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Saying Hallo to M94's Stellar Halo: Investigating the Accretion History of the Largest Pseudobulge Host in the Local Universe

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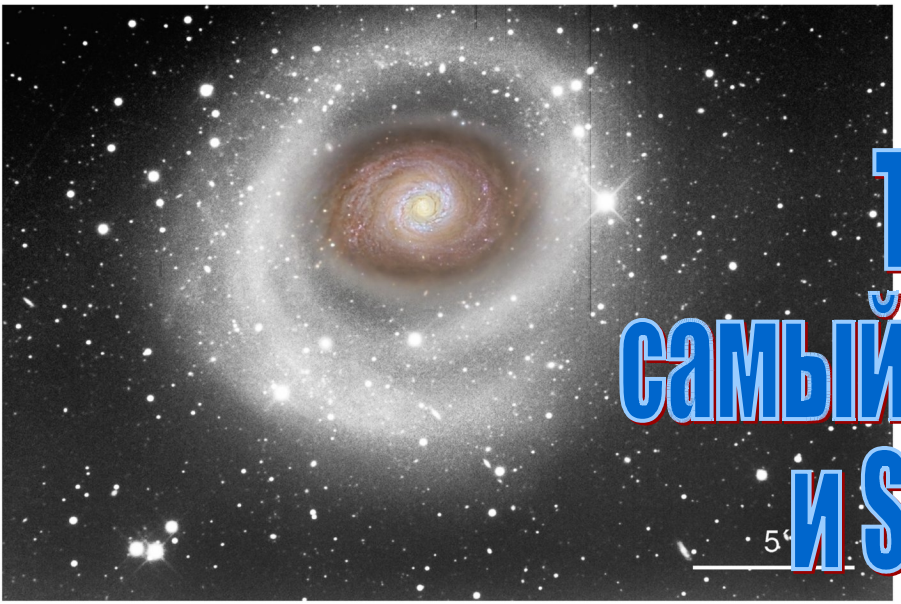
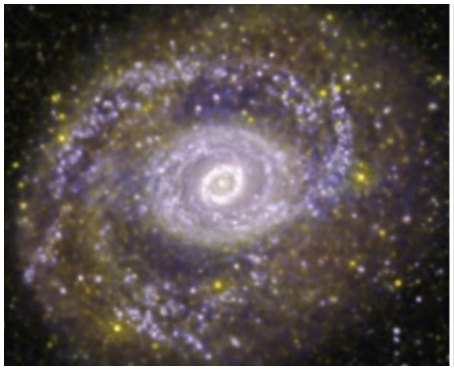
ABSTRACT

It is not yet settled how the combination of secular processes and merging gives rise to the bulges and pseudobulges of galaxies. The nearby ($D \sim 4.2$ Mpc) disk galaxy M94 (NGC 4736) has the largest pseudobulge in the local universe, and offers a unique opportunity for investigating the role of merging in the formation of its pseudobulge. We present a first ever look at the M94's stellar halo, which we expect to contain a fossil record of M94's past mergers. Using Subaru's Hyper Suprime-Cam, we

