Tracing the MW spiral arms with ^{26}Al:

the role of novae in the 2D distribution of ^{26}Al

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Outline

Introduction: Aim of the study

- What do we want to do?
- Why?

2D Chemical Evolution Model: Spitoni+19, 23, Vasini+22,+24

- Parameters and assumptions
- 2D results: SFR, novae and ^{26}Al

Conclusions

Aim: what do we want to do?

We want to study in a more detailed way the distribution of ^{26}Al in the Milky Way

^{26}Al is a tracer of the star formation: lifetime of $\sim 1\ Myr$, produced by massive stars

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Chemical evolution of ^{26}Al and ^{60}Fe in the Milky Way

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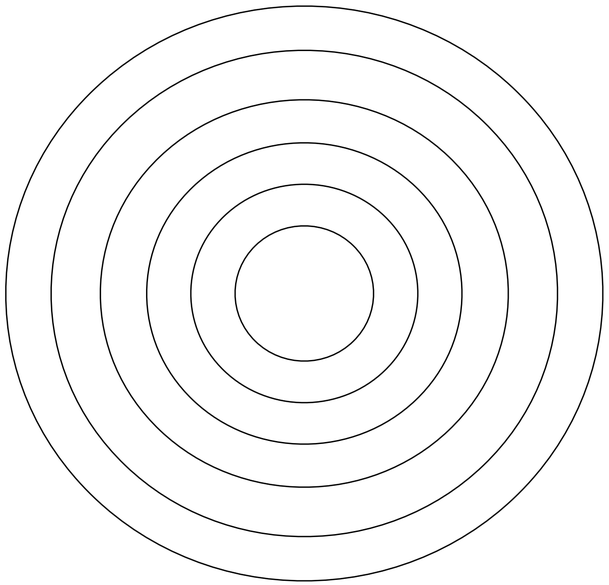

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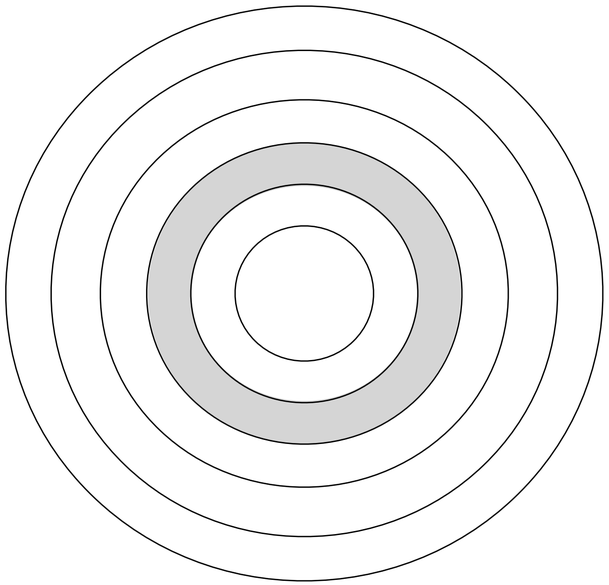

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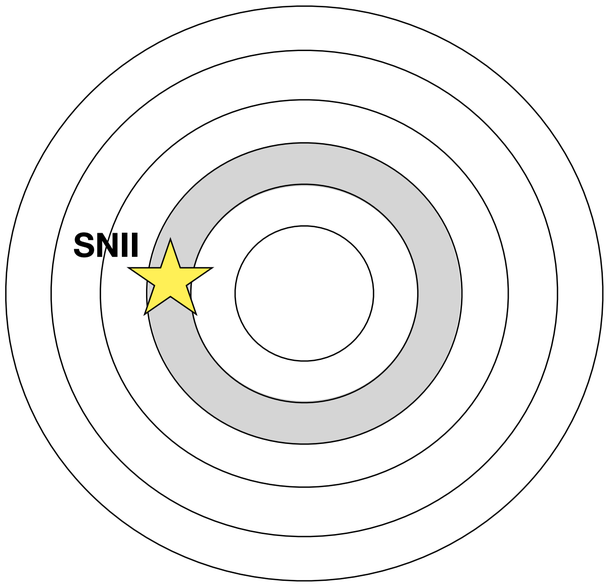

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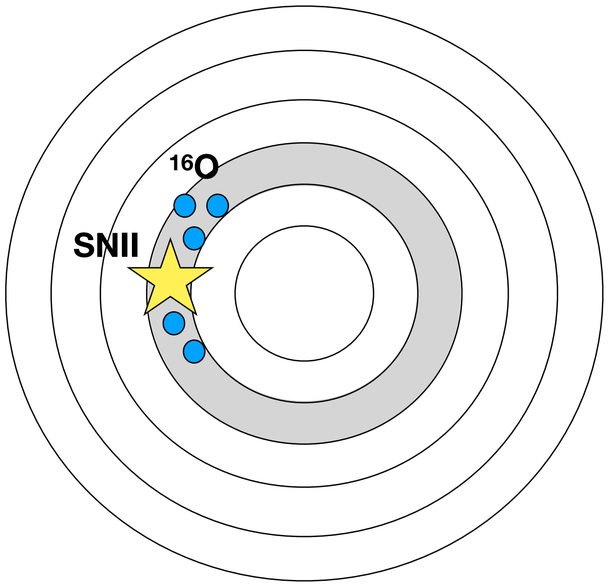

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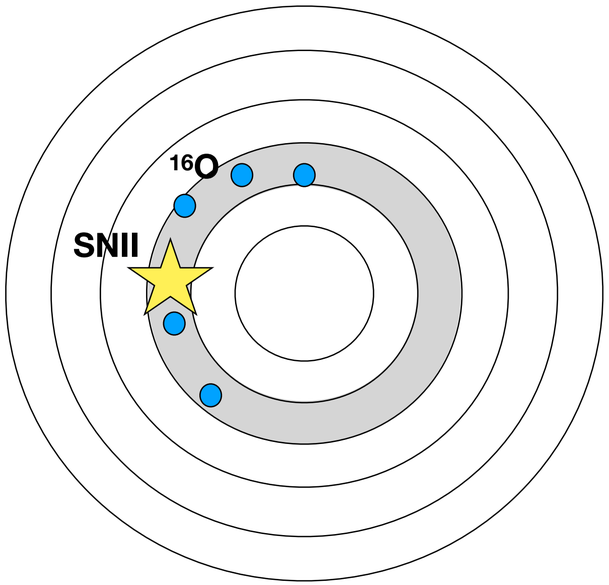

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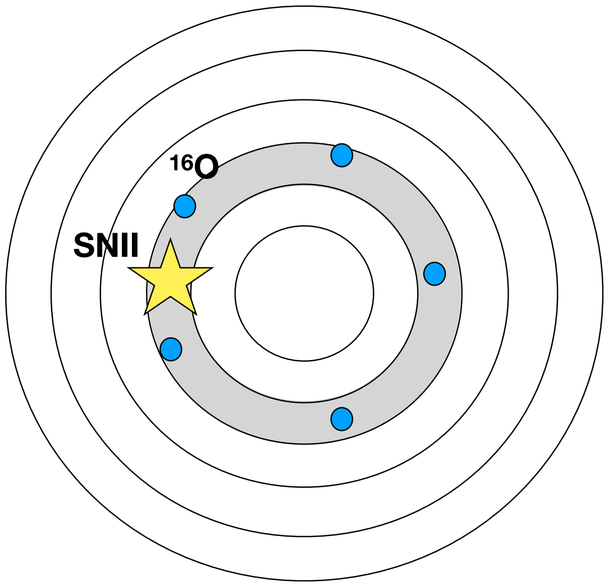

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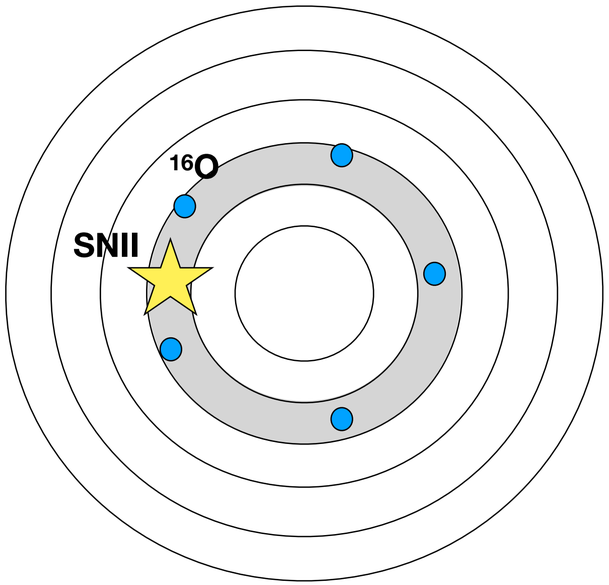

