

An Extragalactic Fossil Record: M94's Merger History through its Stellar Halo

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What do mergers do to galaxies?

Galaxies evolve through **mergers** with other galaxies

"The Mice"



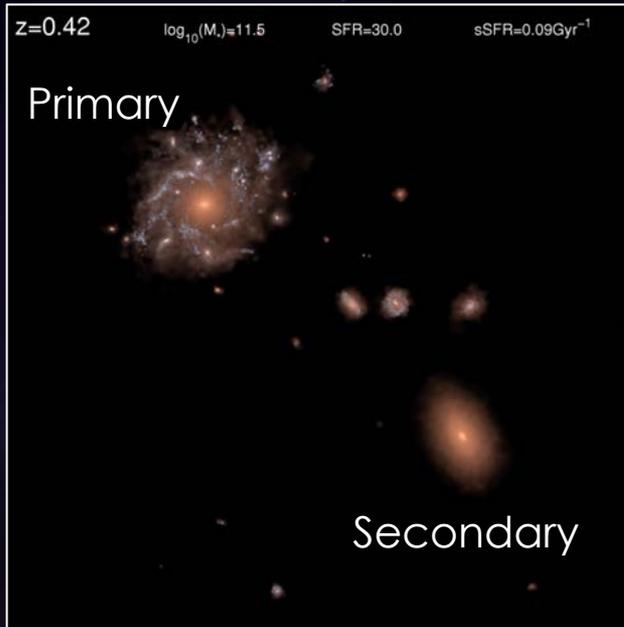
Credit: [NASA](#), Holland Ford (JHU), the ACS Science Team and [ESA](#)

M51



Credit: Katya Gozman, through use of Stone Edge Observatory

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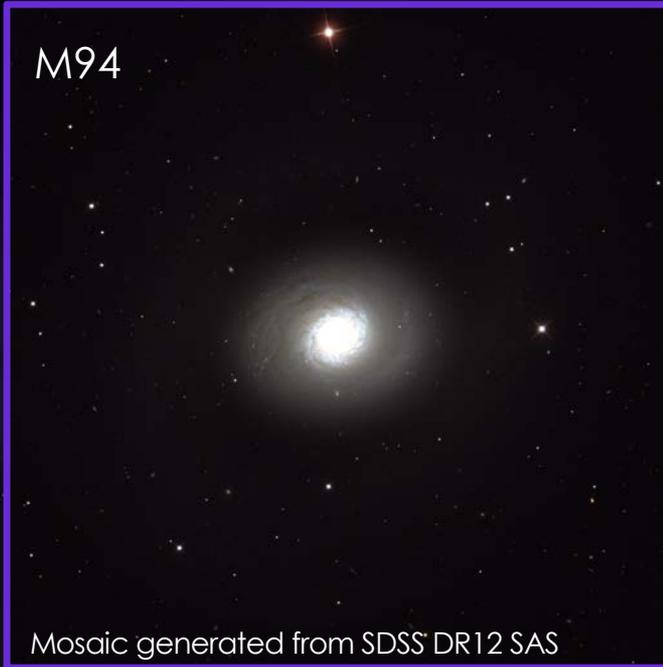
Galaxies evolve through mergers with other galaxies

Signs of past mergers aren't so clear cut, but their remnants are left behind in the primary galaxy's **stellar halo**.

Credit: Illustris TNG, visualization by Shy Genel

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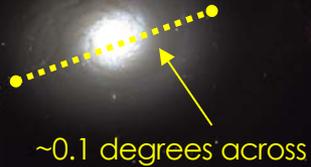
Mosaic generated from SDSS DR12 SAS