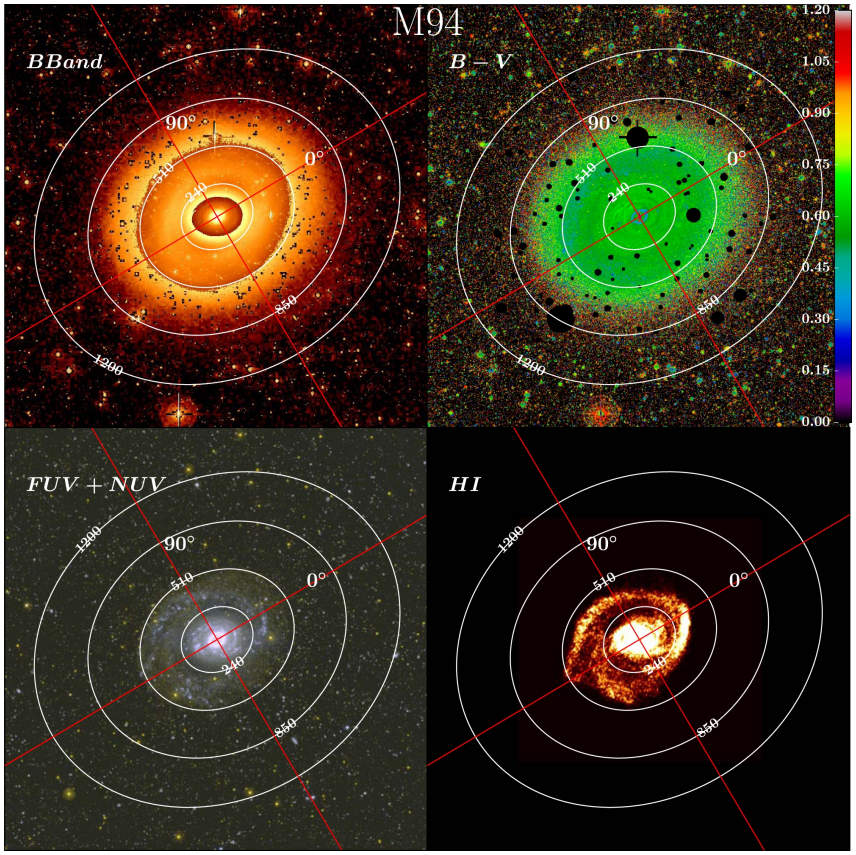
NGC 4736: близкая Sab

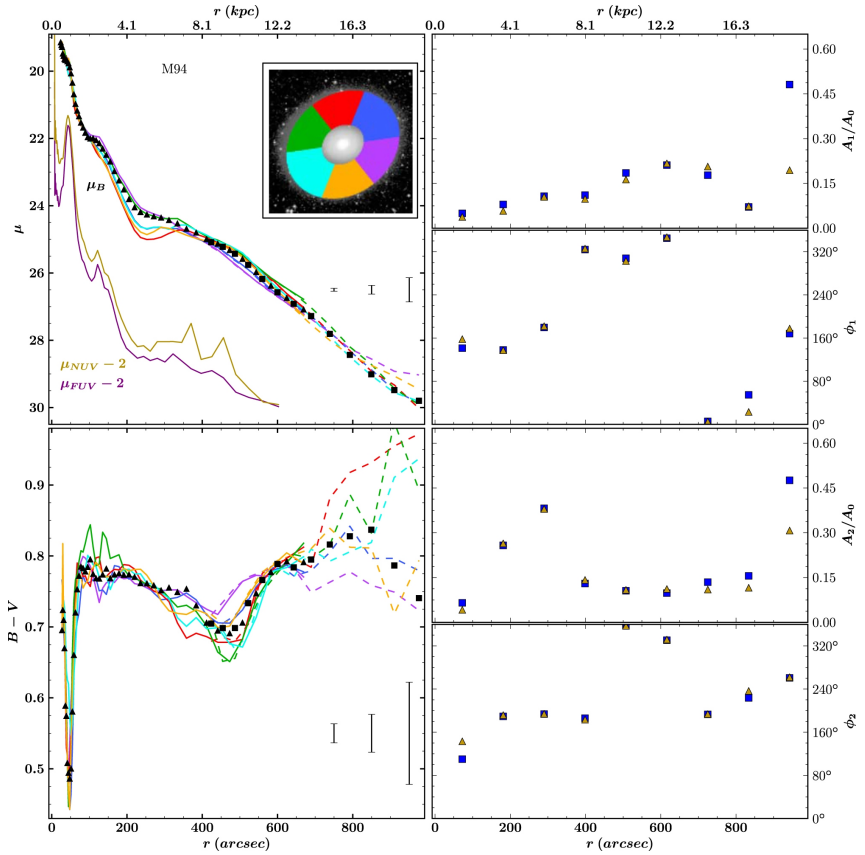


Trujillo et al. (2009):
самый большой псевдобалдж
и SF во внешнем диске



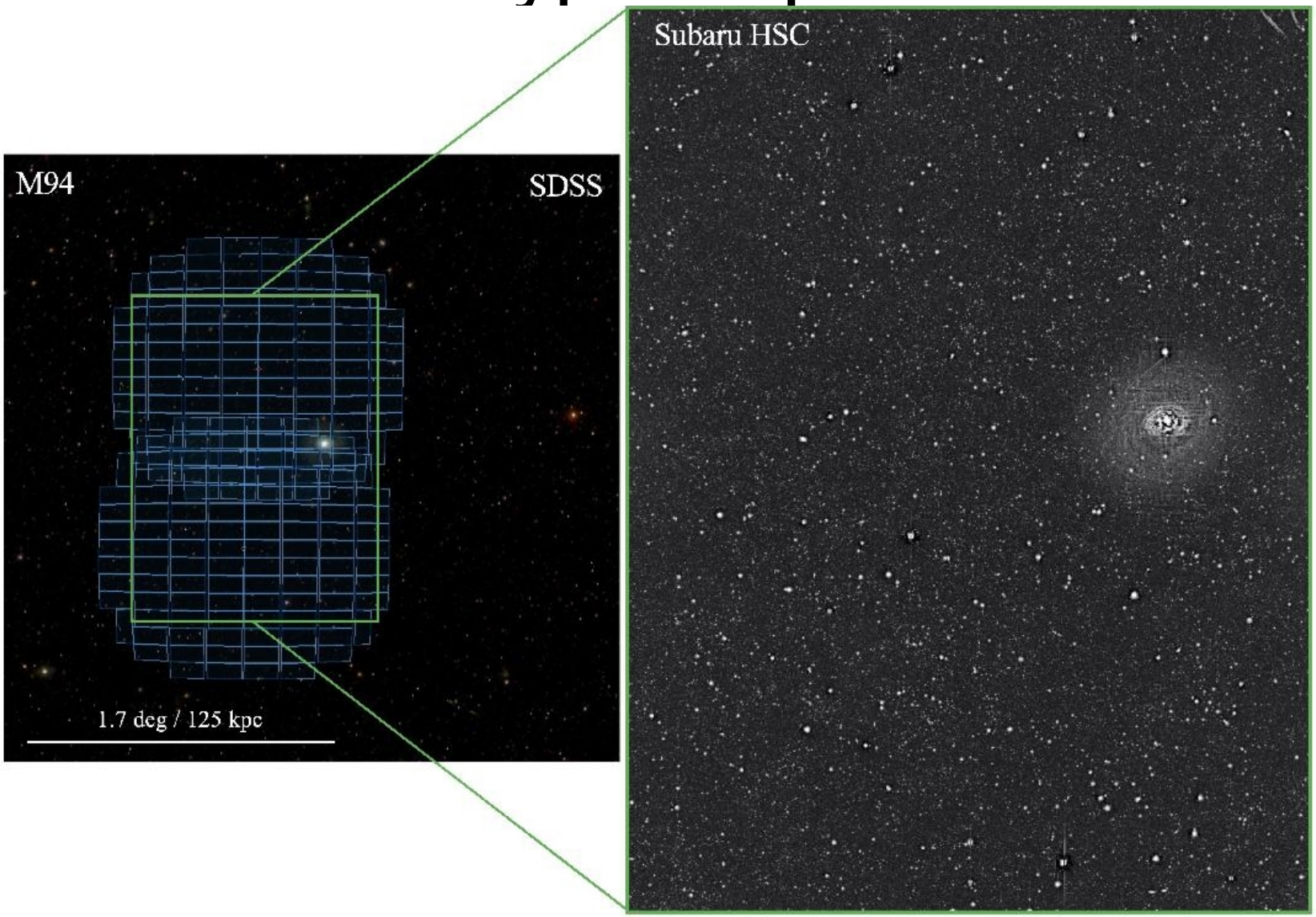
NGC 4736: близкая Sab



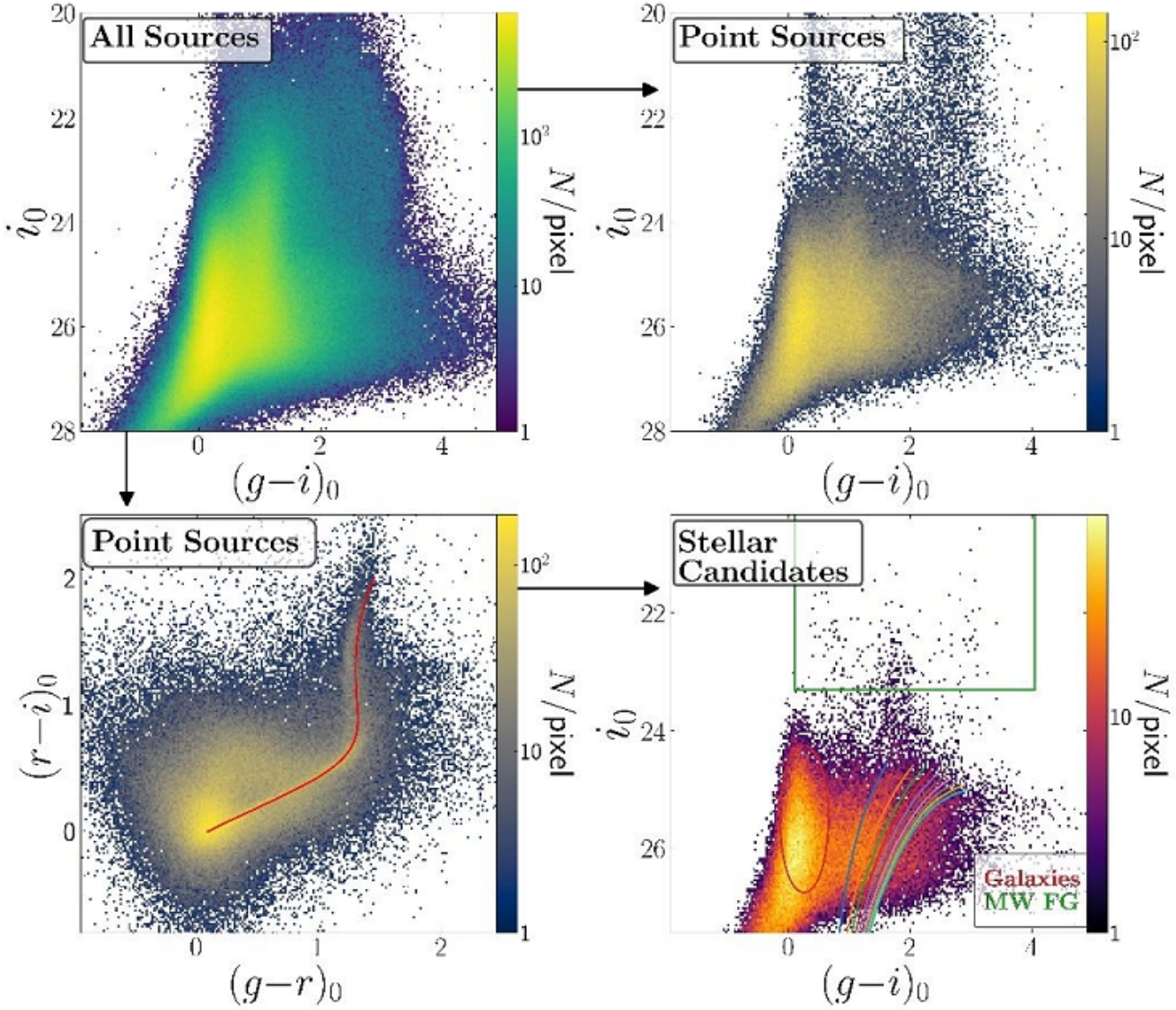


Watkins et al. (2016): красный внешний диск

Новые наблюдения: SUBARU/HyperSuperCam



На уровне 27-28й зв. величины трудно отделить звезды от галактик



