How old are bars?

Determining the cosmic epoch of bar formation using archeological data of nearby galaxies

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Why do we care when bars formed

1. More than half of disc galaxies in the Local Universe have bars

   e.g., Eskridge+00; Menéndez-Delmestre+07; Barazza+08; Sheth+08; Aguerri+09; Nair & Abraham 2010; Buta+15; Erwin18

2. Bars affect their host galaxies

   e.g., Lynden-Bell & Kalnajs 1972, Combes & Gerin 1985, Fragkoudi+16, Masters+12, Géron+21, Ishizuki+90, Ellison+11, Coelho & Gadotti 2011)

How old are bars observed in the Local Universe?

Do bars and bar-built structures grow?

How the bars affect their host galaxy?

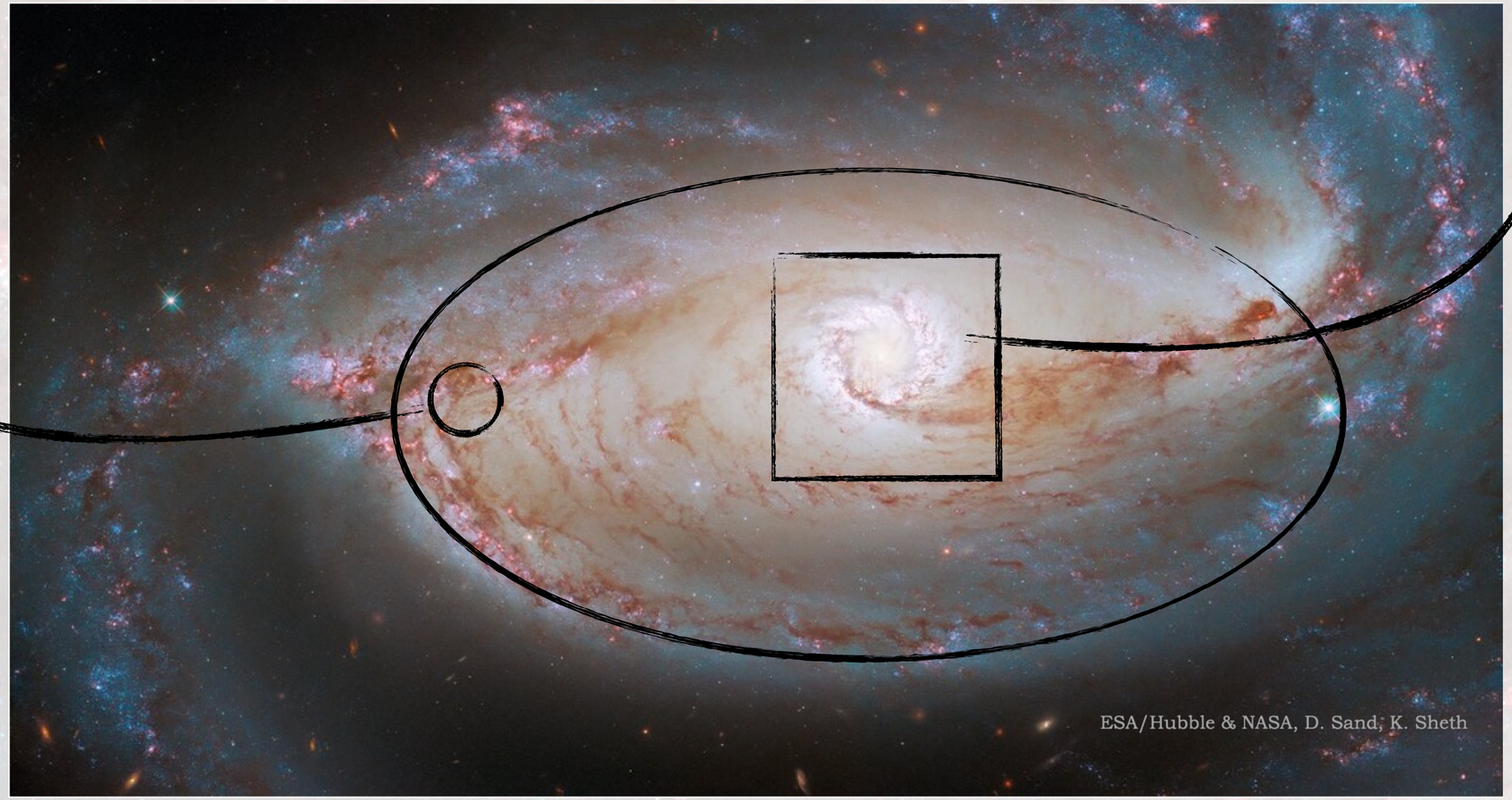
Are massive galaxies able to form bars earlier?

For how long?