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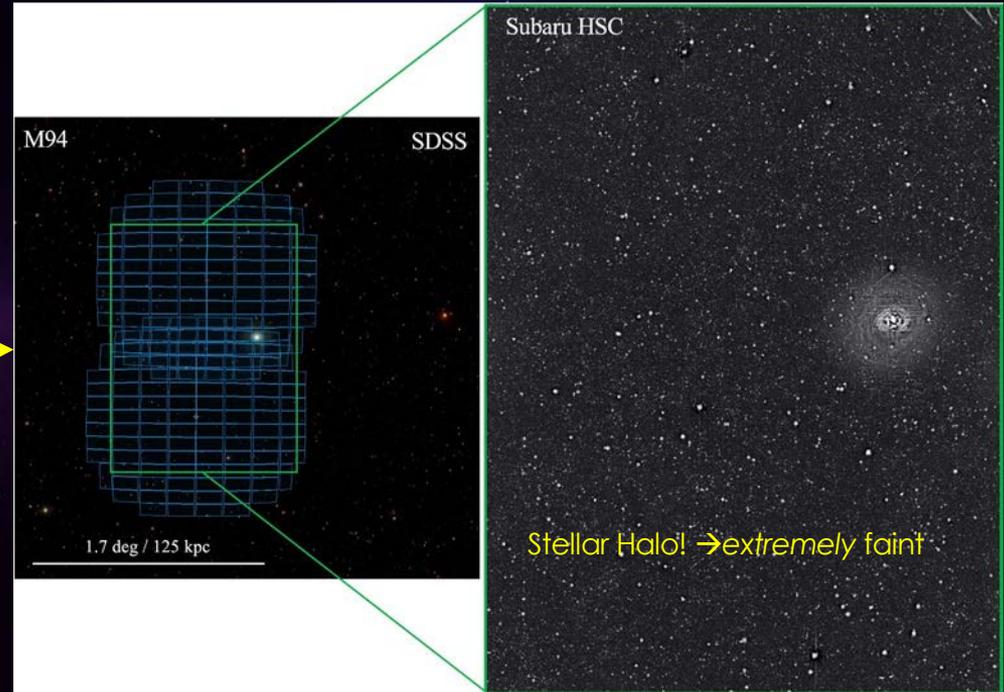
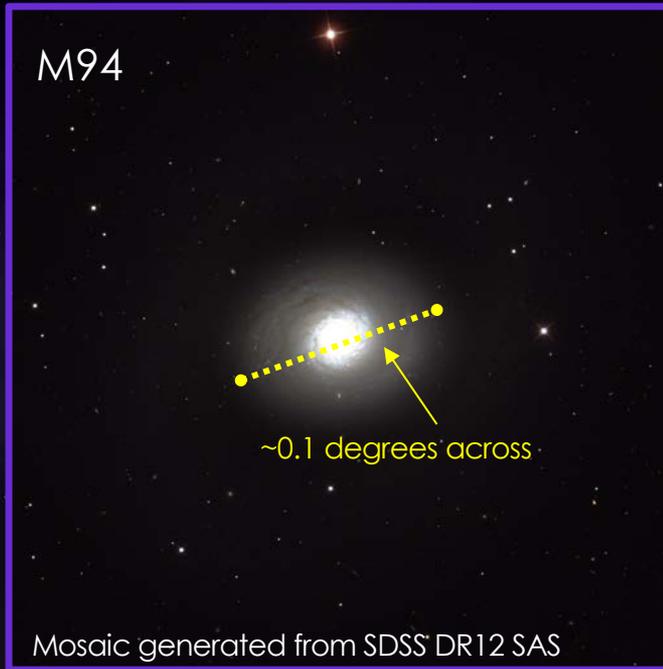


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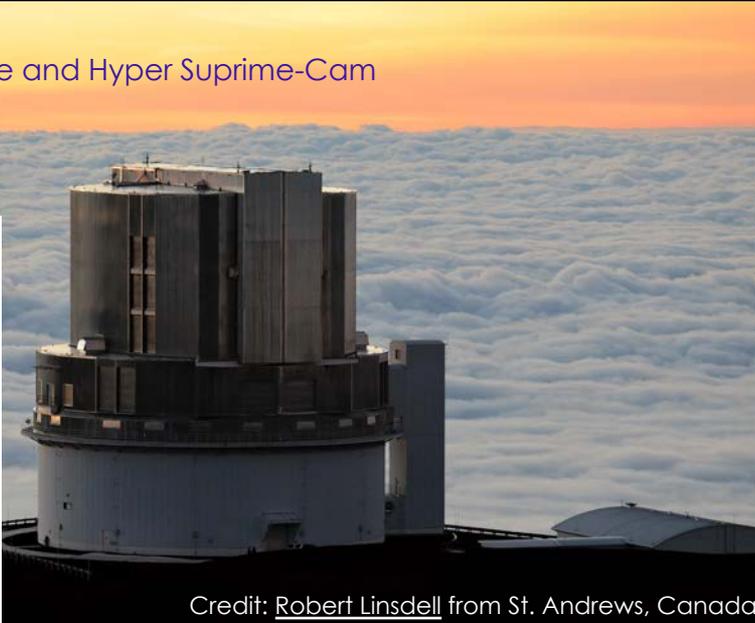
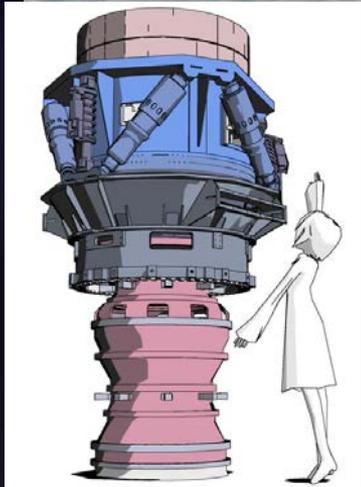
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Resolving and studying **stars** in the stellar halo can teach us about the **merger history** of a galaxy.