Бимодальная ветвь звезд-красных гигантов

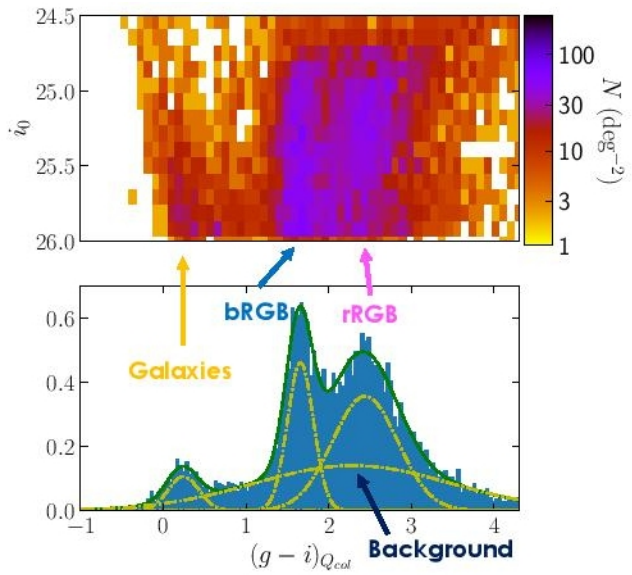


Figure 3. *Top*: A Hess Q-color CMD of stellar sources from 12-30 kpc with magnitudes $24.5 \leq i \leq 26$. *Bottom*: A 1D histogram of the $g-i$ Q-color (blue) fitted with a four-component Gaussian mixture model. Each Gaussian is shown as a dash–dotted yellow line, with the sum of all four curves displayed as a solid green line. The leftmost peak is