного населения – Miles…

Вот он, пример извлечения звездного населения…



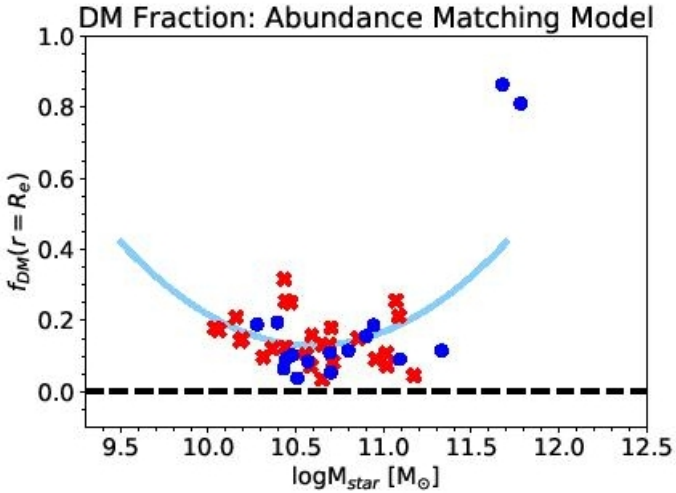


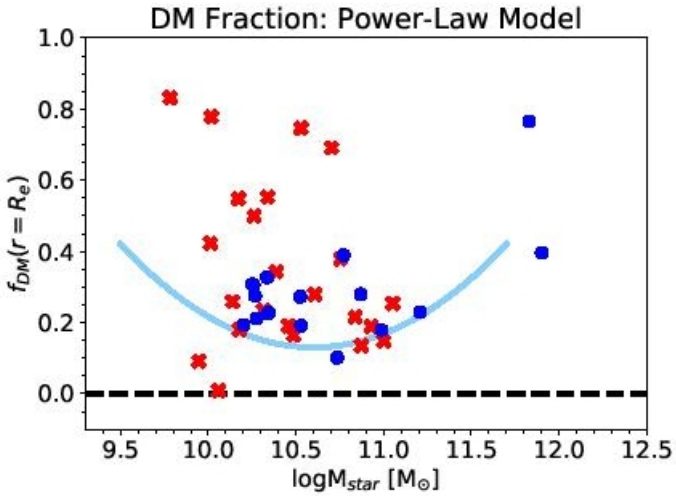
Ну зачем ограничивать возраст сверху?!!

Три динамических модели:

- Self-consistent, то есть бнз темной материи;
- Abundance-matched – гало как в космологических симуляциях
- Power-law… Оказывается, линзирование показывает чистый степенной профиль гравитирующей массы…

Таки да, темной материи почти нет





Выборка SAURON

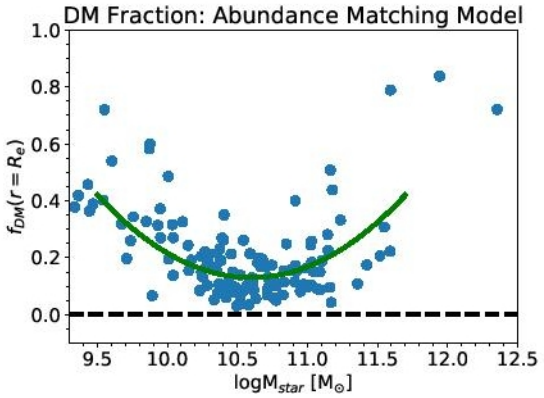


Figure 4. The dark matter fraction within a sphere of radius $1R_e$ as derived from the simple dynamical models using the one-dimensional SDSS spectra for the Full sample. The plot includes all 148 galaxies of the full sample, including the galaxies in the SAURON subset. The solid line in the plot represents the trend seen in the sample by ATLAS^{3D} using a similar model for the total mass profile of the galaxies.