The Subaru Telescope and Hyper Suprime-Cam



Credit: Robert Linsdell from St. Andrews, Canada

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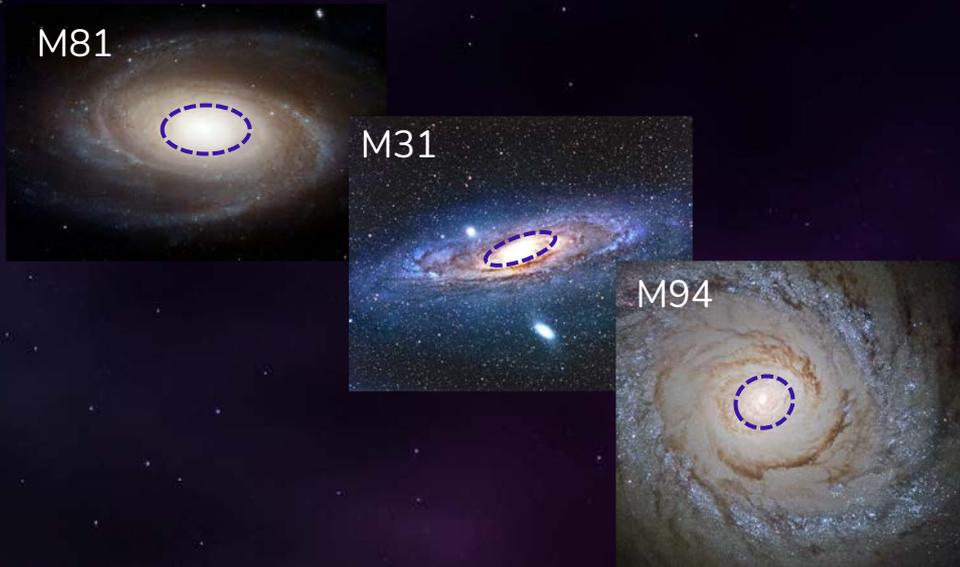
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Want to use this to learn about **internal structures** of the primary galaxy