the region of unresolved galaxies. The next two peaks represent two different populations of RGB stars, which we call bRGB and rRGB, respectively. The fourth, broad peak is

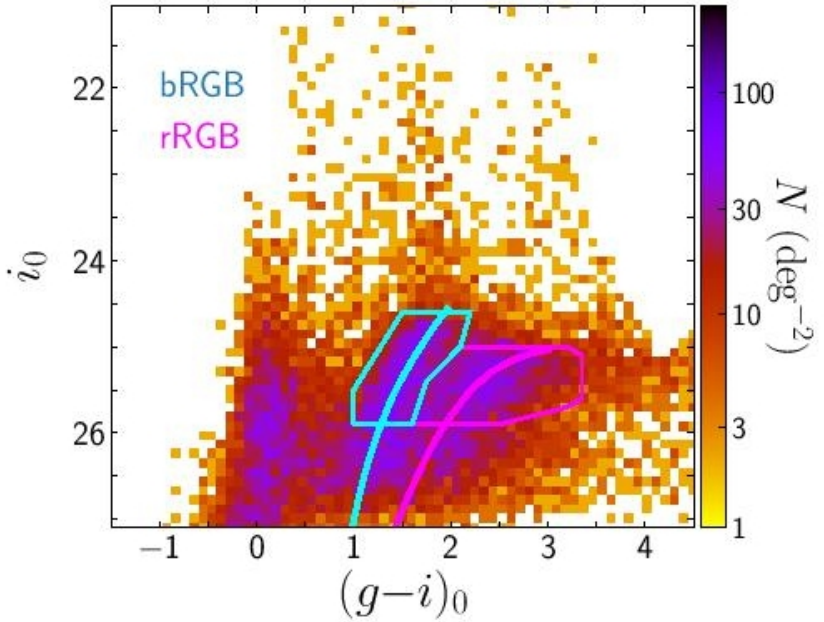


Figure 4. A Hess CMD of stellar sources between 12-30 kpc. Overlaid in cyan and pink are the regions we use for bRGB and rRGB, with their best-fit isochrones from Gaussian fitting and color-metallicity interpolation shown.