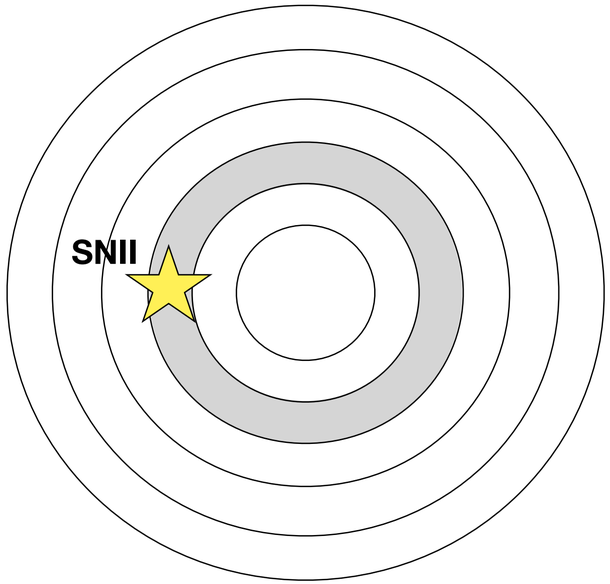

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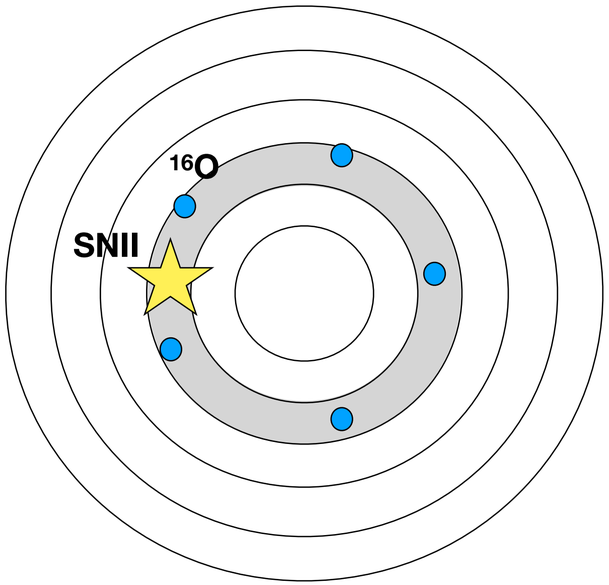

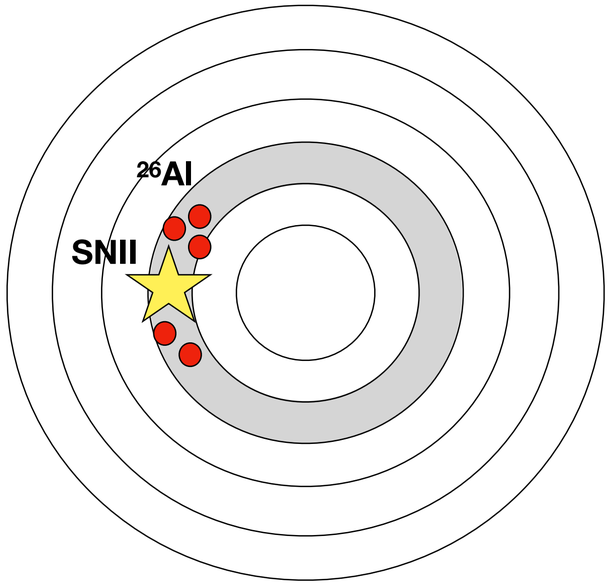

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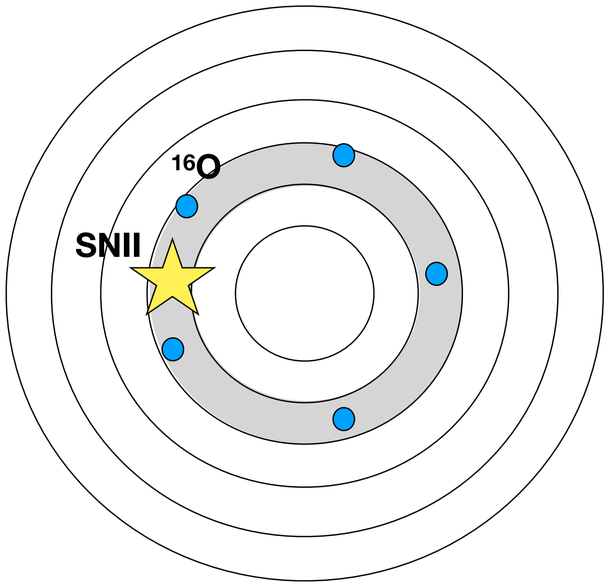

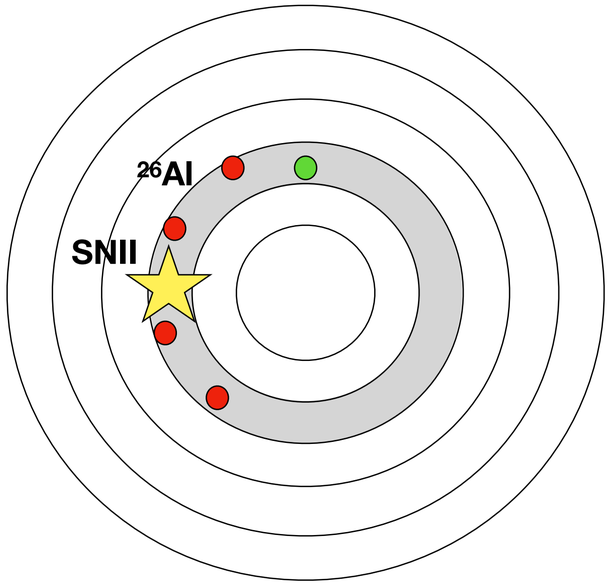

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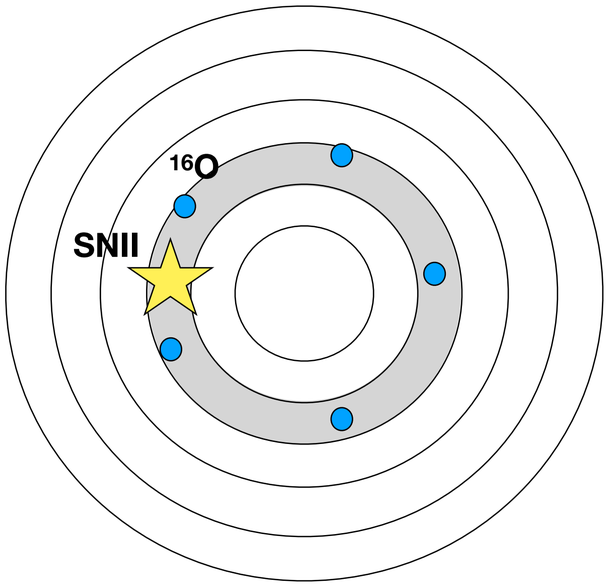