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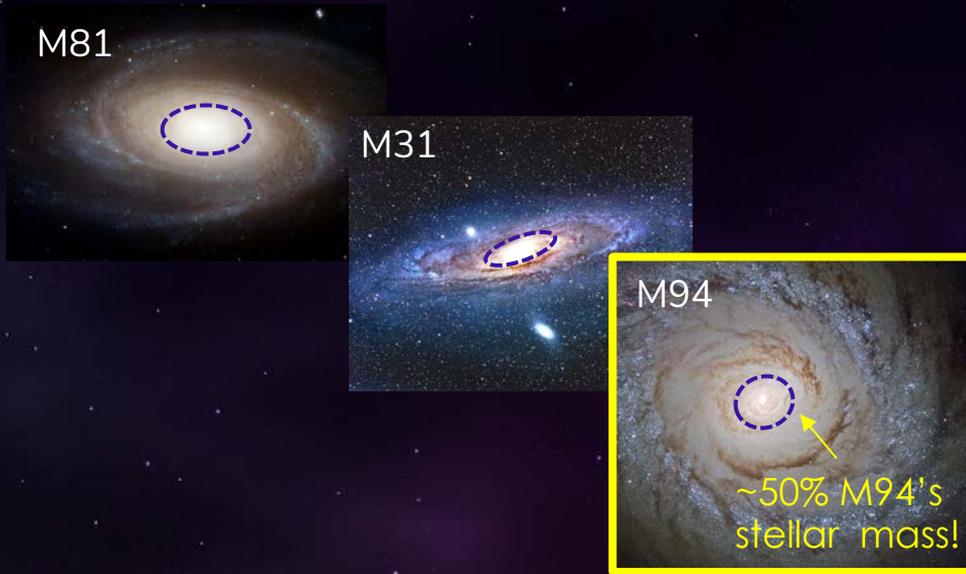
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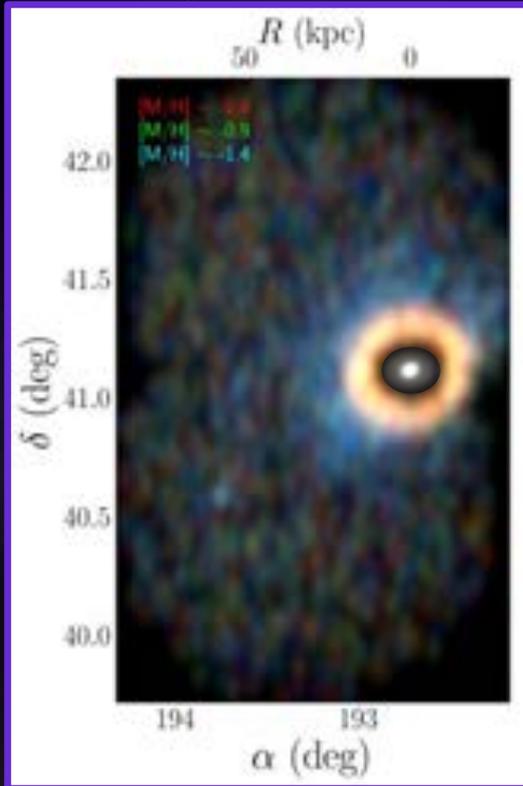
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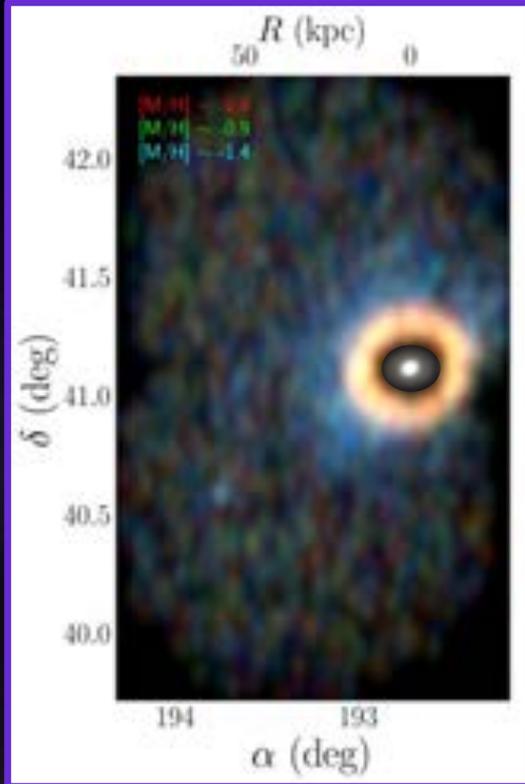
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Results



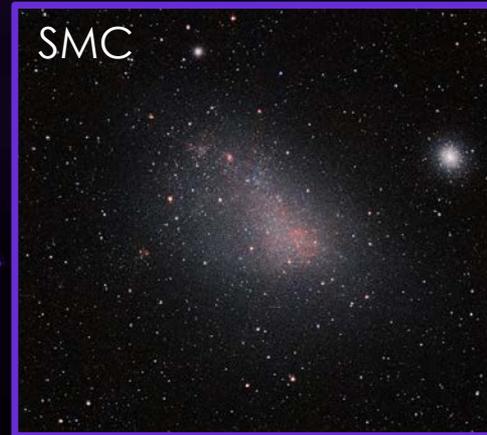
M94's stellar halo is **not very massive** and pretty **metal-poor**