При T=10 млрд лет [M/H]=-0.4 и -1.4

Разное пространственное распределение

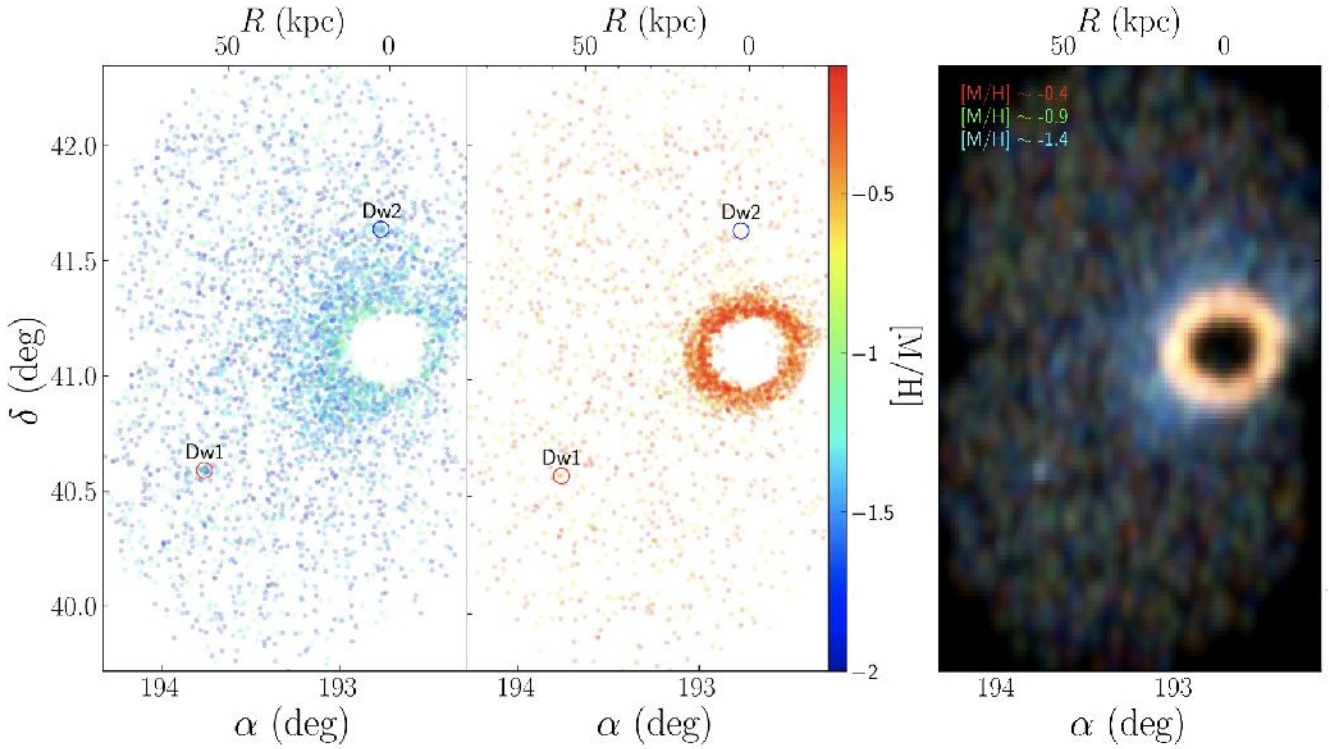
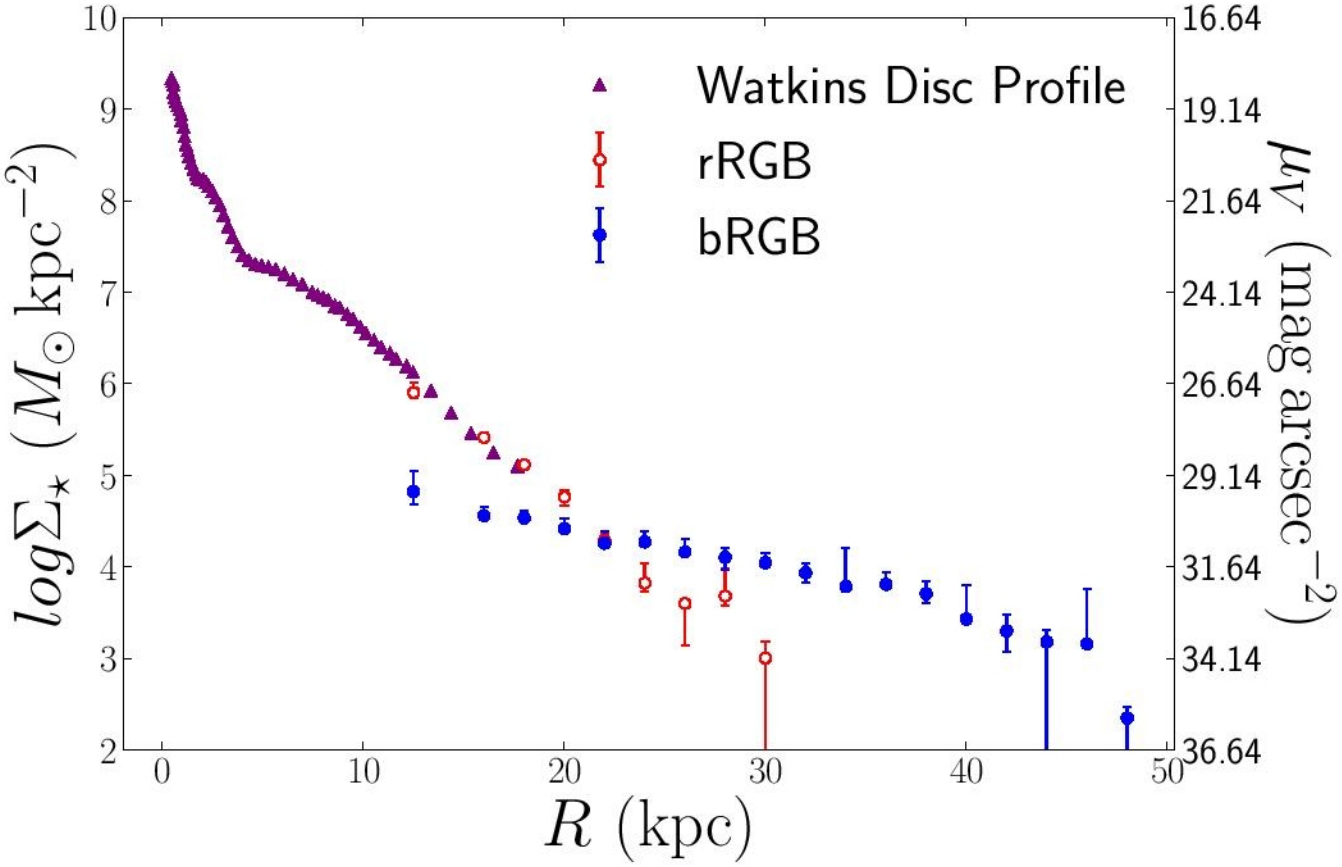