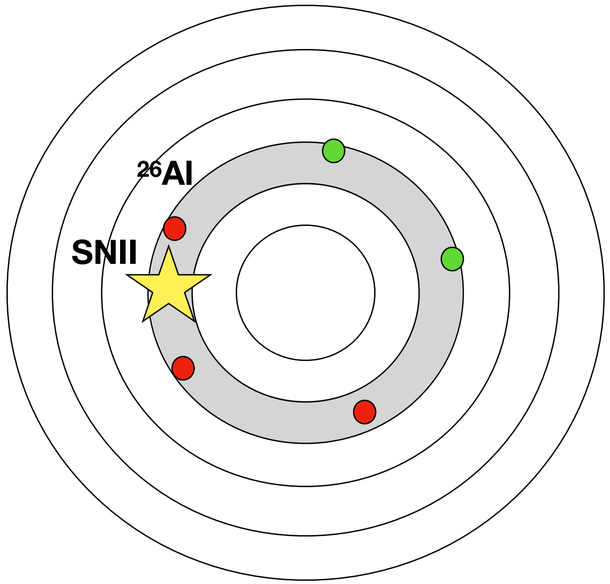

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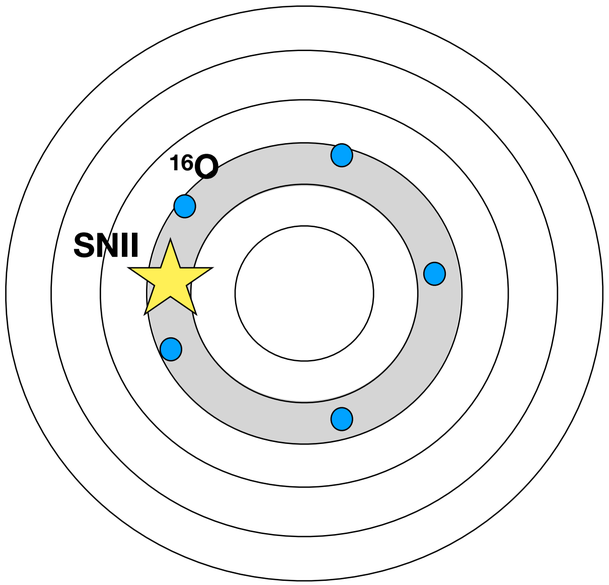

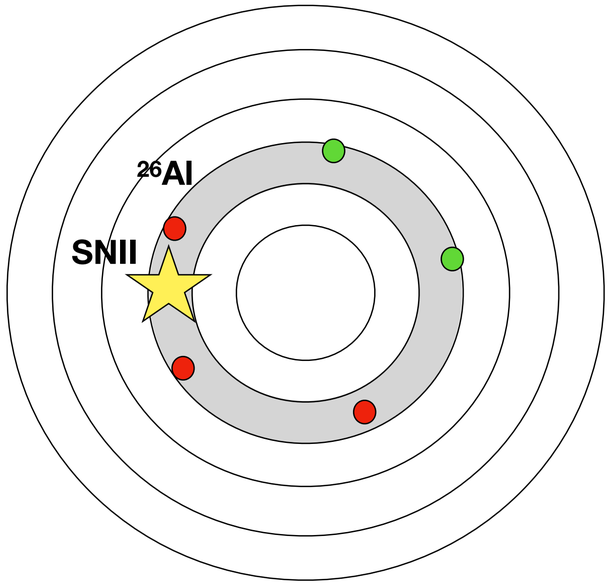

→ homogeneous mixing does not hold for Short Lived Radioisotopes: 2D model needed

Aim: why?

Spitoni+2019,+2023: 2D model can trace the alpha-element abundance oscillations in an annulus

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Nova systems contribute too:
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Model: prescriptions from Vasini+22 and Spitoni+23

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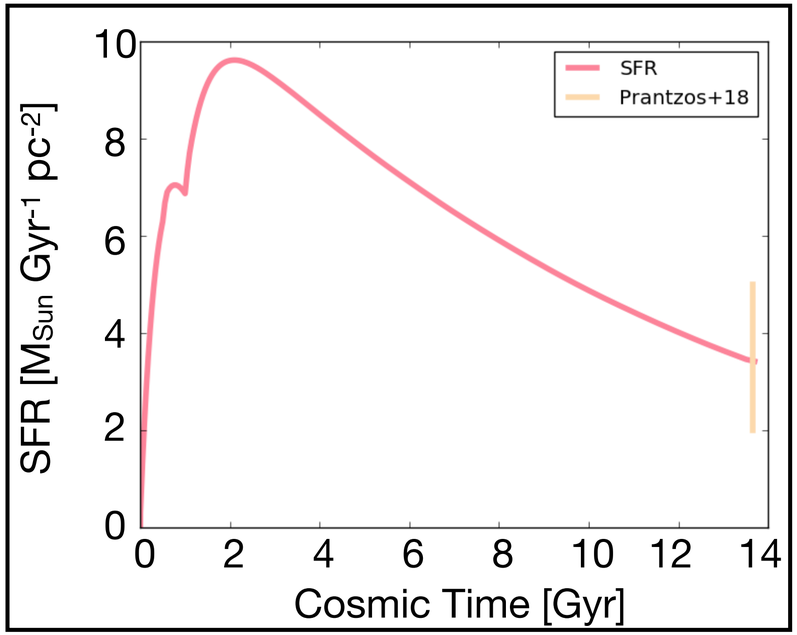

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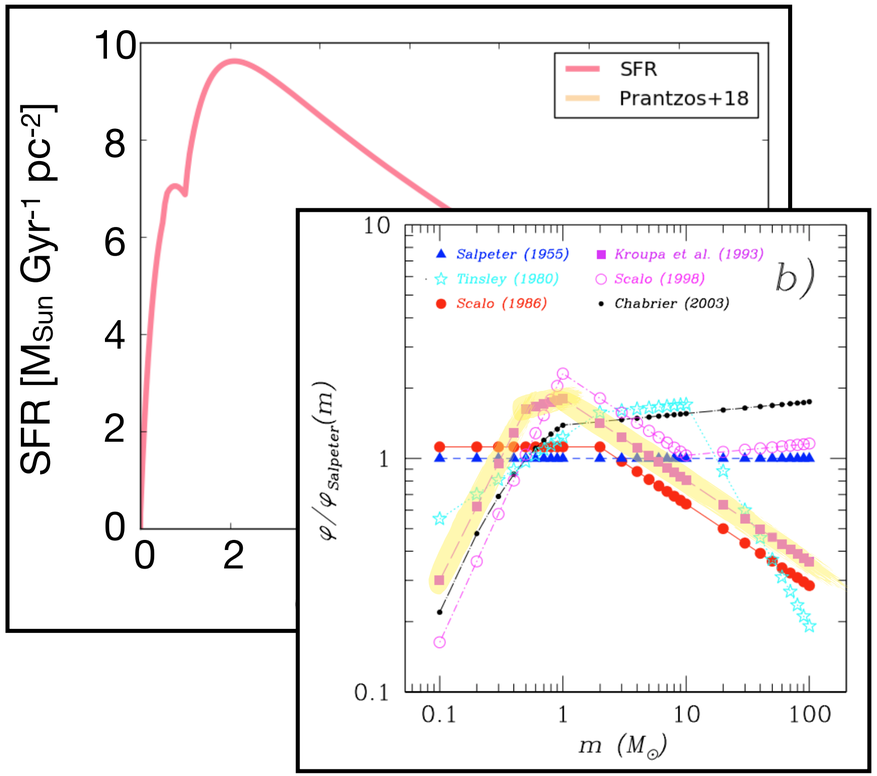

Romano+05

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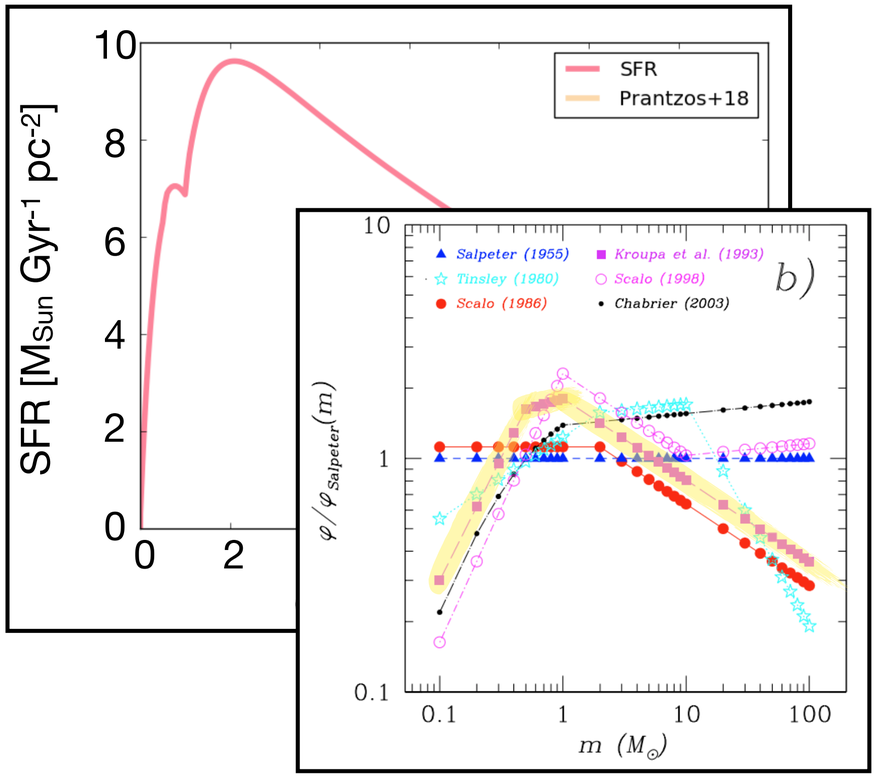