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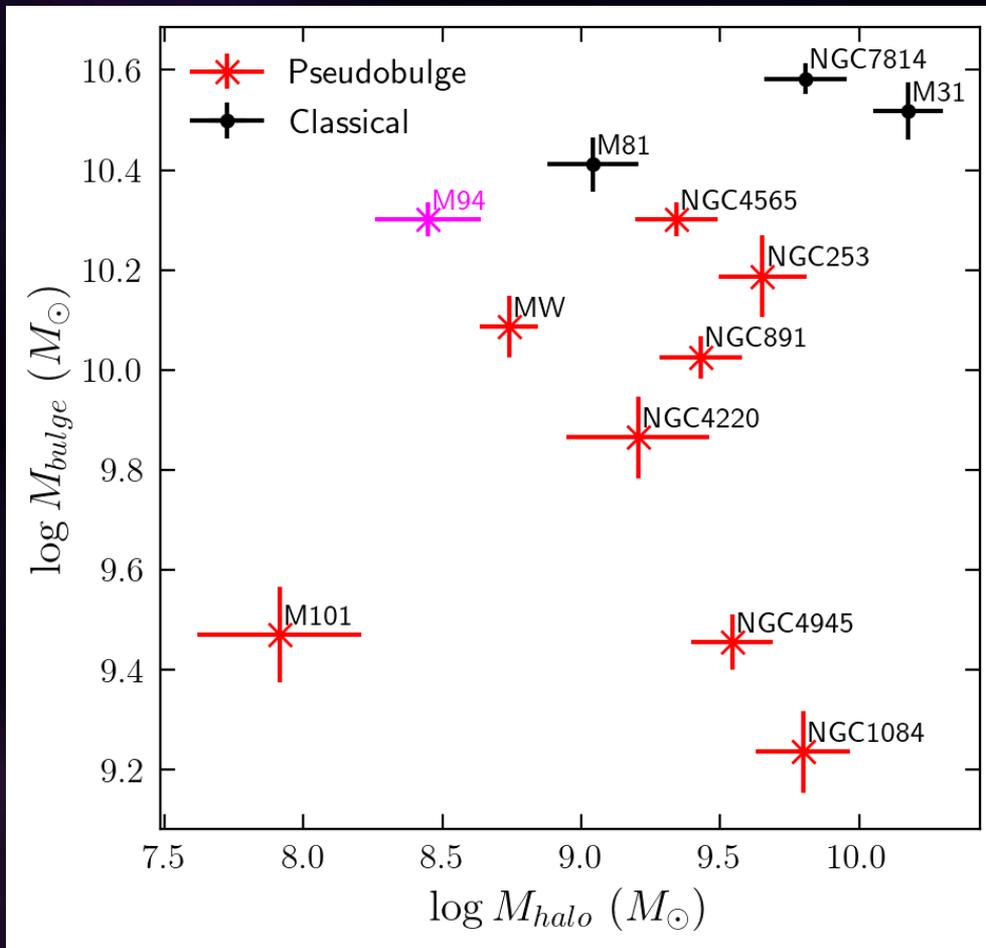


M94's stellar halo is **not very massive** and pretty **metal-poor**

We infer the mass of its dominant merger to be **less than a nearby dwarf galaxy**, the Small Magellanic Cloud