Figure 5. Stellar sources in bRGB (left) and rRGB (center), color-coded by their best-fit metallicity. bRGB stars are me poor and compose M94's outer halo, while rRGB stars are metal rich and comprise most of M94's disk. Also shown are locations of M94's two known dwarf galaxies, characterized in Smercina et al. (2018). *Right*: A density image of M94 with e color coded by stars in three metallicity bins: [M/H] ~ -0.4 (red), [M/H] ~ -0.9 (green), [M/H] ~ -1.4 (blue). The map smoothed using a Gaussian filter and then a square-root scaling was applied. All three plots are on the same scale.

Профиль поверхностной яркости двух компонент: диск и гало



Полная масса гало=интеграл под профилем поверхностной плотности

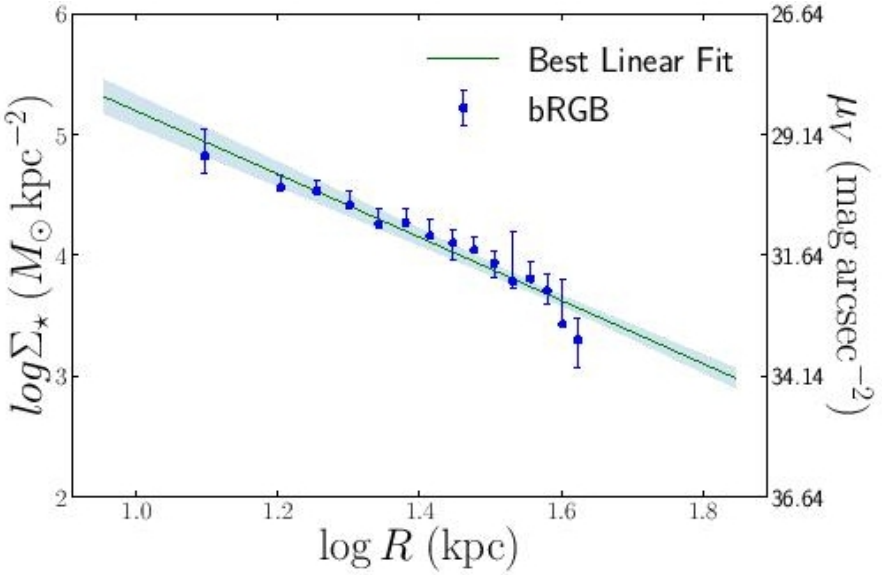


Figure 8. Best linear fit to the log-log mass density profile for data between 16-42 kpc.