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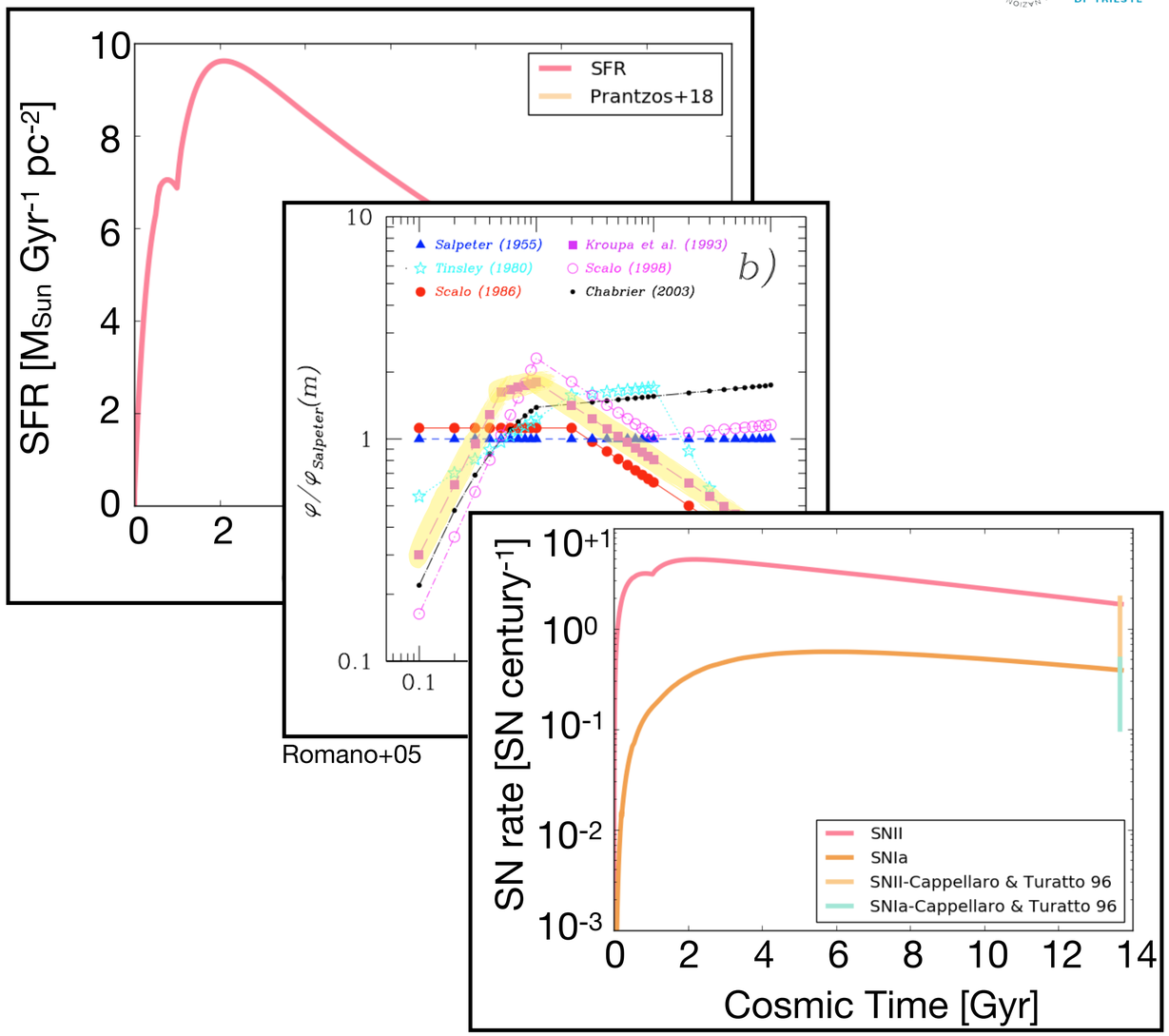

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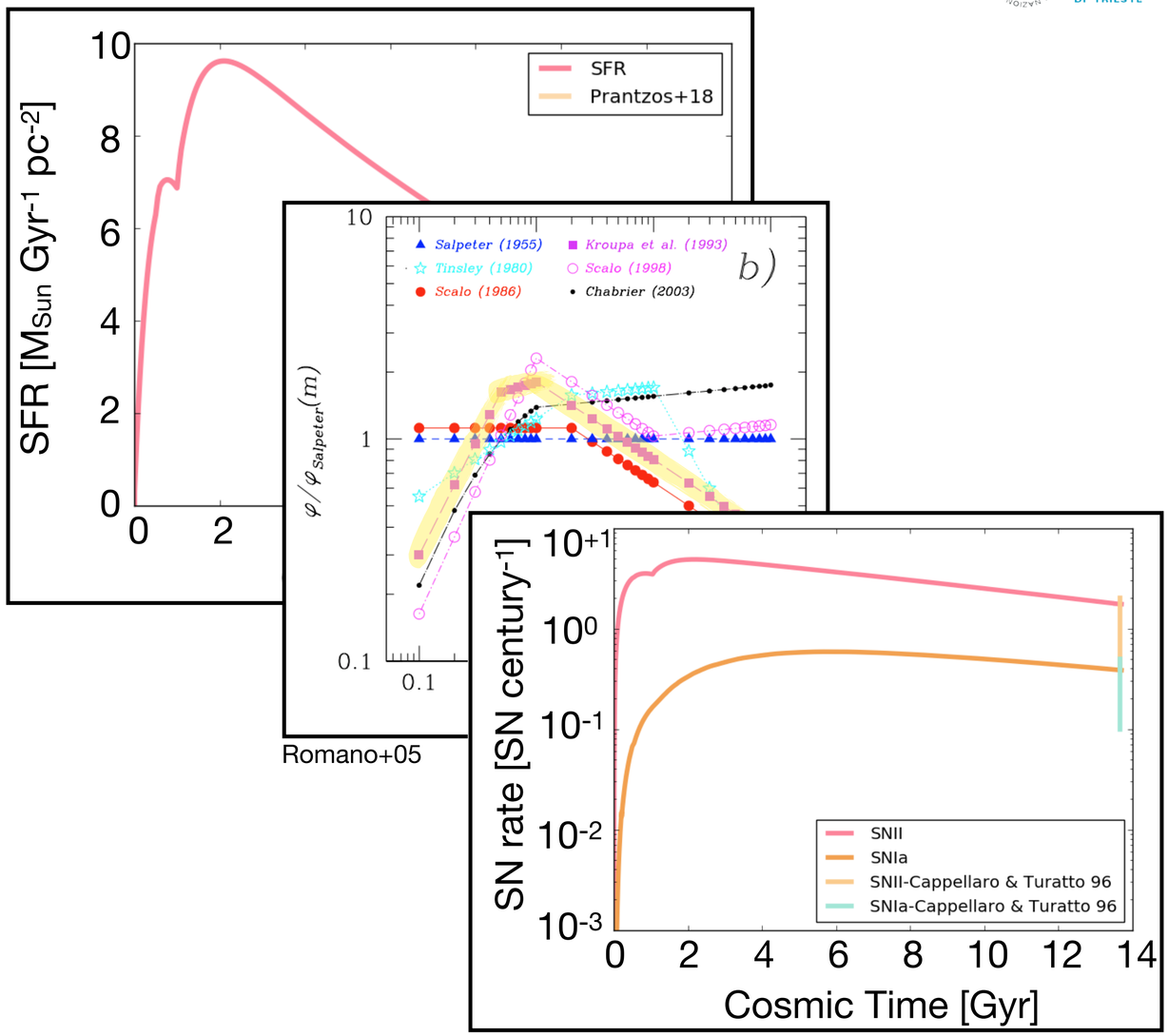