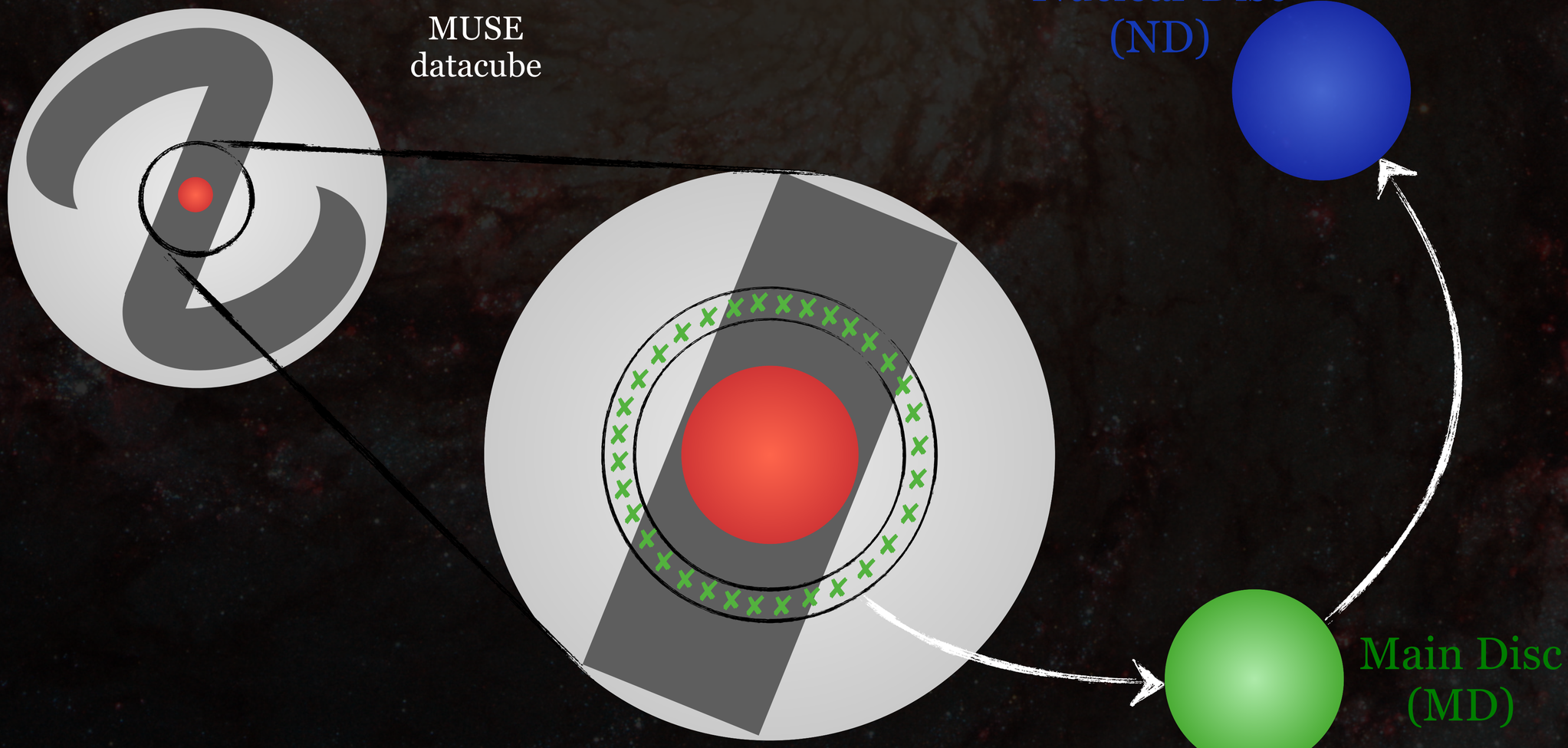
Measuring ages of extragalactic bars

Problem: tangled information

Trapped stars from the disc



Timing bar formation



Adapted from C. de Sá-Freitas+23

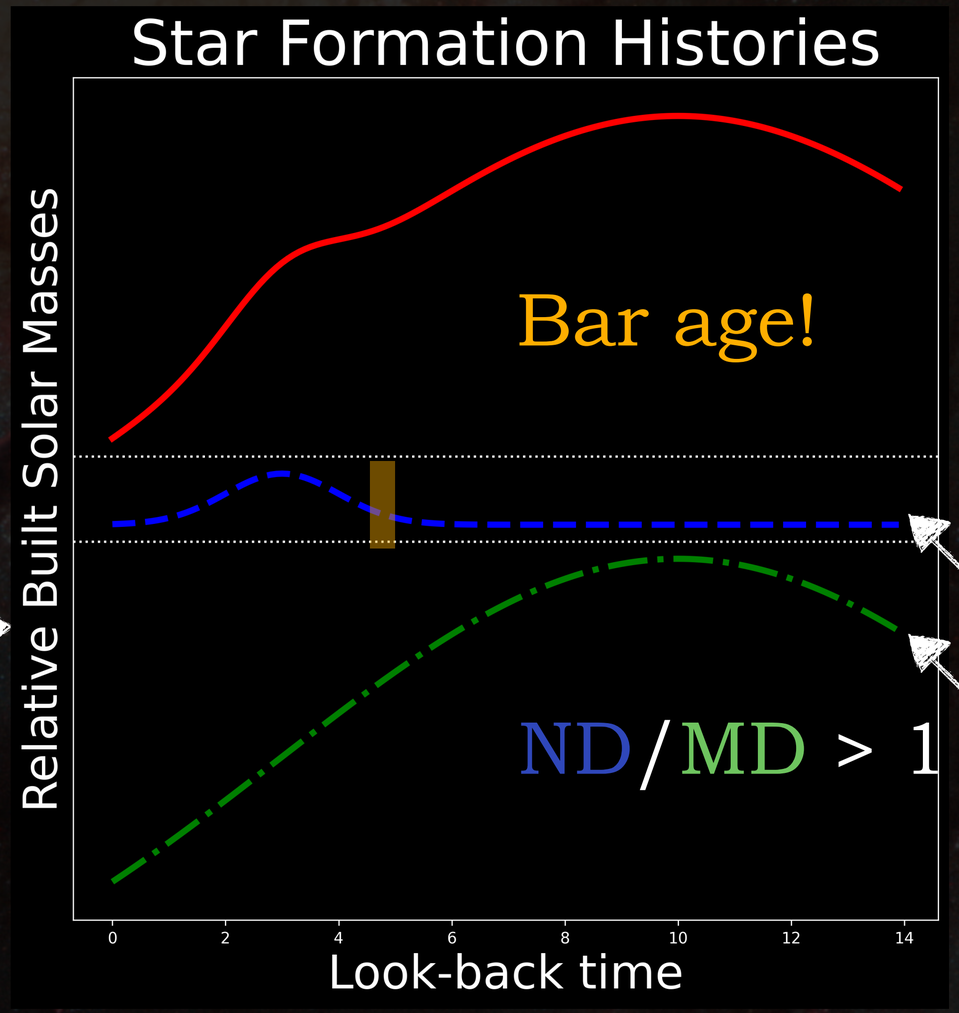
Timing bar formation

Tested the approach in simulated galaxies!

MUSE Original

Main Disc (MD)

Nuclear Disc (ND)



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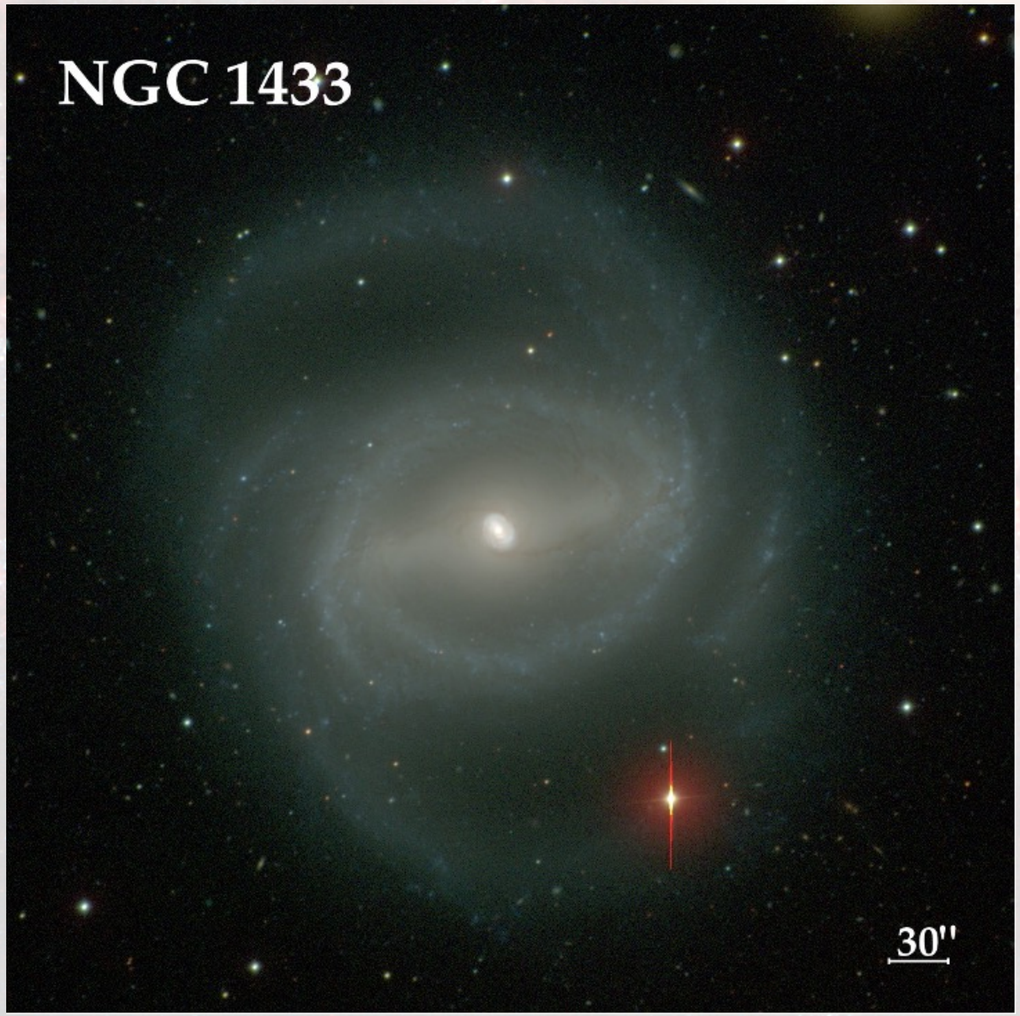
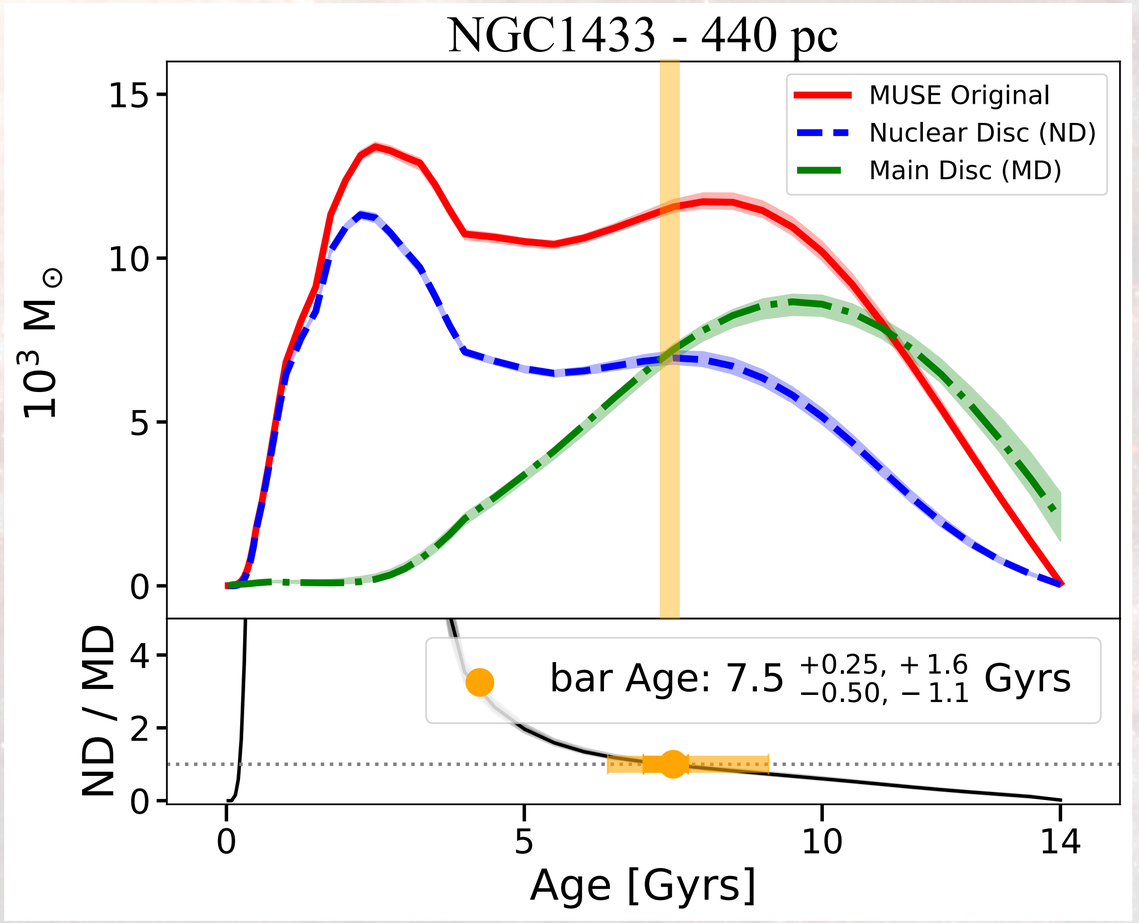
NGC1433 hosts an old bar

MUSE Original

Main Disc (MD)

Nuclear Disc (ND)