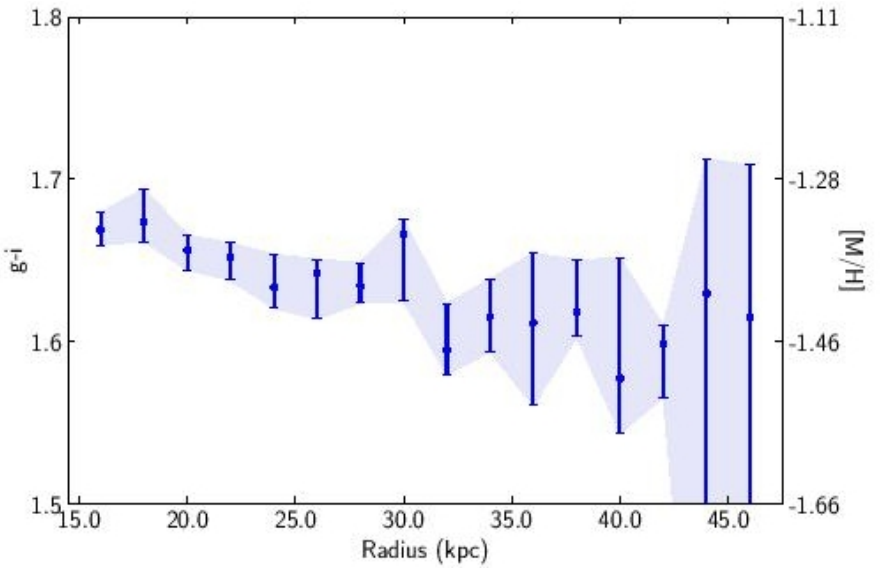


Figure 9. The $g-i$ color profile of resolved stars in the bRGB region. Metallicity, which is calculated from the color and set of isochrones previously mentioned in 3.2, is shown along the right y-axis. We estimate a relatively mild halo

Масса гало 300 млн солнечных масс

Это гало – маленькое: мержинг с ММО? См. модель дальше

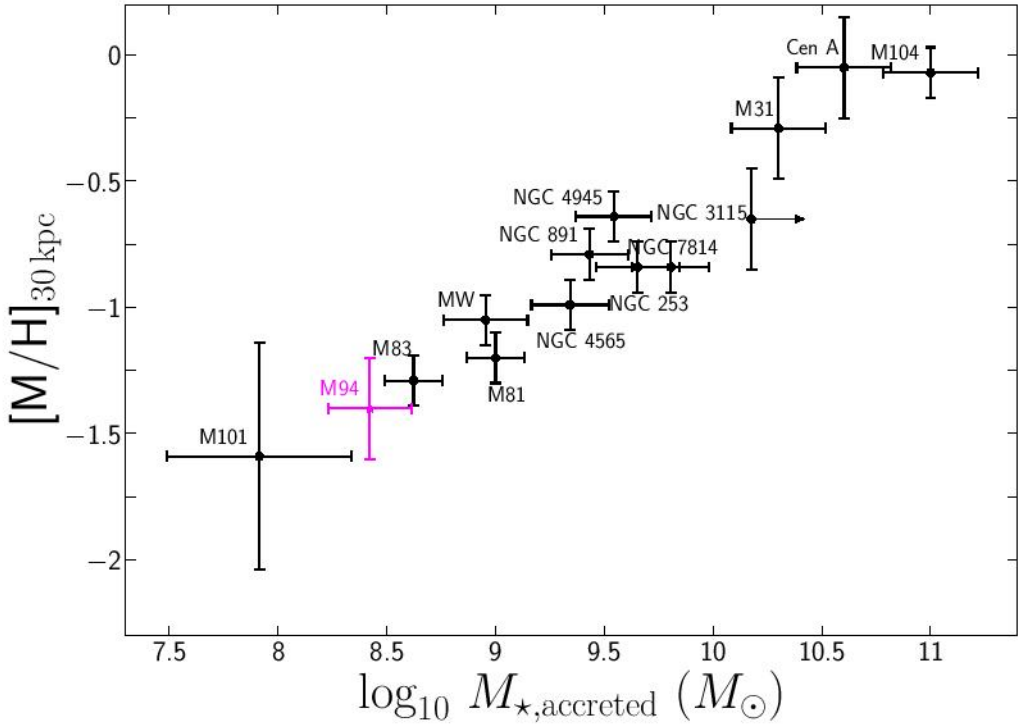


Figure 10. [M/H] at 30 kpc from the center as a function of the total stellar mass accreted for various galaxies in the Local Universe, reproduced from Smercina et al. 2022. Galaxies whose metallicities were listed as [Fe/H] were converted to their respective [M/H] following Streich et al. (2014). M94 falls along the general trend, having one of the smallest and most

Антикорреляция масса балджа-масса поглощенного спутника?