Полная выборка

Проверка, как работает методика на фиберных спектрах

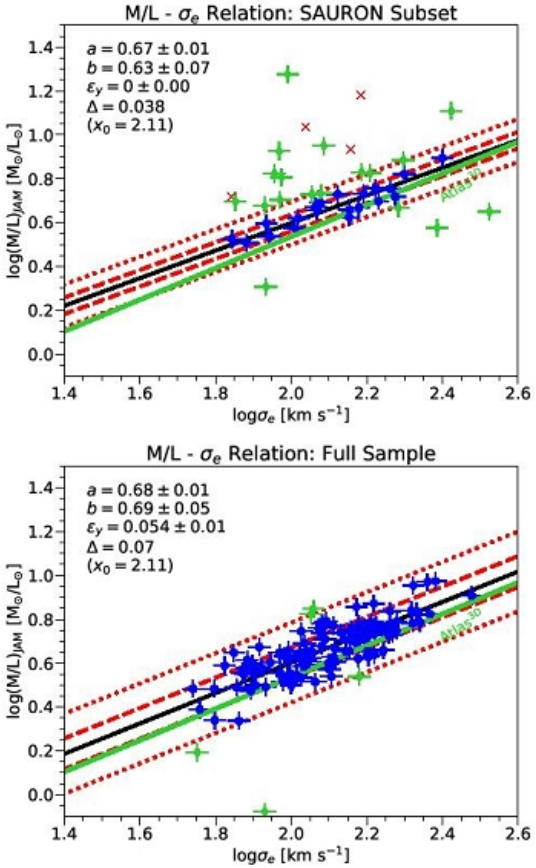


Figure 6. The dynamical (M/L) – σ_e relation for the SAURON subset using the IFU data (top) and the full sample using the one-dimensional SDSS data (bottom). The blue points in the top panel represent the galaxies with $Qual = 2$, with the green triangles and red crosses depicting galaxies with acceptable ($Qual = 1$) and bad ($Qual = 0$) dynamical models respectively. In the top left portion of the panels we present the results of a line fit to the data using LTS_LINEFIT; the slope (b) and offset (a) of the relation, the intrinsic scatter along the y-axis (ϵ_y), the root-

- Собственно, метод проверяется на 16ти галактик, снятых с SAURON, для которых получились осесимметричные динамические модели

Подтверждение ползучей с массой нормировки НФМ

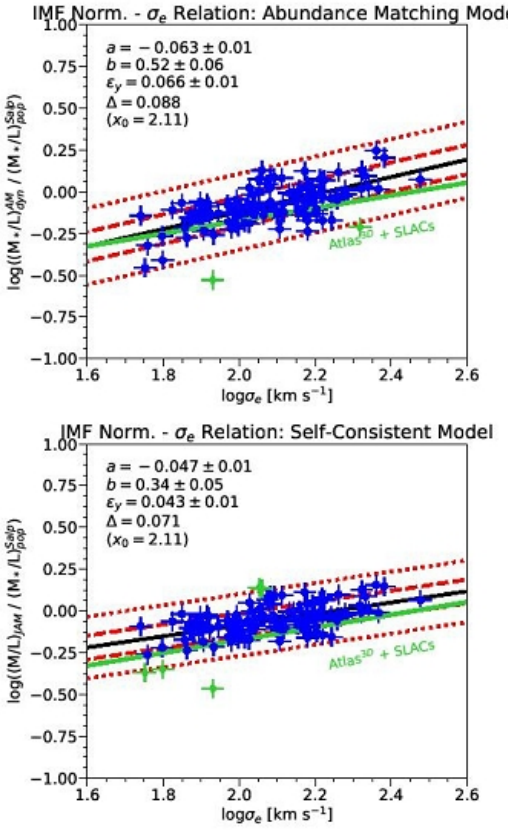


Figure 7. The IMF normalization – σ_e relation for the galaxies in the Coma cluster. *Top panel*: The IMF normalization is derived using the stellar $(M/L)^{AM}_{dyn}$ from the Abundance Matching model and the stellar $(M/L)^{Salp}_{star}$ calculated from the regularized mass-weighted fit to the galaxy spectra. The black line represents the best fit to the full sample, depicted in blue circles, and the dashed and the dotted red lines are the 1 σ and 2.6 σ lines respectively. The solid green line is the IMF normalization–σ_e relation for the extended sample of the ATLAS^{3D} + SLACS galaxies. As in Fig. 6, the top left portion of the panels present the results of the linear fit to the data. As expected, due to the low relative uncertainty in distances, the galaxies in the Coma cluster illus-