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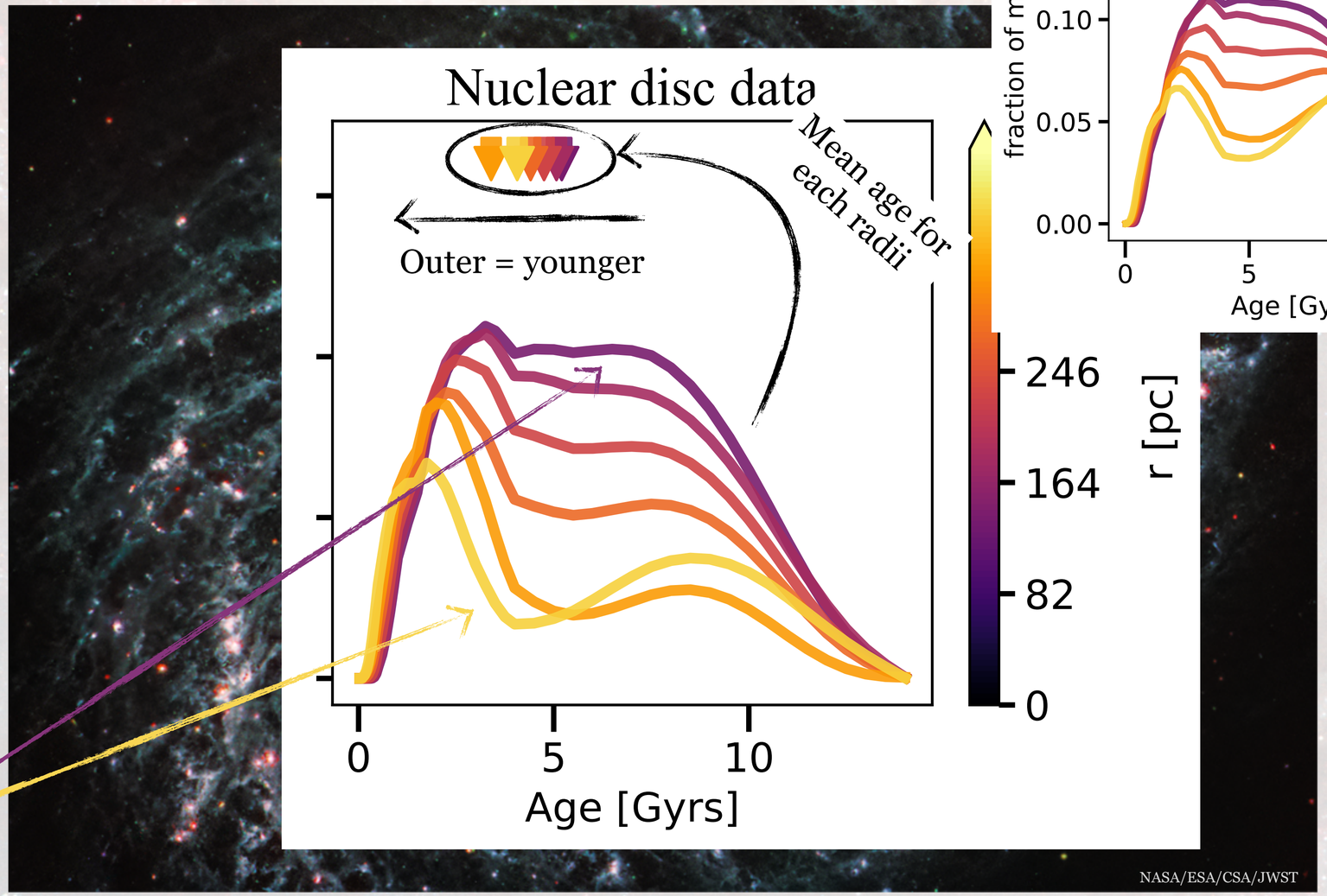
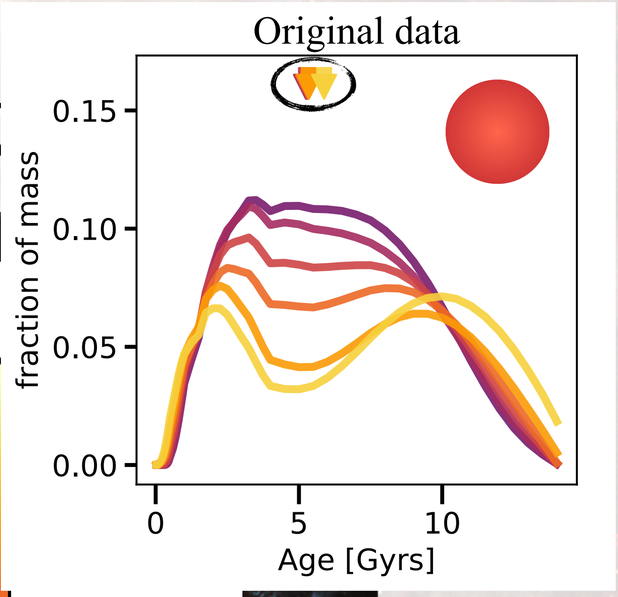
A little detour

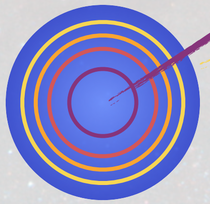
Nuclear disc inside-out build

Bittner+2020





Nuclear Disc (ND)



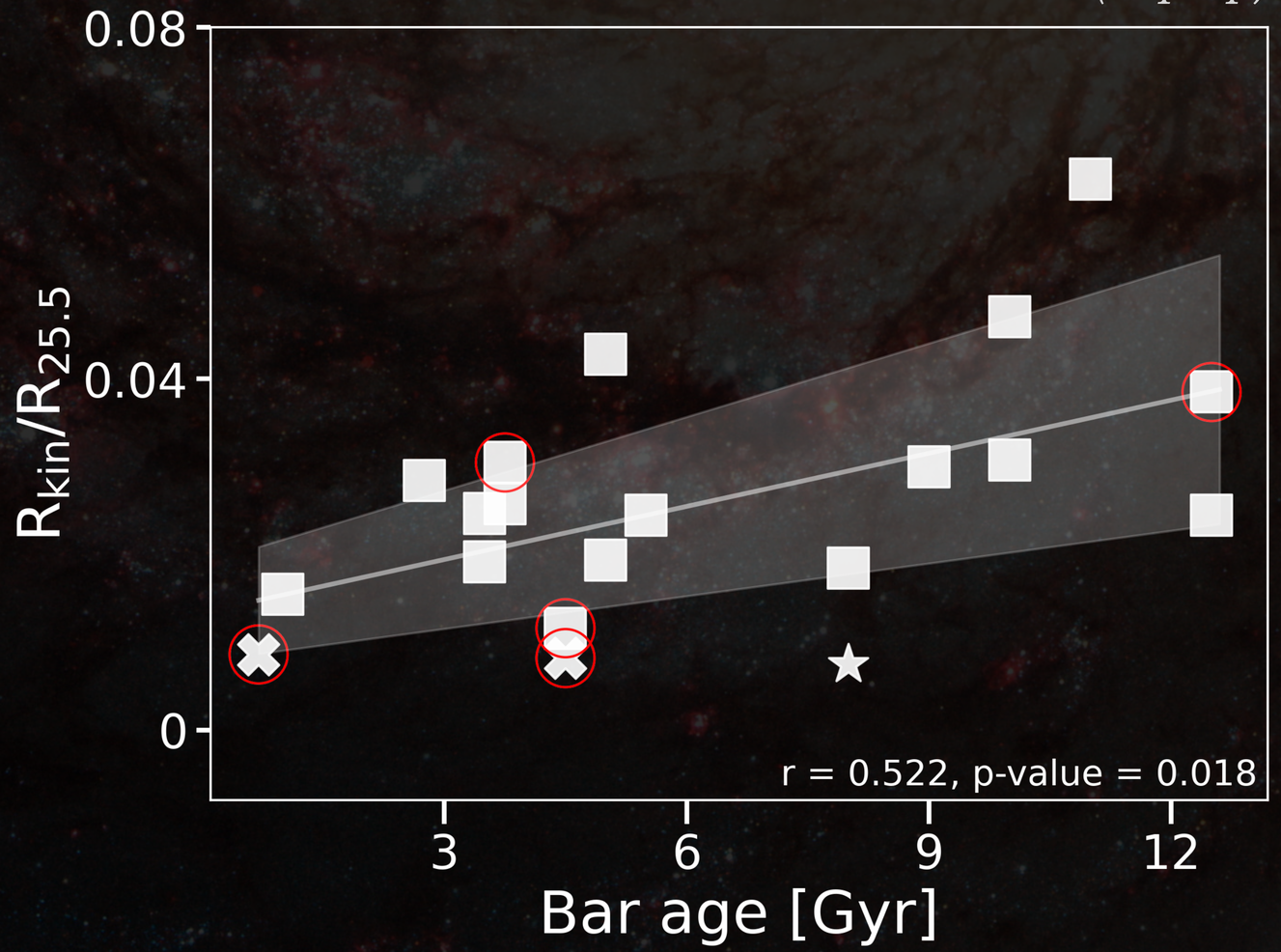
Adapted from C. de Sá-Freitas+23

Gadotti+2019

Bar ages on the TIMER survey

Work in progress

de Sá-Freitas+ TIMER (in prep)