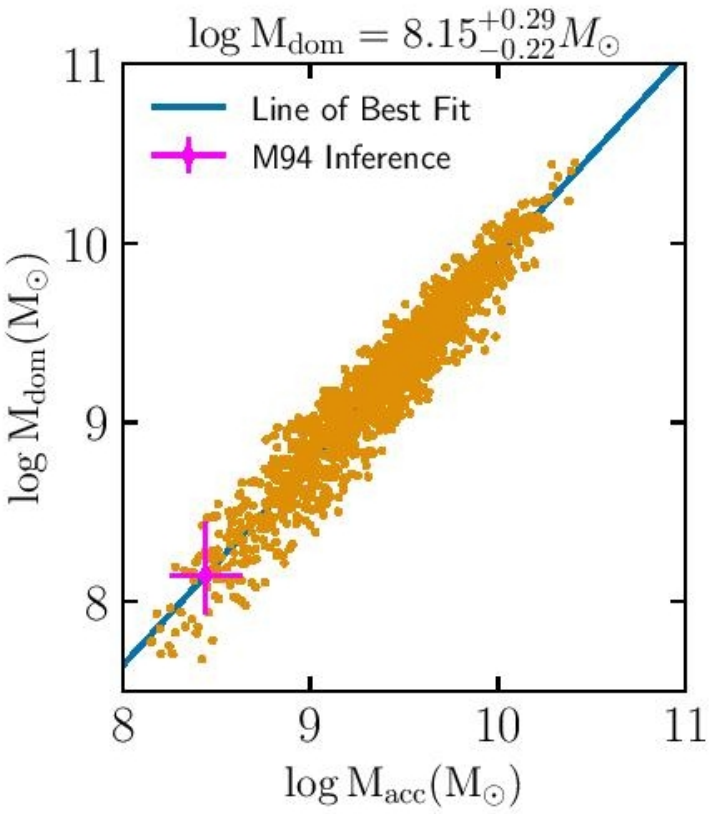


Figure 11. Orange points show the masses of the dominant progenitor galaxies as a function of the total accreted stellar mass for galaxies in dark matter halos with masses between $11.7 \leq \log M_{DM} \leq 12.15$ from the Illustris simulation. The

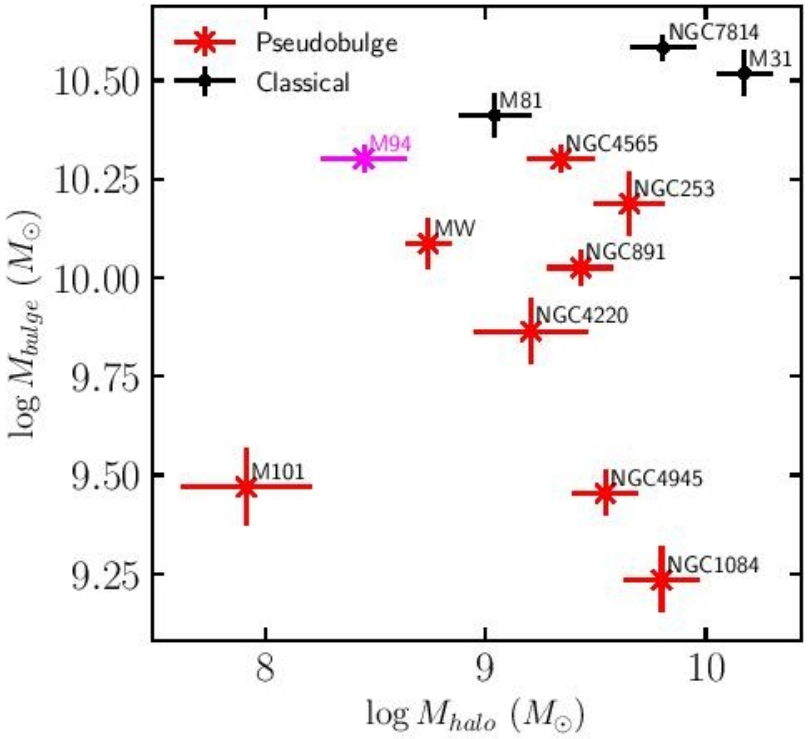


Figure 12. The accreted halo mass as a function of bulge mass for galaxies in the Local Universe where both measurements exist. M94 is highlighted in pink text.