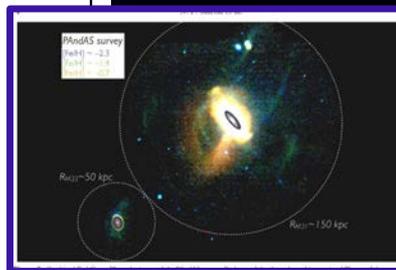
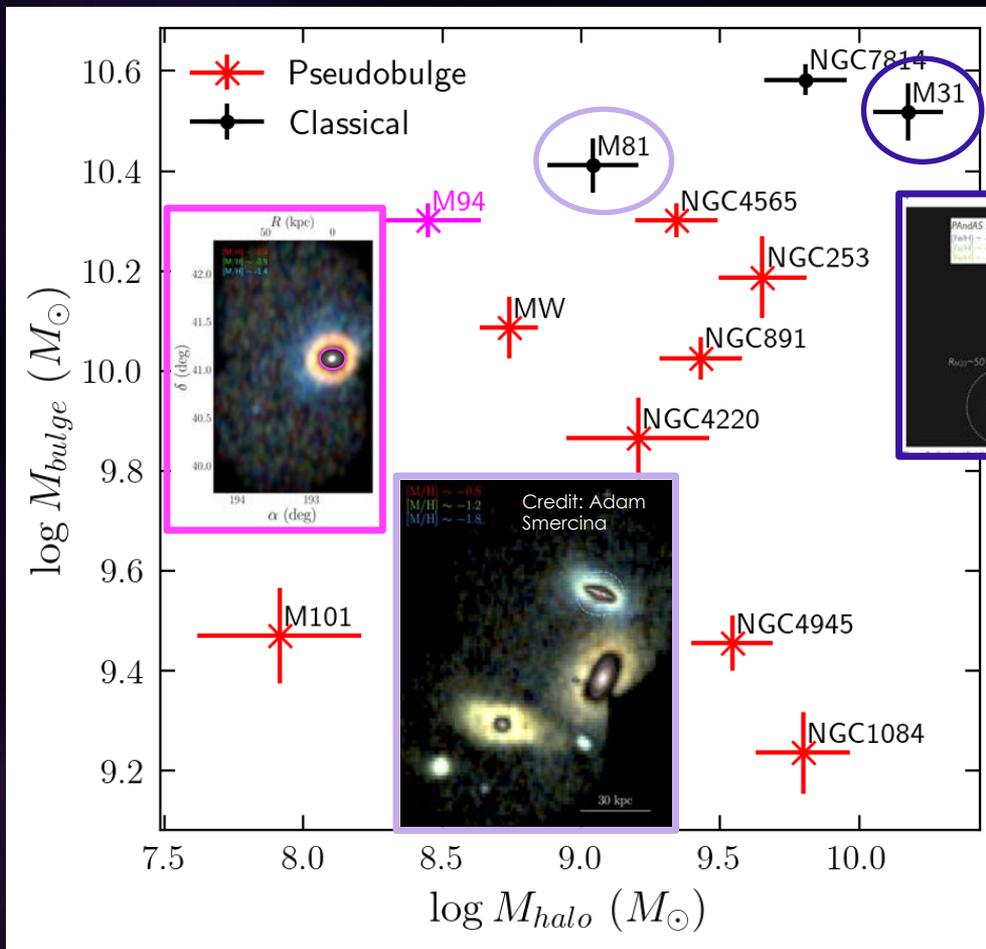


How massive the galaxy's central part is →



← How active a merger history the galaxy had

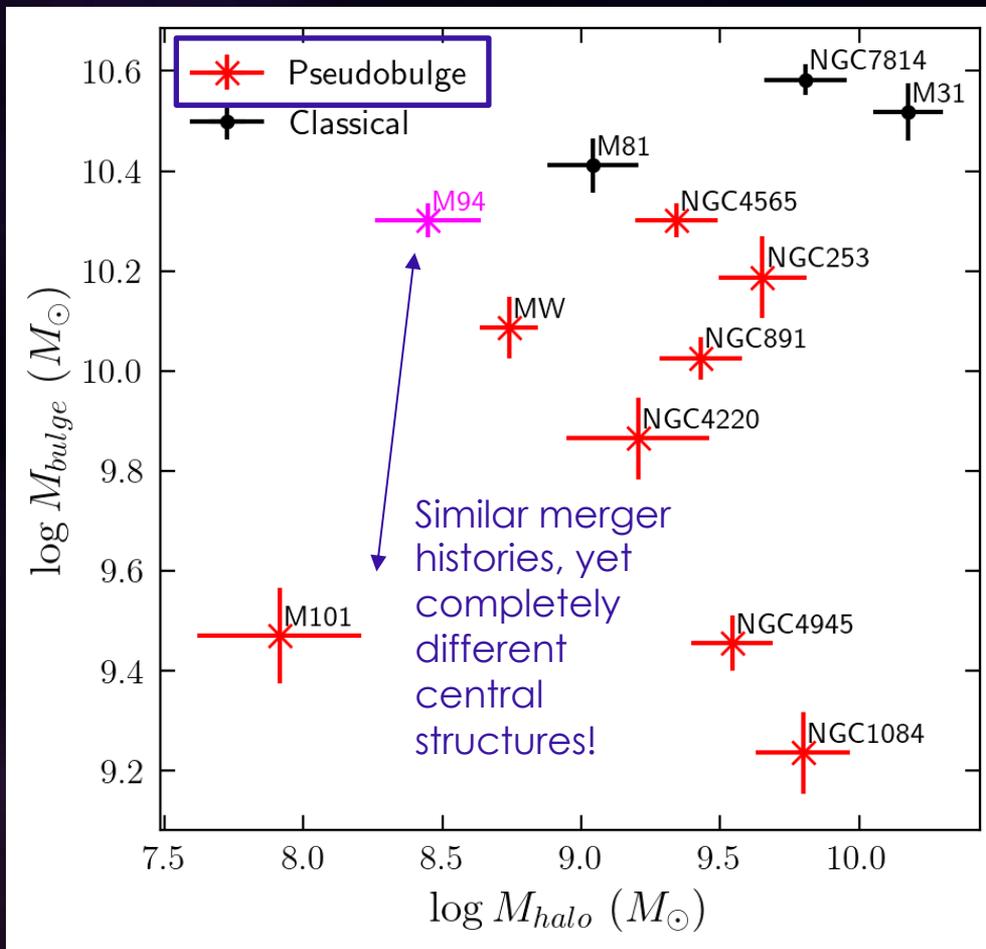
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Credit: N. F. Martin, PAndAS collaboration