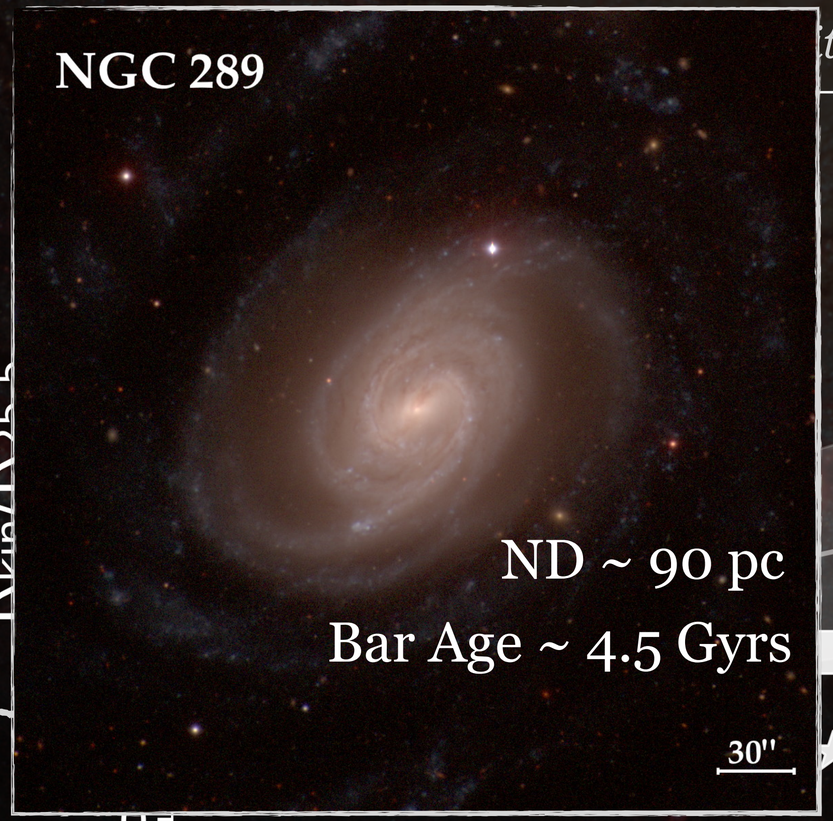
Nuclear discs are bigger in older bars

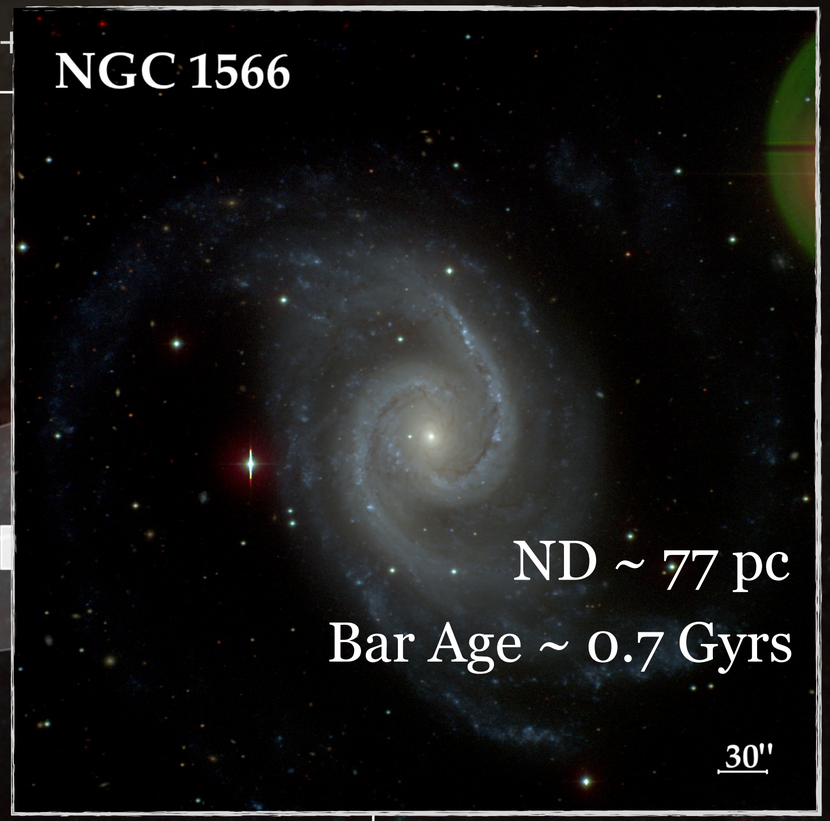
Gadotti+2019

Bar ages on the TIMER survey

Work in progress

de Sá-Freitas+ 2023b (subm)





$R_{kin}/R_{25.5}$

r = 0.522, p-value = 0.018

3 6 9 12

Bar age [Gyr]

Gadotti+2019

Bar ages on the TIMER survey

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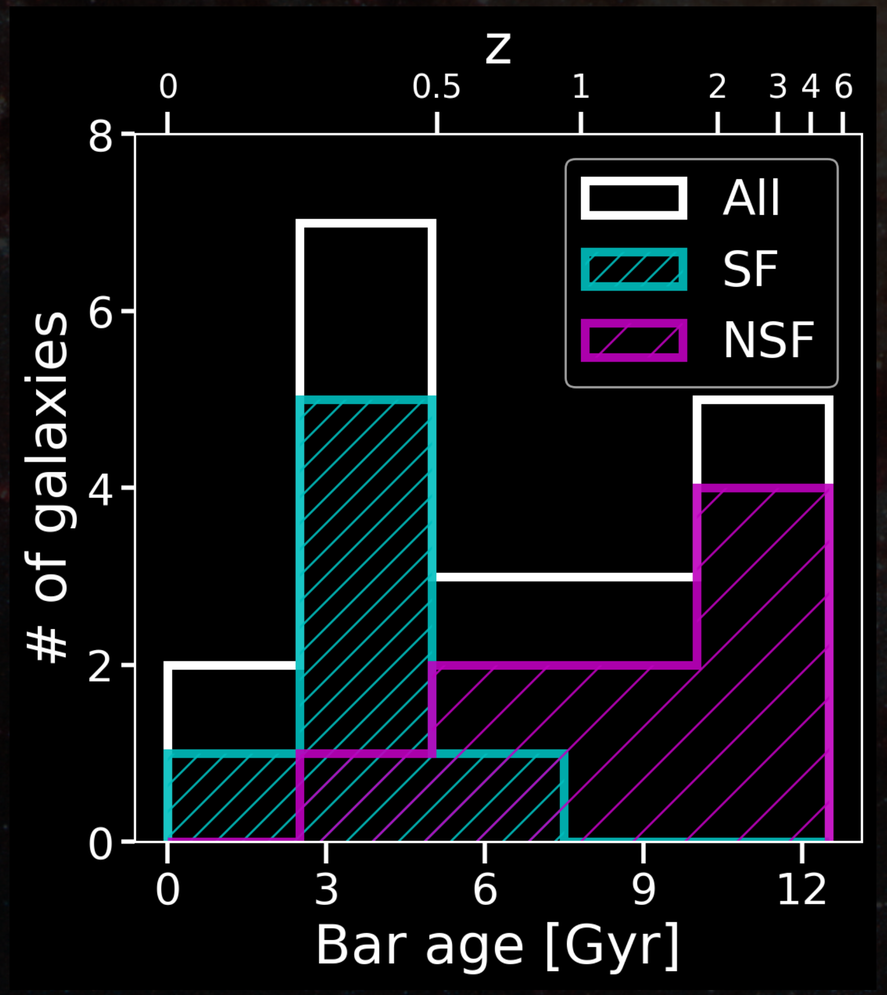
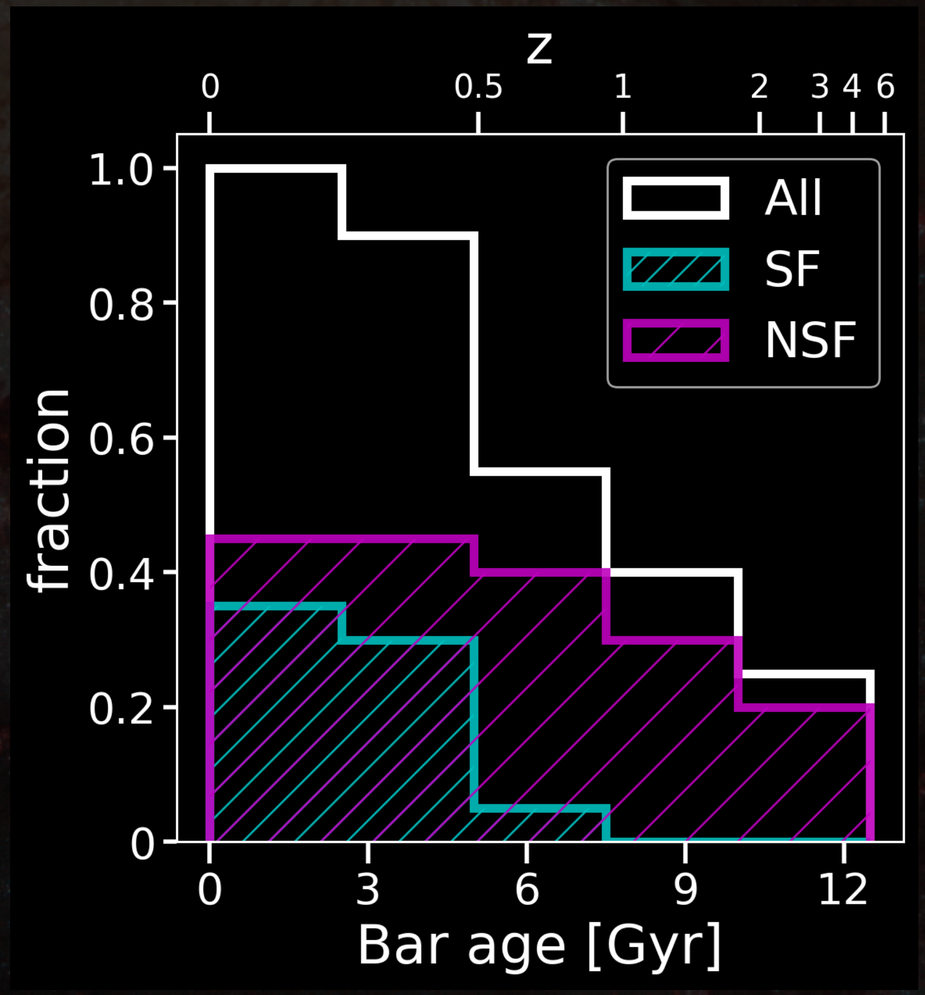