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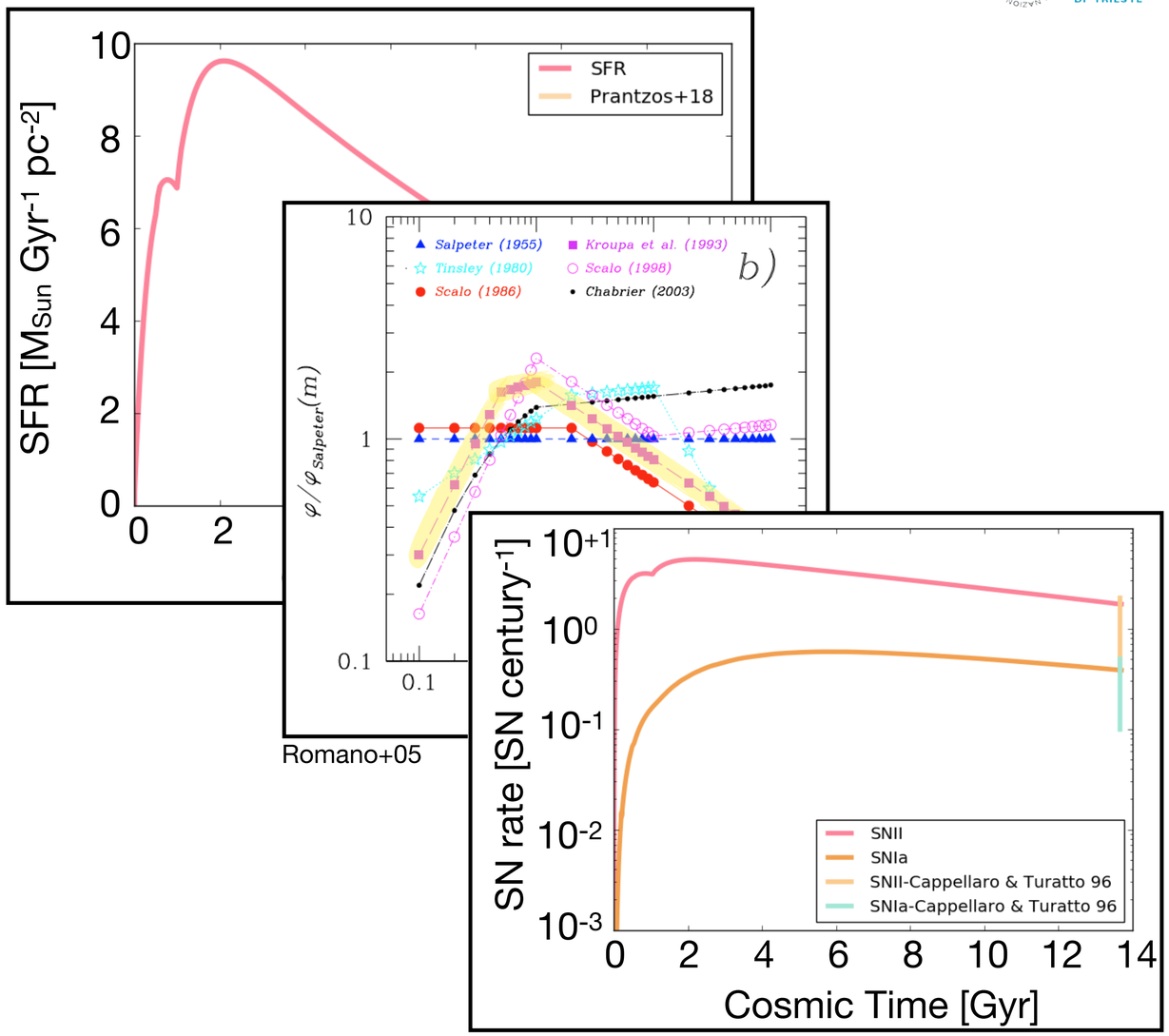

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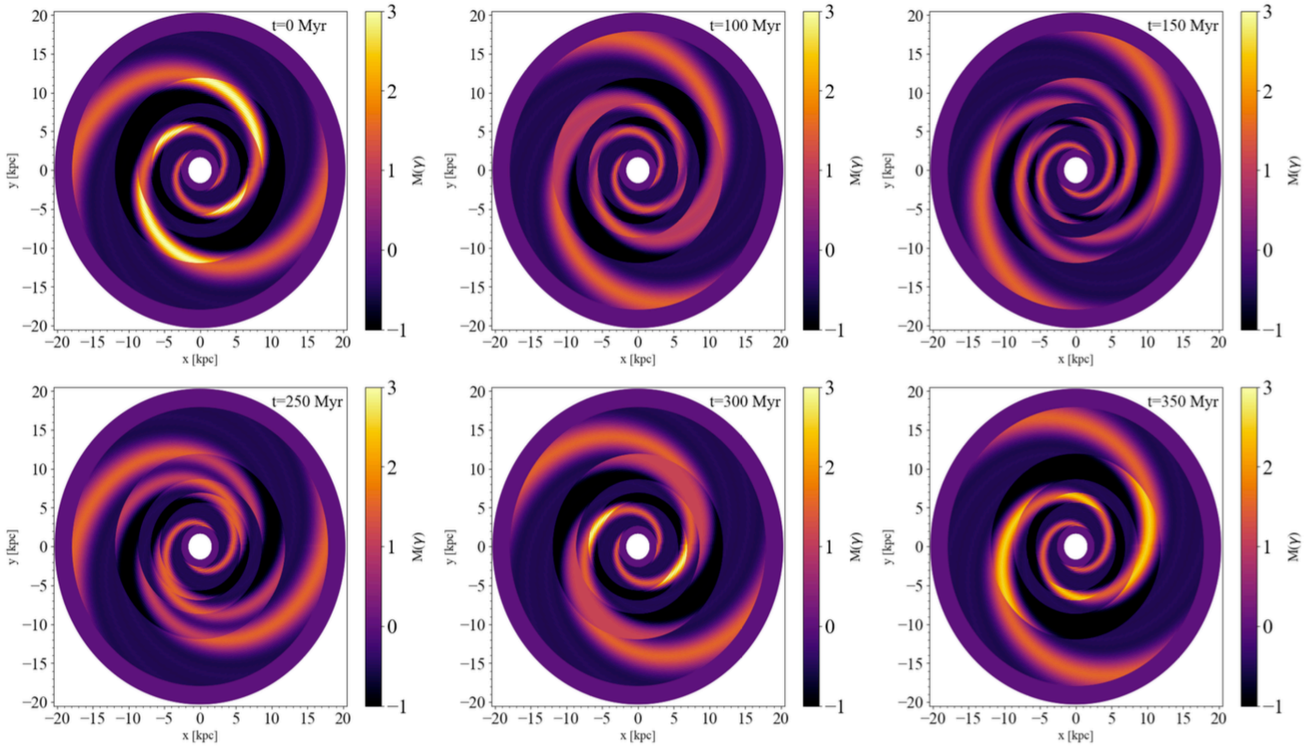