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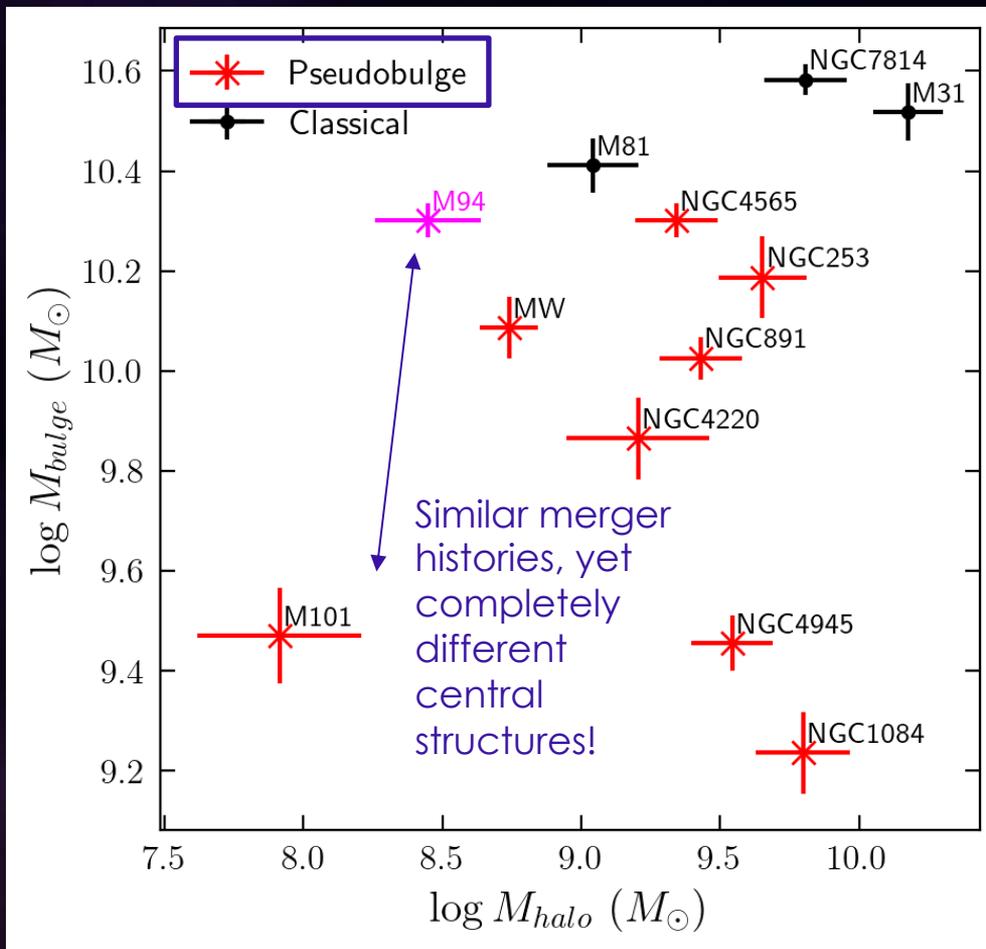
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Similar merger histories, yet completely different central structures!

← How active a merger history the galaxy had

How massive the galaxy's central part is →



Similar merger histories, yet completely different central structures!

M94's dominant merger most likely did not have a major role in the growth of its enormous pseudobulge!

← How active a merger history the galaxy had

The Big Picture

- We used stars in M94's **stellar halo** to determine that it has a very **metal-poor** and **tiny halo**
- We infer M94 has had a **quiet merger history** so far
- Nearby galaxies have **very diverse** merger histories and central structures—M94 has a **massive pseudobulge**, but probably **not because of its dominant past merger**
- We've added a **significant data point** to our knowledge about the evolution of local galaxies, since studying them in detail is so difficult