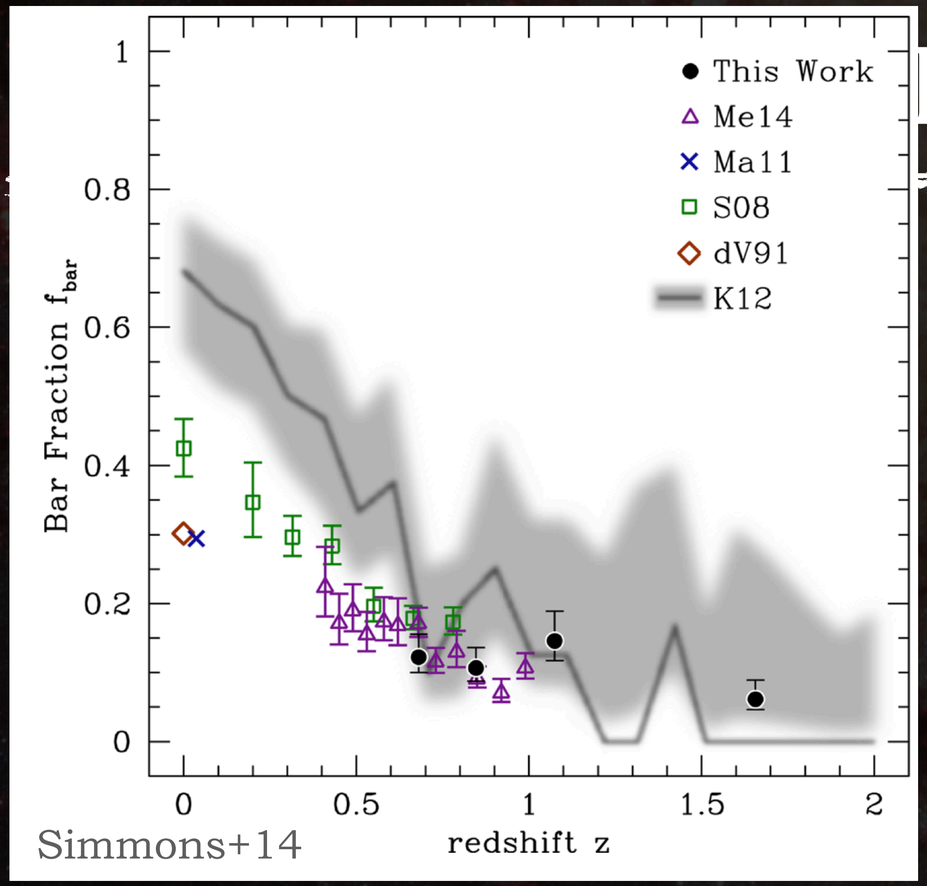
Star-forming nuclear discs

Bittner+2020

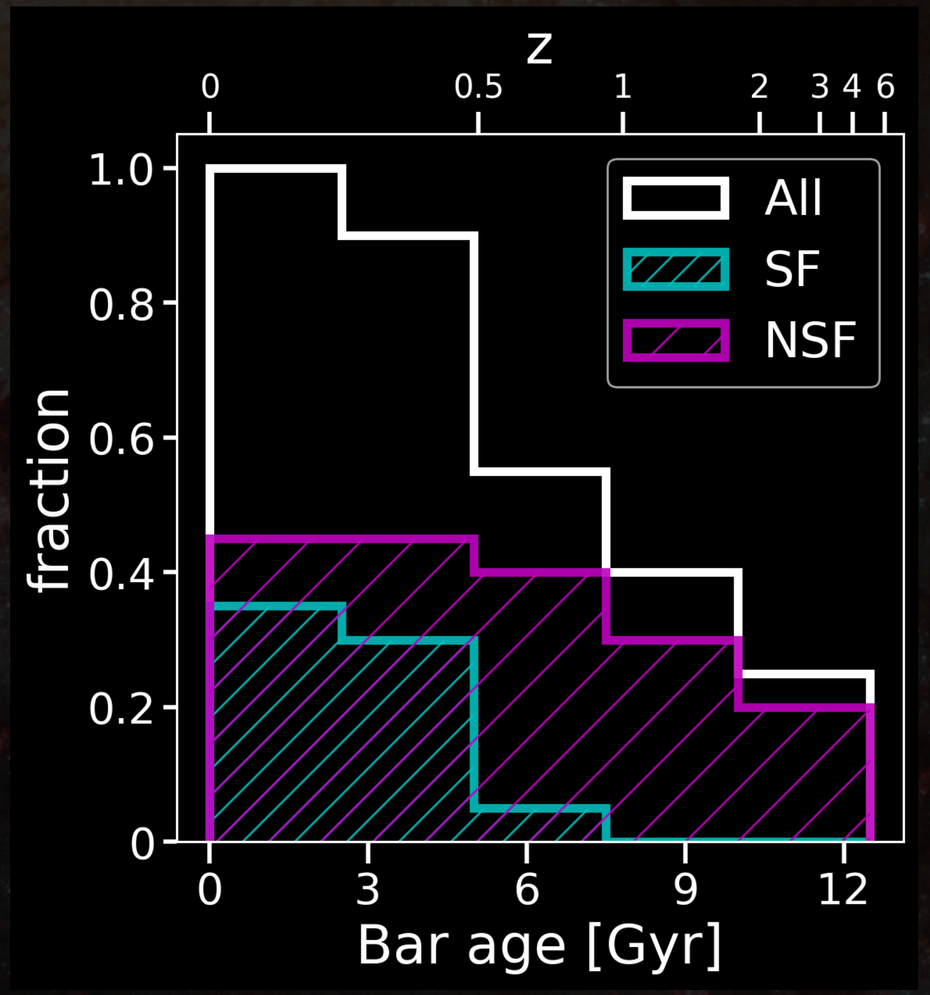
Non-star-forming nuclear discs

TIMER survey

Work in progress



de Sá-Freitas+ TIMER (in prep)



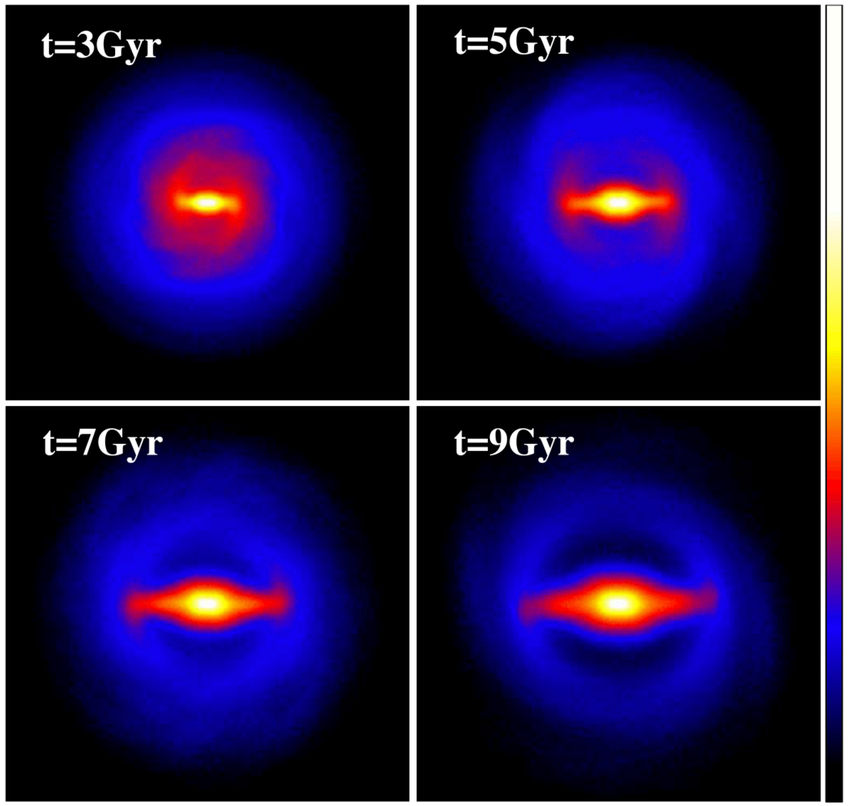
Star-forming nuclear discs

Non-star-forming nuclear discs

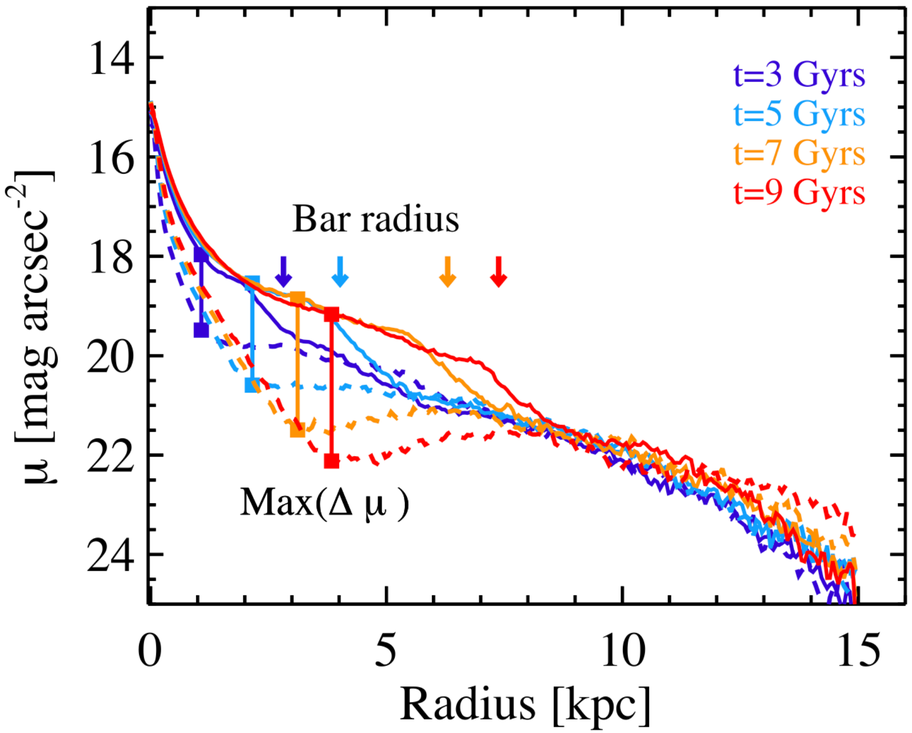
See Zoe Le Conte's talk tomorrow for bar fractions at z > 2