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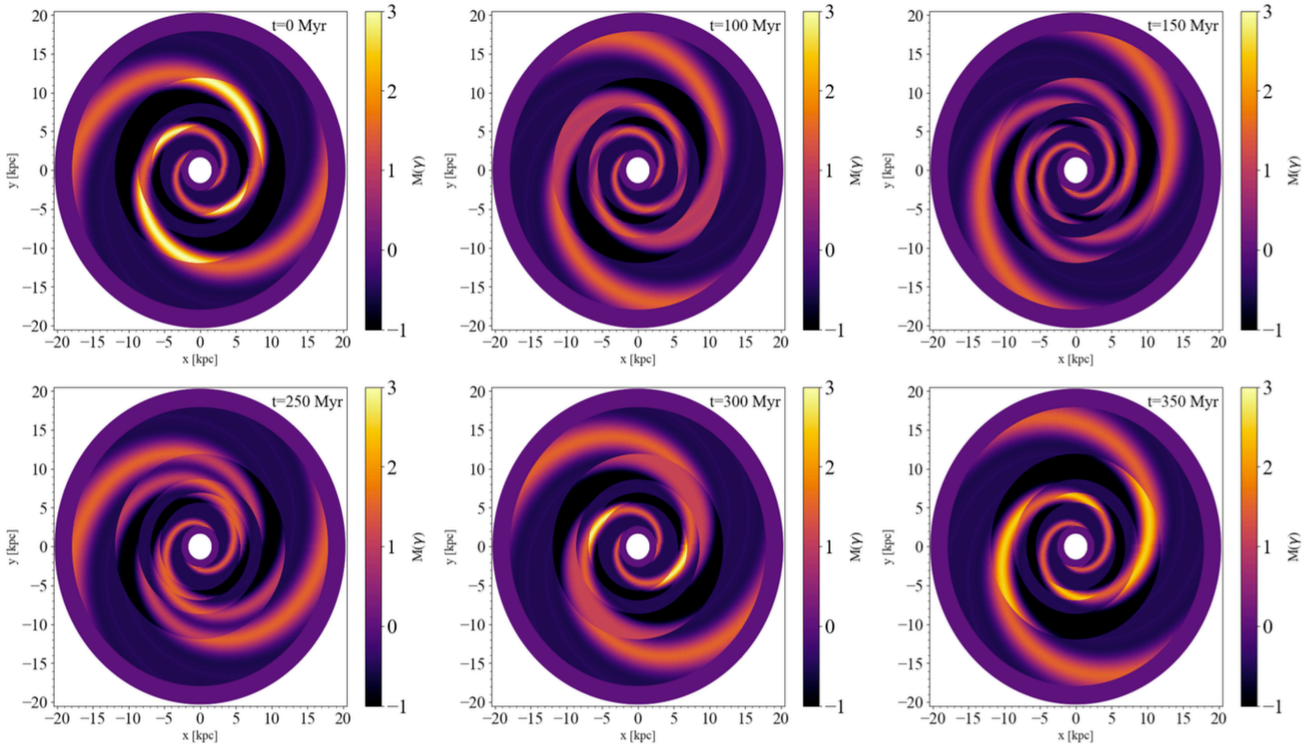
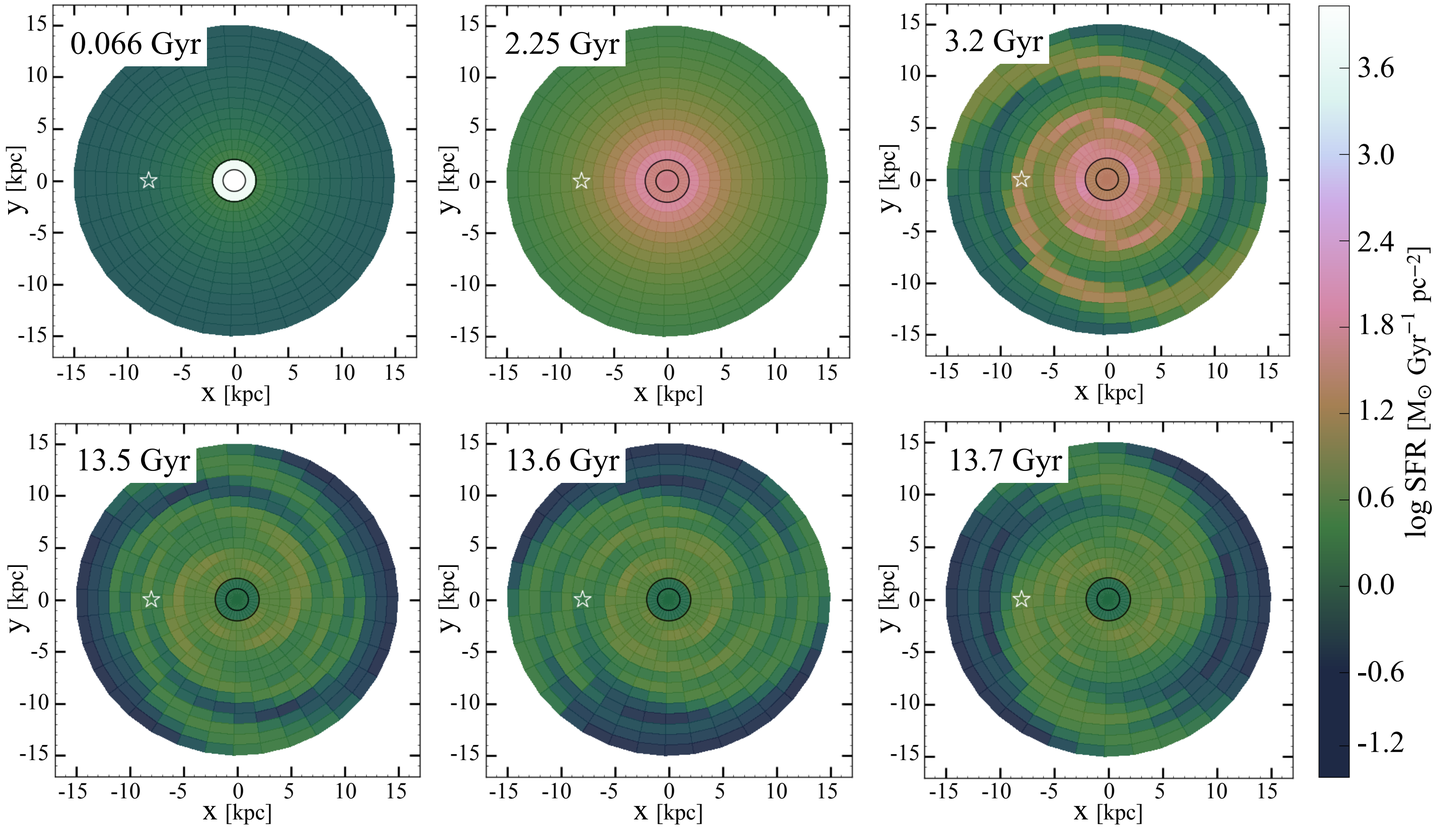
3. Apply the modulation function to the SFR