- При этом вспоминаем, что динамические массы считались с библиотекой спектров Indo-US, а солпитеровы аналоги – с библиотекой Miles…

Однако если перейти от светимости к массе, фундаментальная плоскость становится вириальной

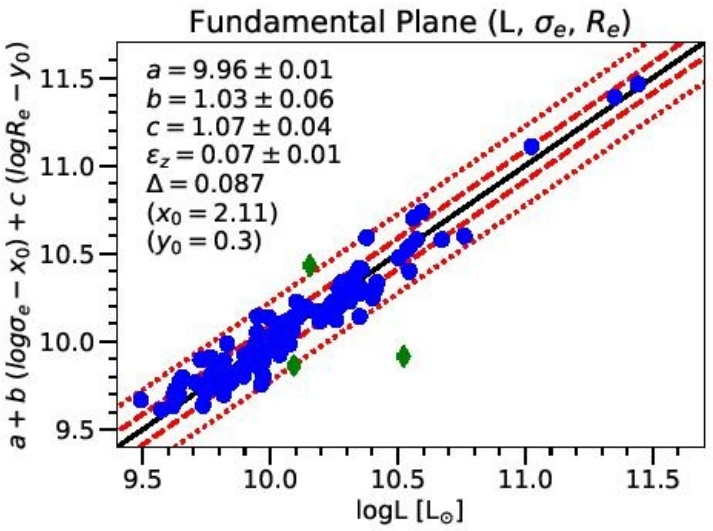


Figure 8. The Fundamental Plane for our galaxies in the full sample. The solid black line is the best fit solution by LTS_PLANEFIT, with the red dashed and red dotted lines representing the 1σ and 2.6σ errors. The best-fitting coefficients, based on LTS_PLANEFIT fitting, are presented in the top left-hand corner of the plot; the coefficients a, b, c, x_0 and y_0 are the best fit coefficients for the plane fit, while ϵ_y and Δ are the intrinsic scatter along the y-axis of the plot and the root-mean-square of the data along the best fit respectively. The blue points represent the galaxies fitted, while the green points represent galaxies that were clipped during the fitting process. As seen in numerous previous studies, the best-fitting coefficients for the plane are not consistent with those expected by the Virial equilibrium condition under the assumption of a constant M/L, i.e. b=2 and c=1.

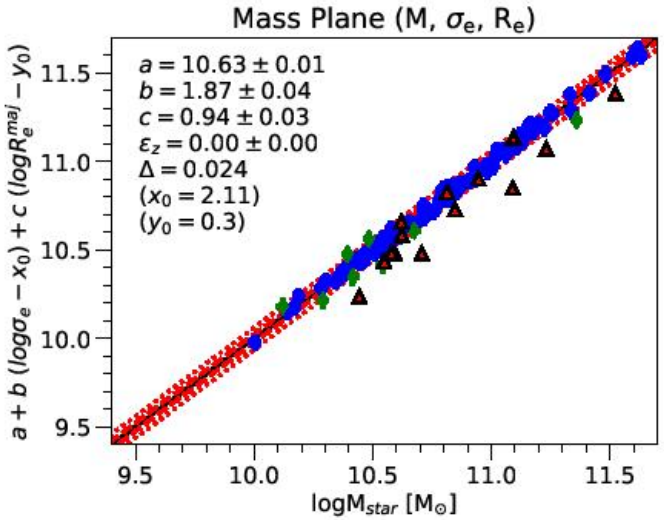


Figure 9. The mass plane for our galaxies in the full sample, with the best-fit solution derived using the LTS_PLANEFIT and, similar to Fig. 8, its results are described along the top left corner of the plot. The mass plane is significantly closer to the predictions of the Virial equation than the Fundamental Plane. To complement the results of the full sample, we over-plot SAURON subset, with $Qual = 2$, using results from their detailed dynamical models as red triangles. Like the full sample, the SAURON subset presents little scatter in the mass plane though these galaxies appear to be offset compared to the full sample.