Bars capture stars from the disc

Work in progress



Kim+16, Athanassoula's Talk



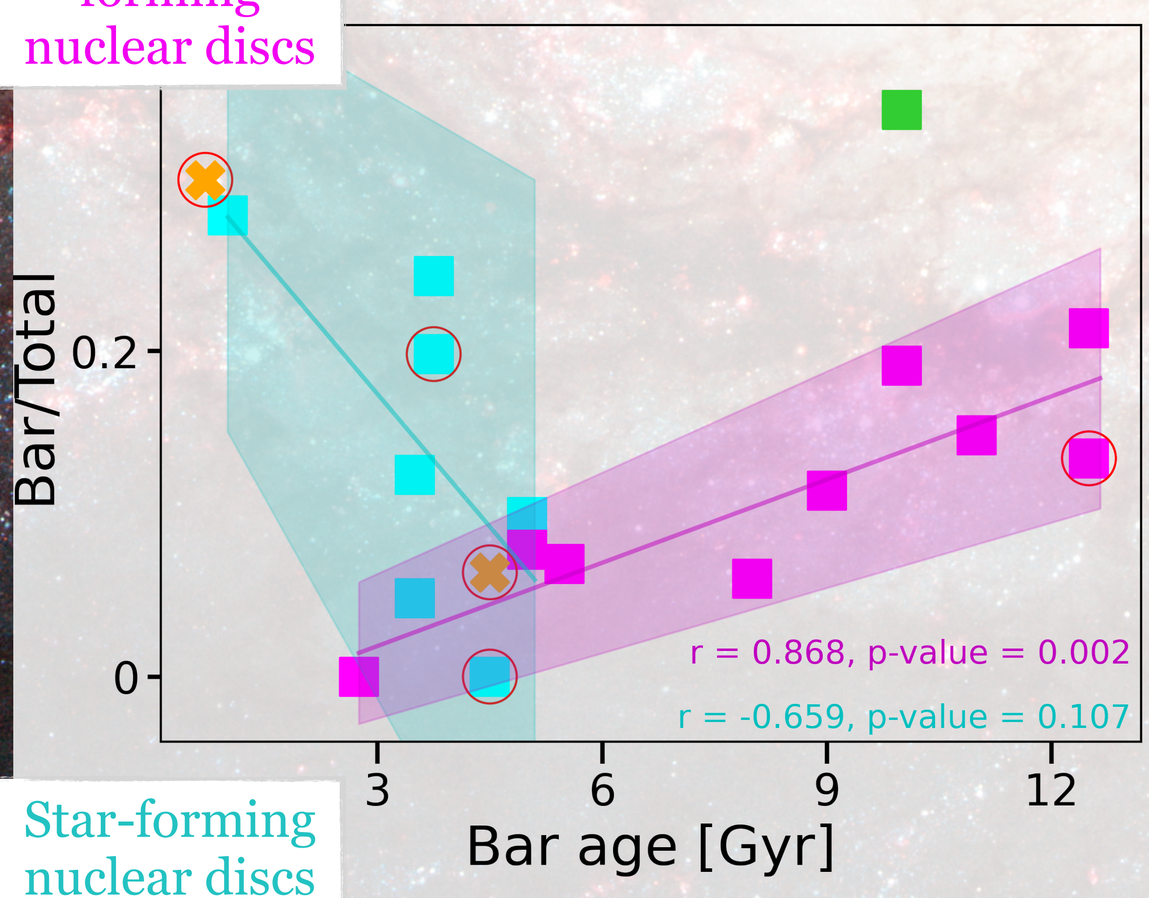
Bars capture stars from the disc

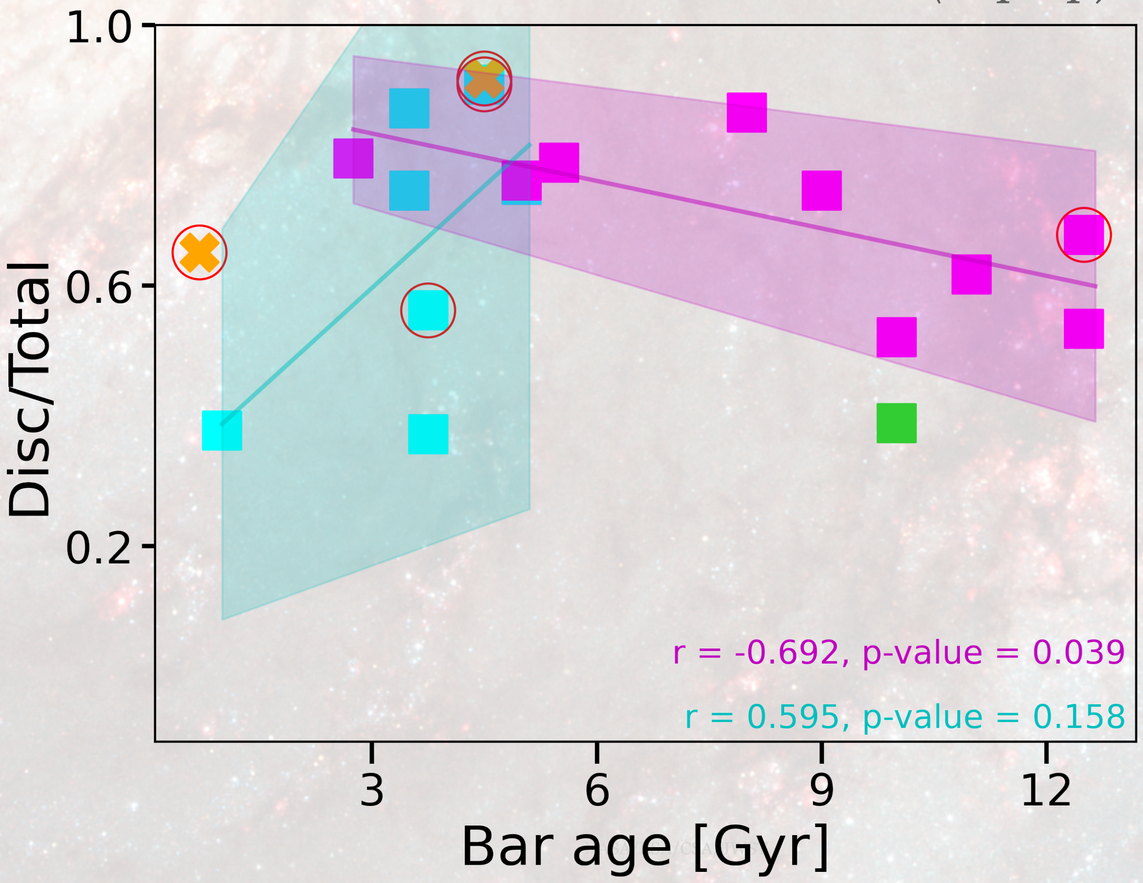
Work in progress

Non-star-forming nuclear discs

Star-forming nuclear discs

de Sá-Freitas+ TIMER (in prep)

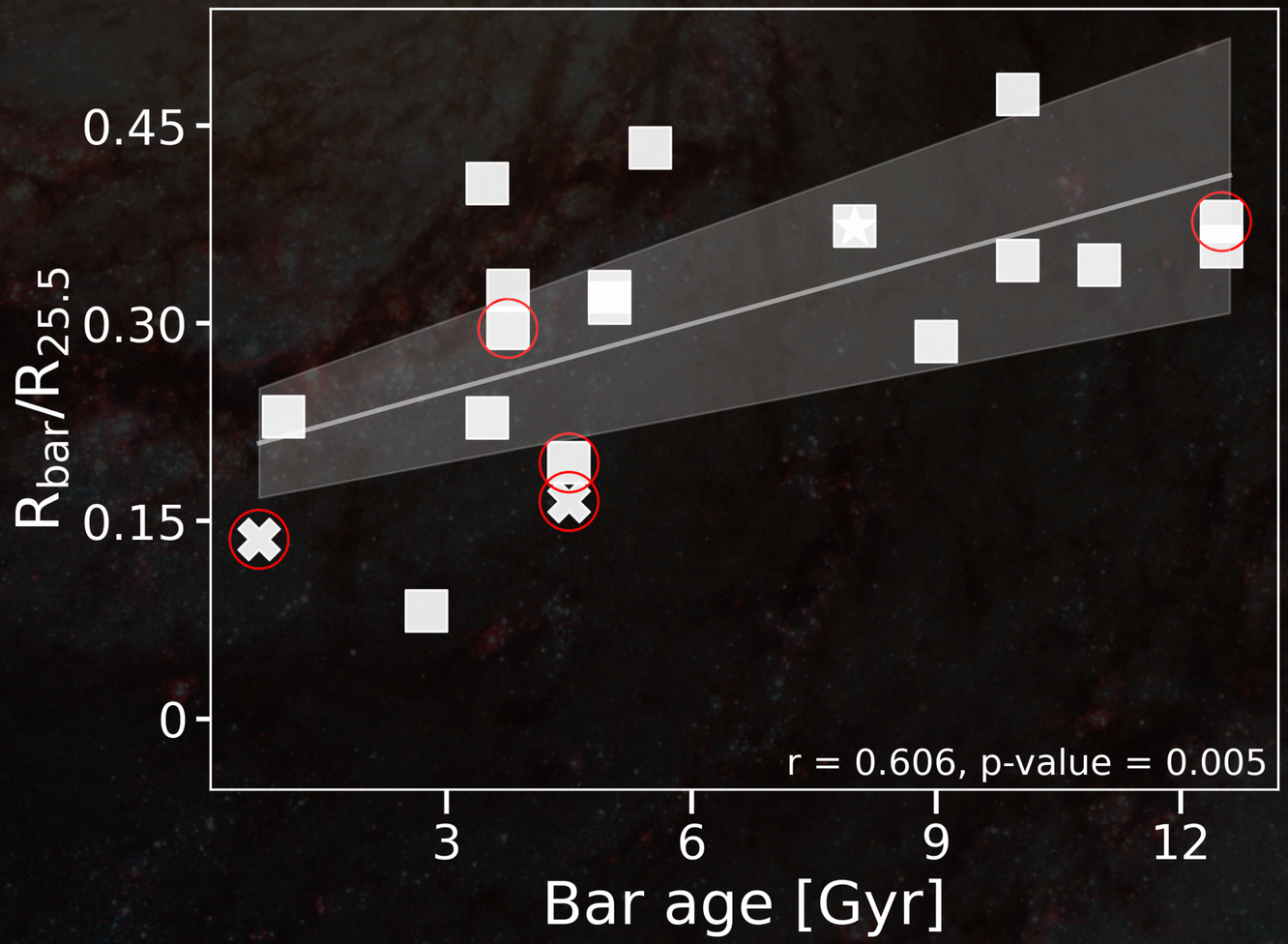




Do bars grow with time?