$$\psi(R,\phi,t) \longrightarrow \psi(R,t)M(\phi)$$

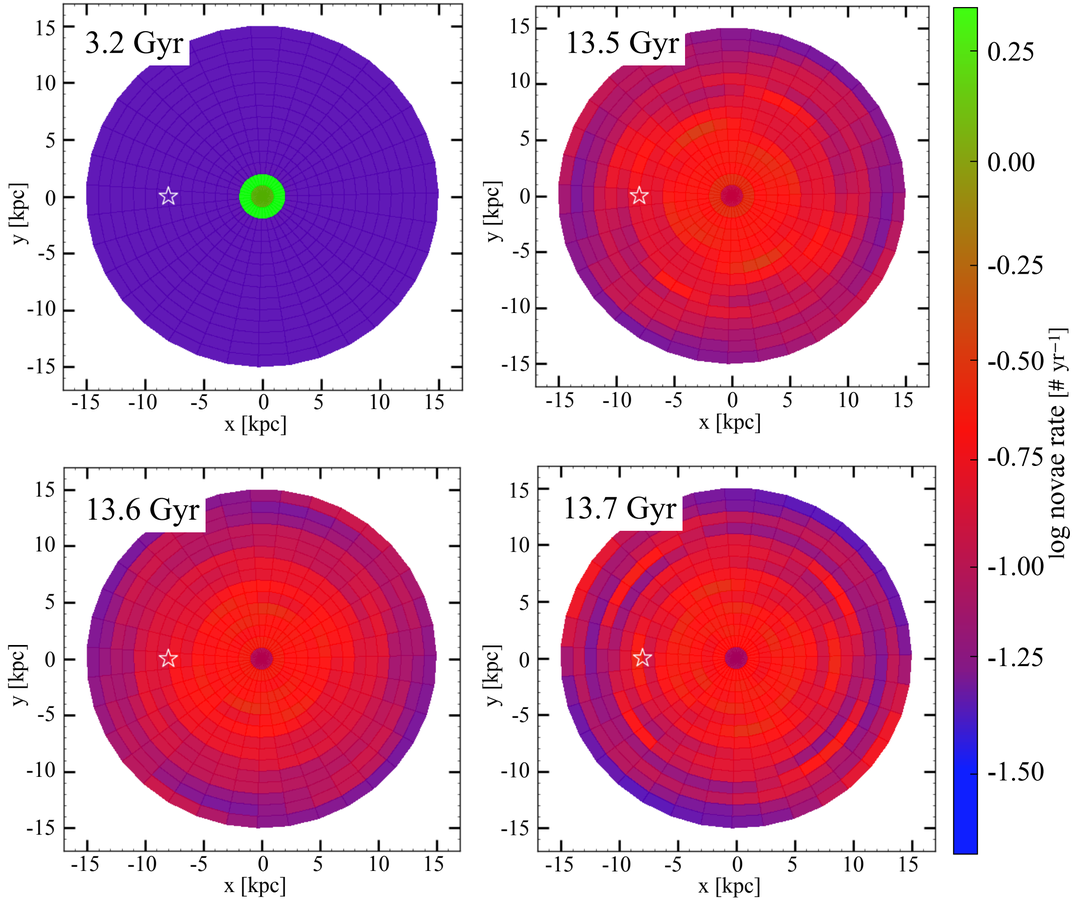


Results: SFR and nova rate distribution

SFR

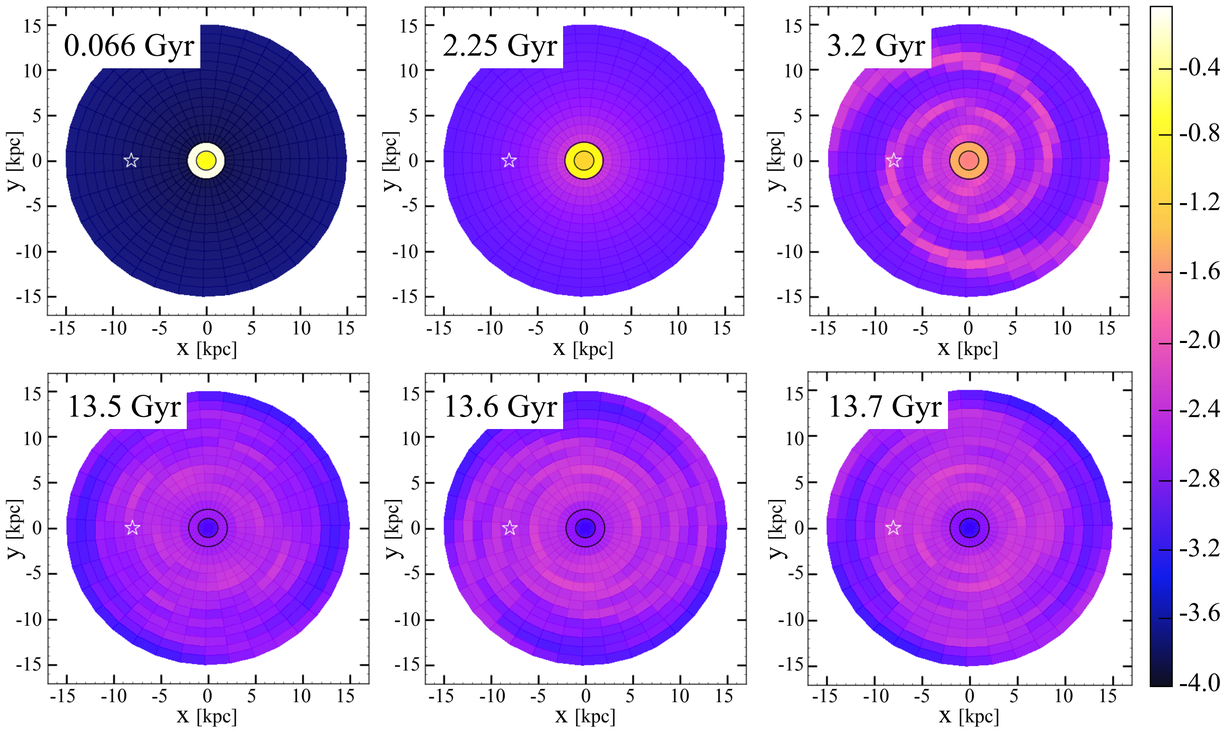


Novae outbursts

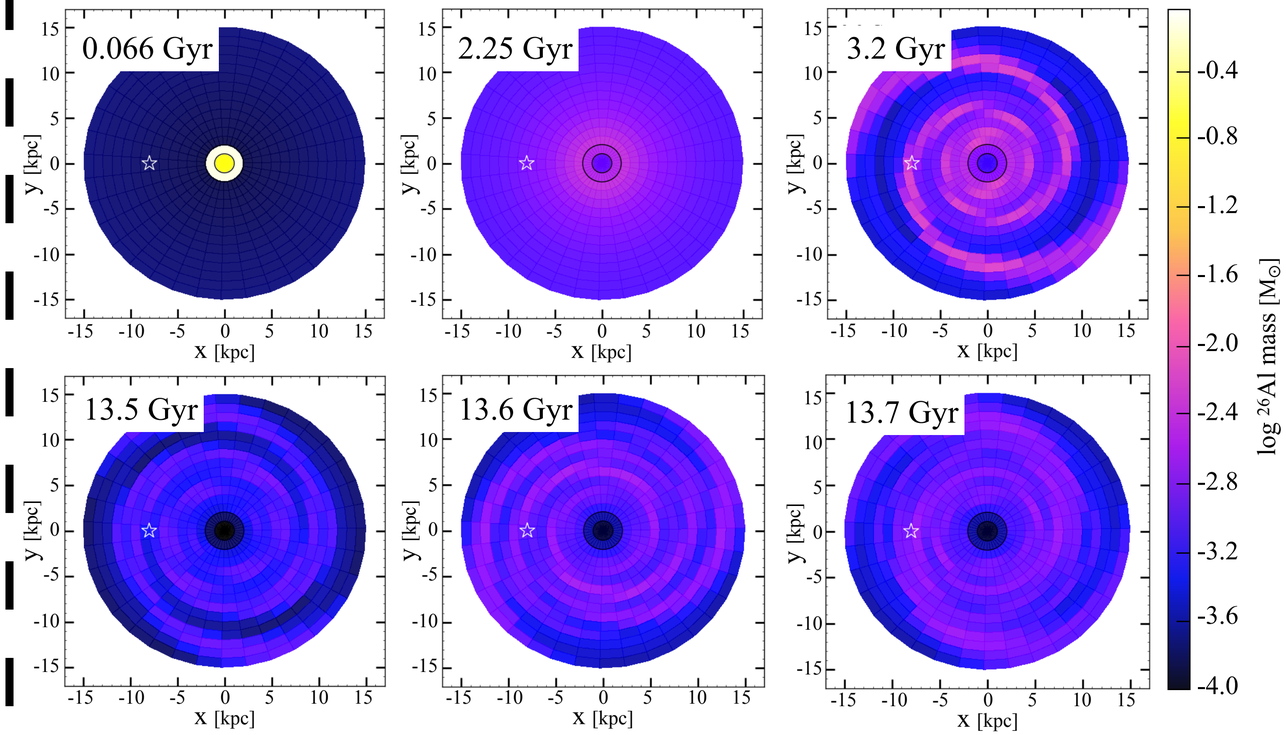


Results: ^{26}Al distribution - with or without novae

M1: ^{26}Al from massive stars + novae



M2: ^{26}Al from massive stars only