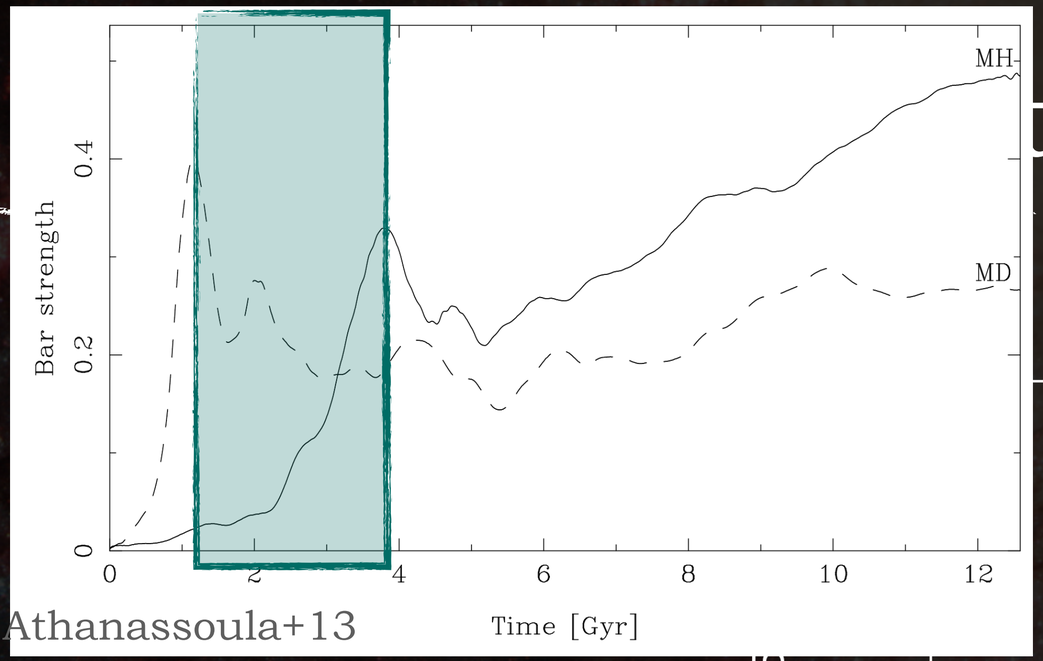
Work in progress

de Sá-Freitas+ TIMER (in prep)



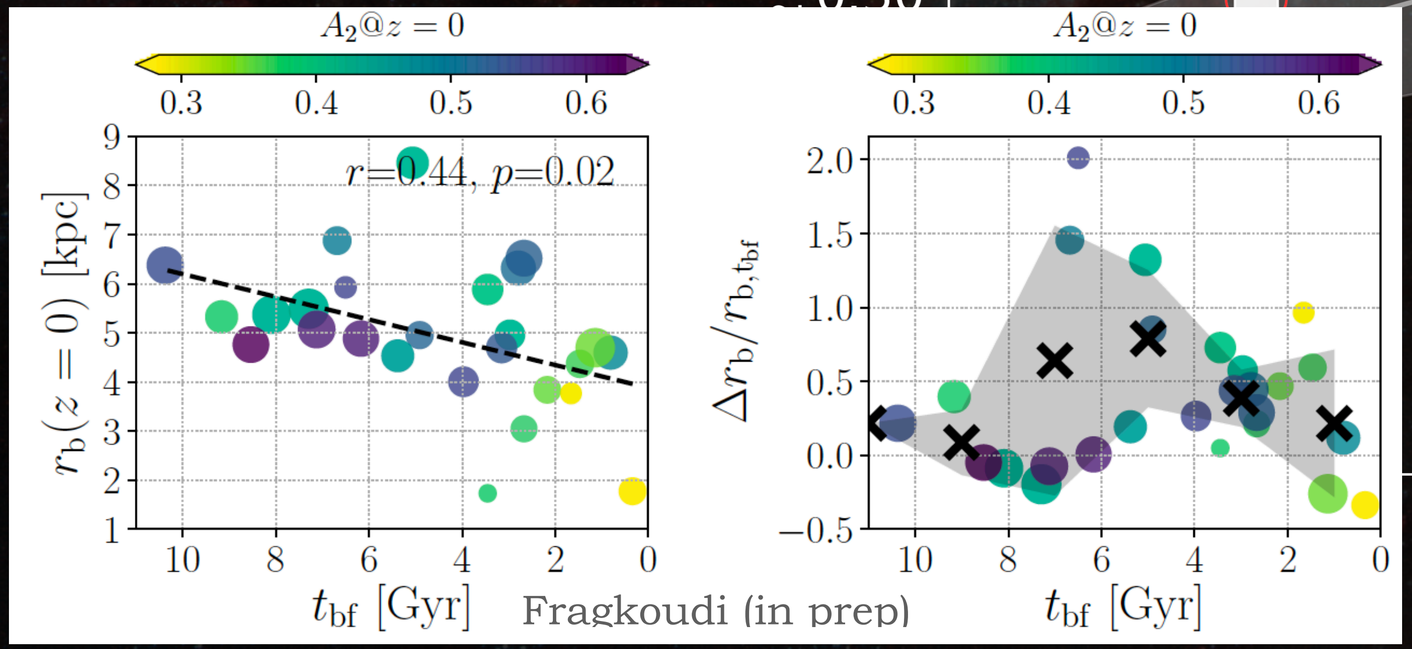
time?

Work in progress

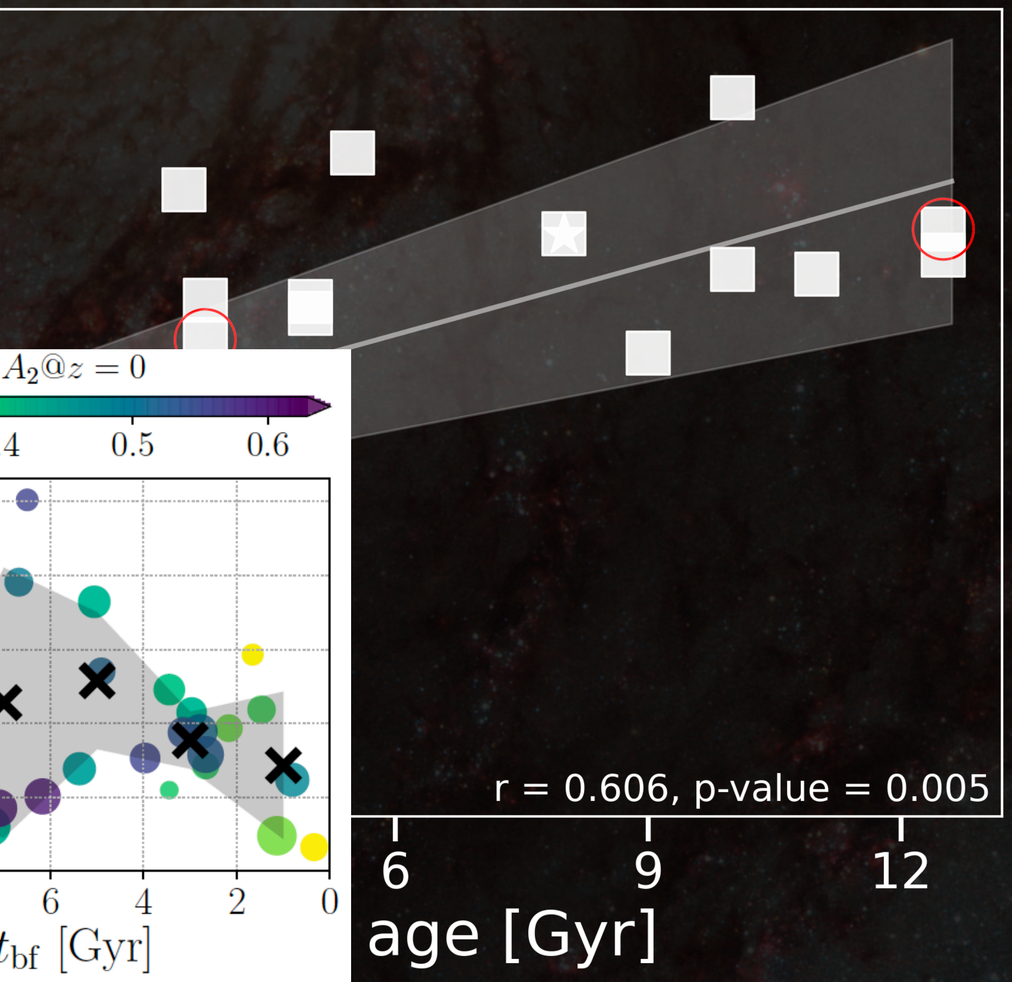


Athanassoula+13

de Sá-Freitas+ TIMER (in prep)



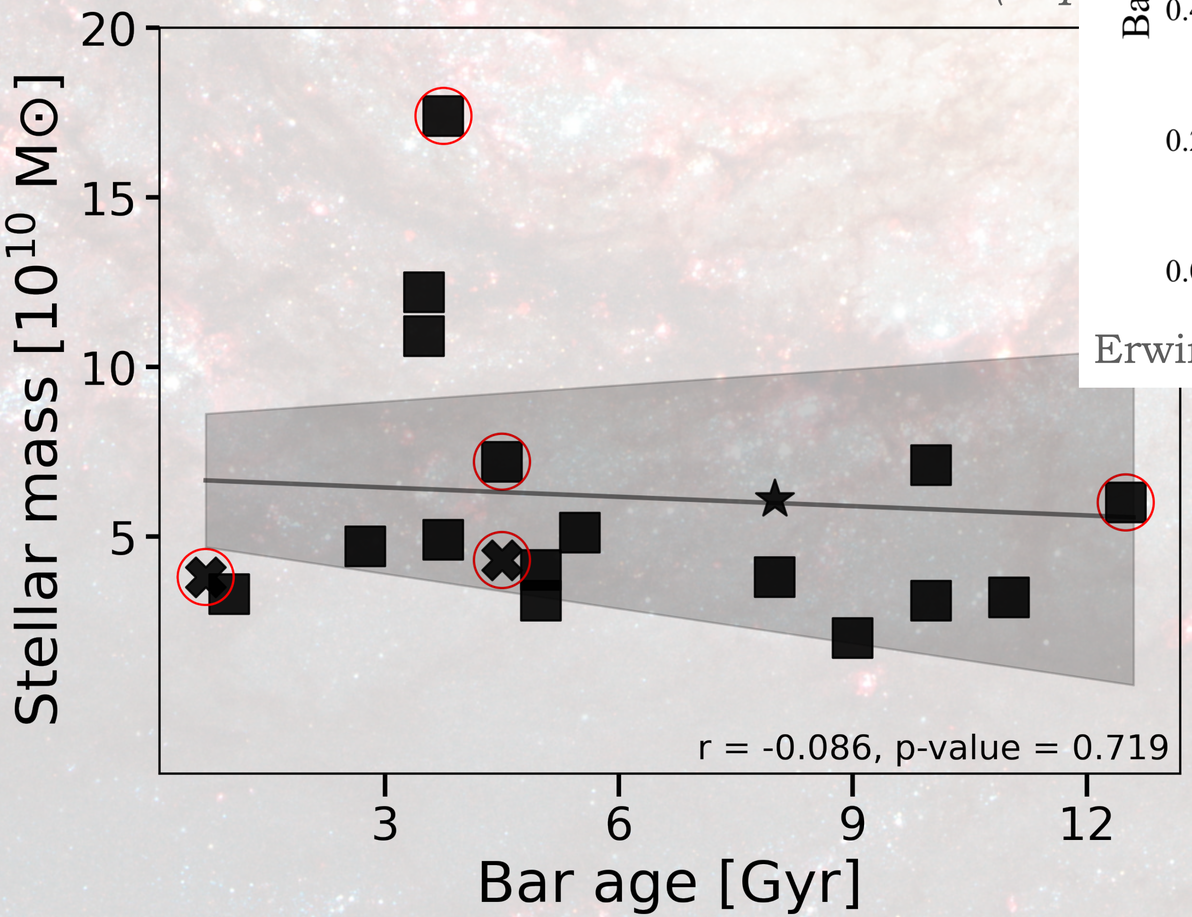
Fragkoudi (in prep)

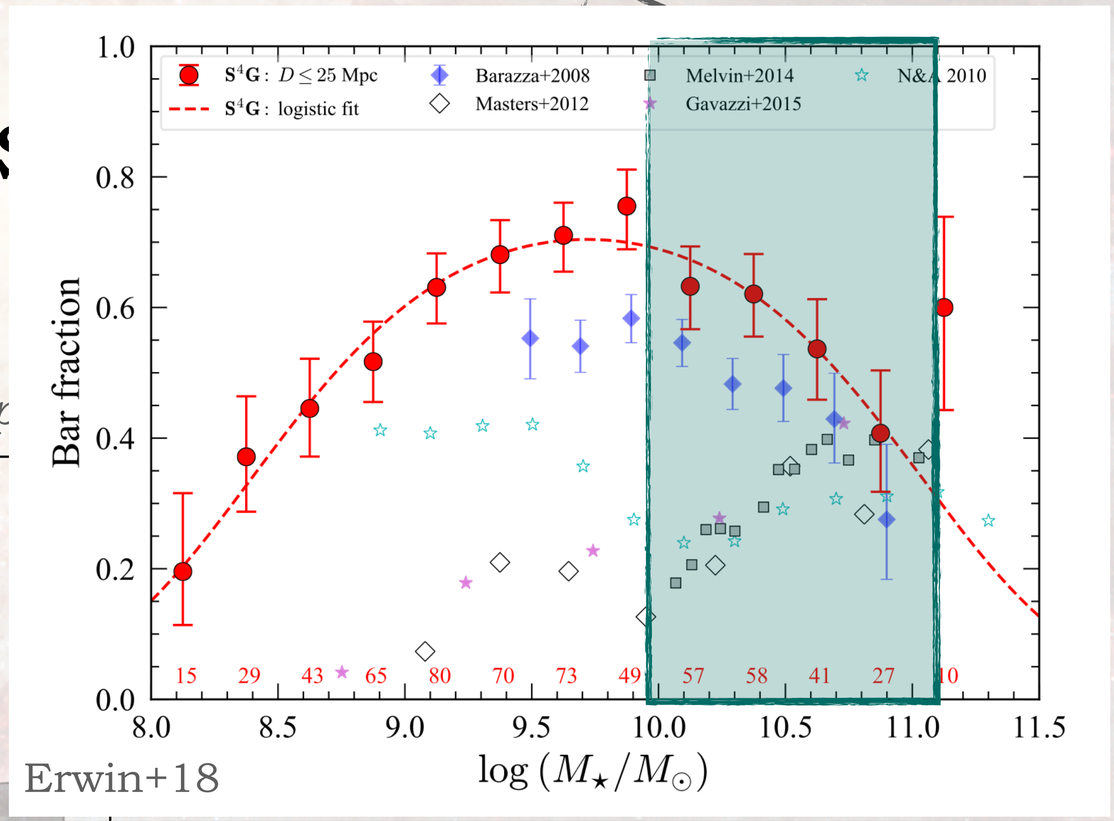


How old are bars? | Camila de Sá-Freitas

Bar formation: is mas

de Sá-Freitas+ TIMER (in p





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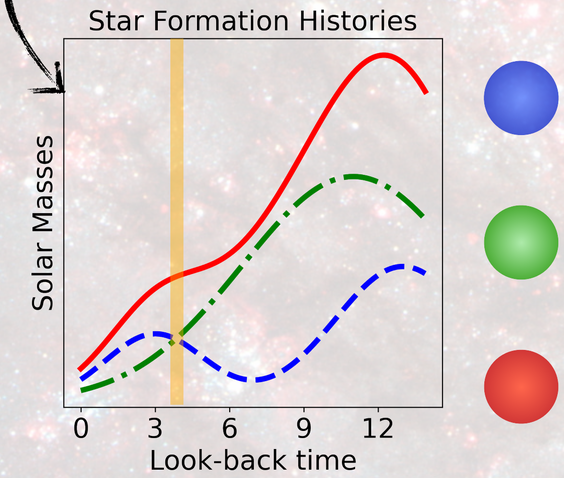
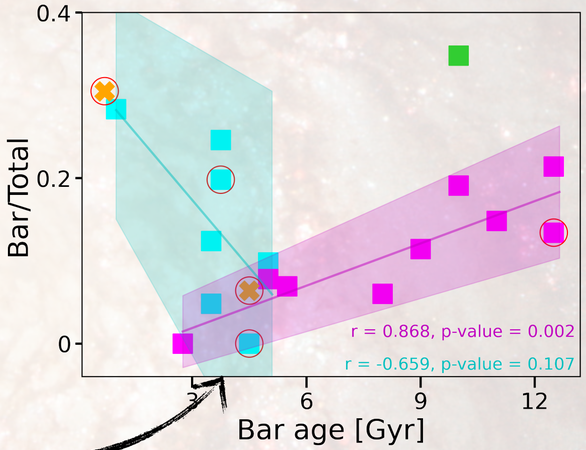
Take away messages

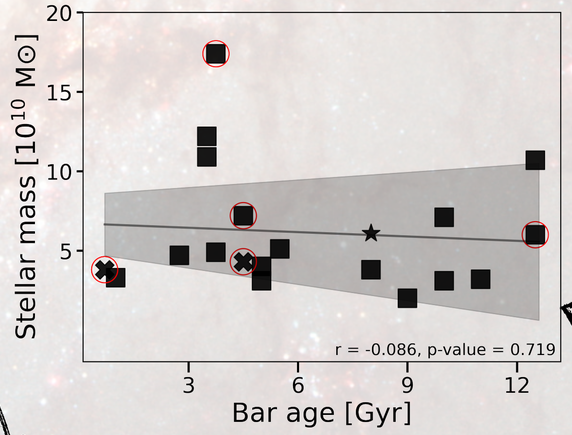
For how long?



How the bars affect their host galaxy?

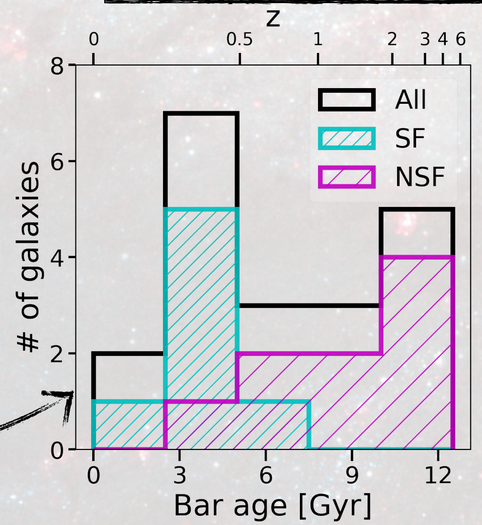


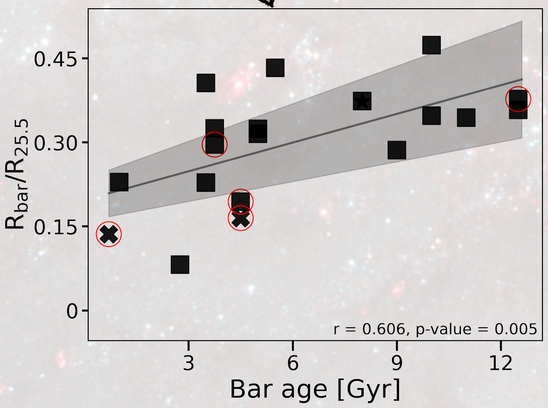
Do bars and bar-built structures grow?



What's next?

How old are bars observed in the Local Universe?





Are massive galaxies able to form bars earlier?

How old are bars?

Determining the cosmic epoch of bar formation using archeological data of nearby galaxies

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