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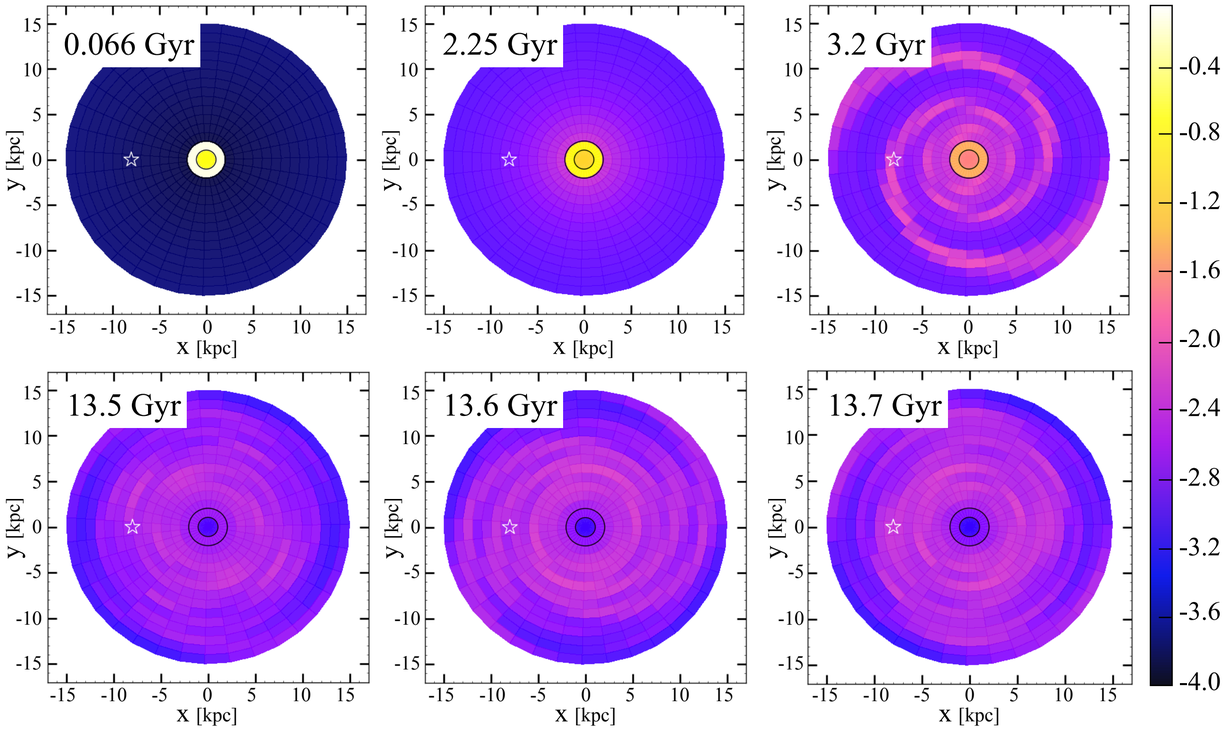

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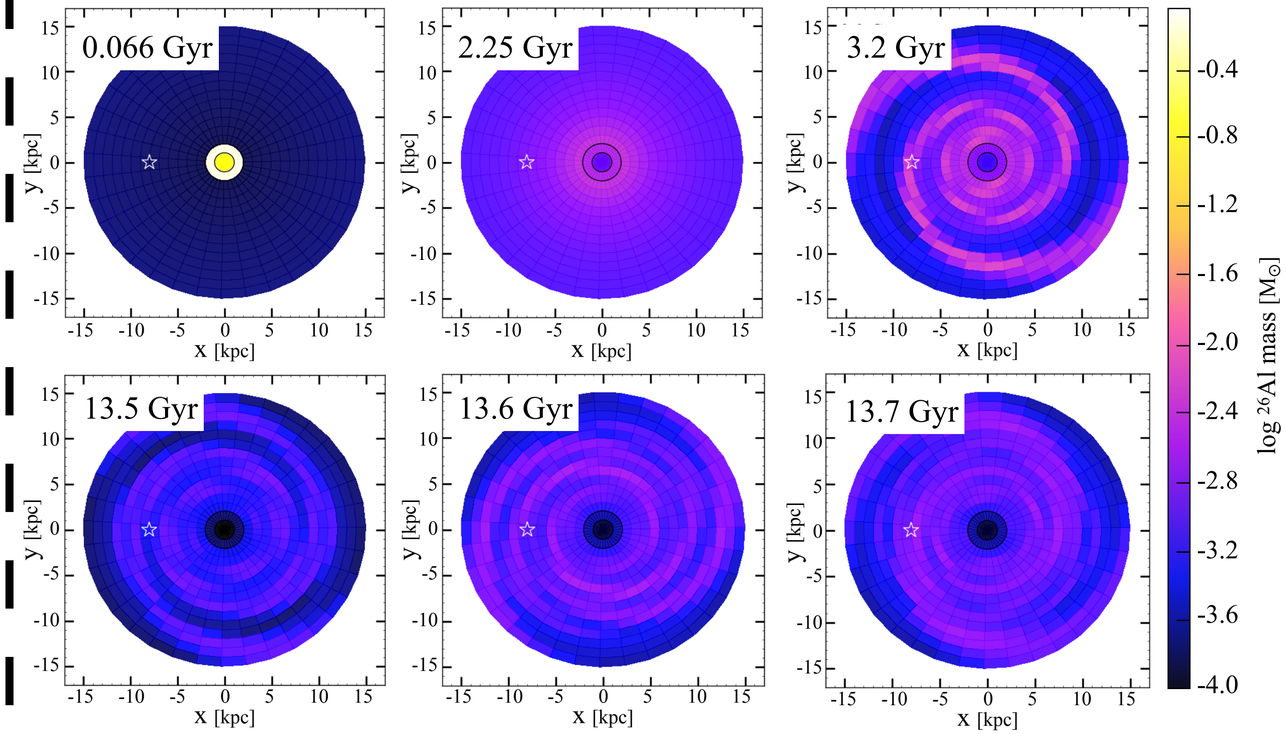

	Total (0 - 5 kpc)
M1	1.028 $M_\odot$
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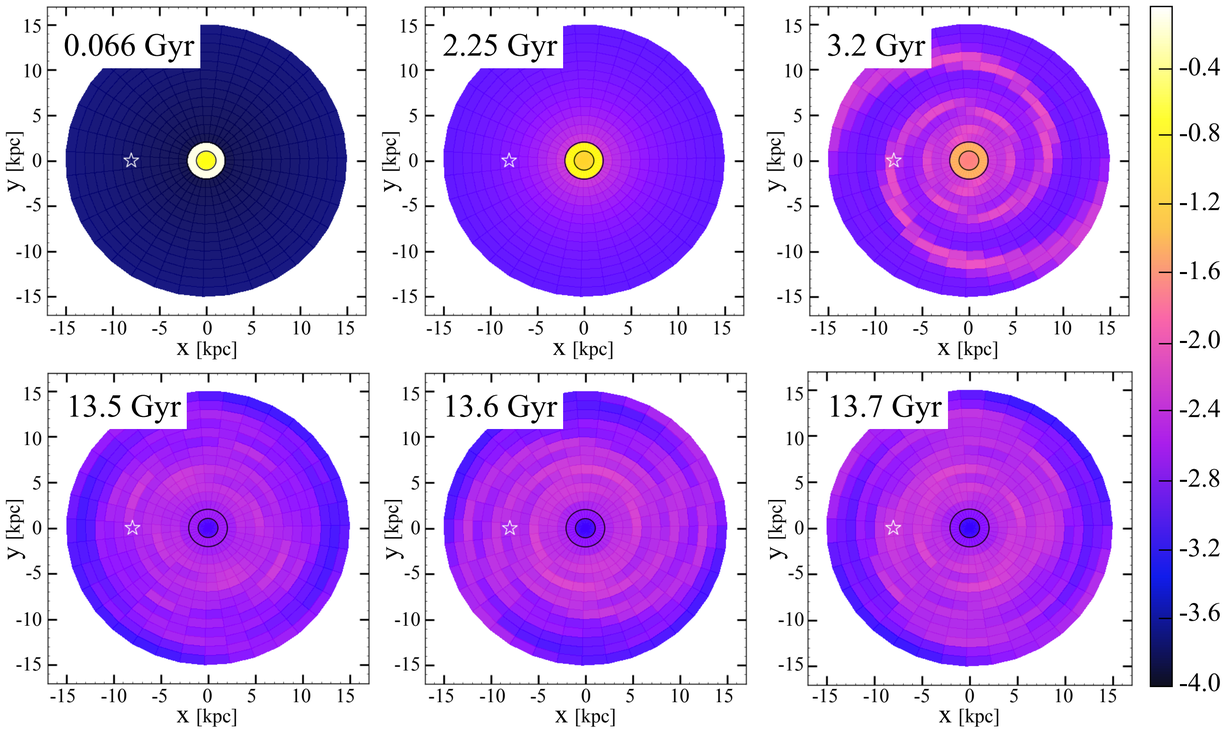

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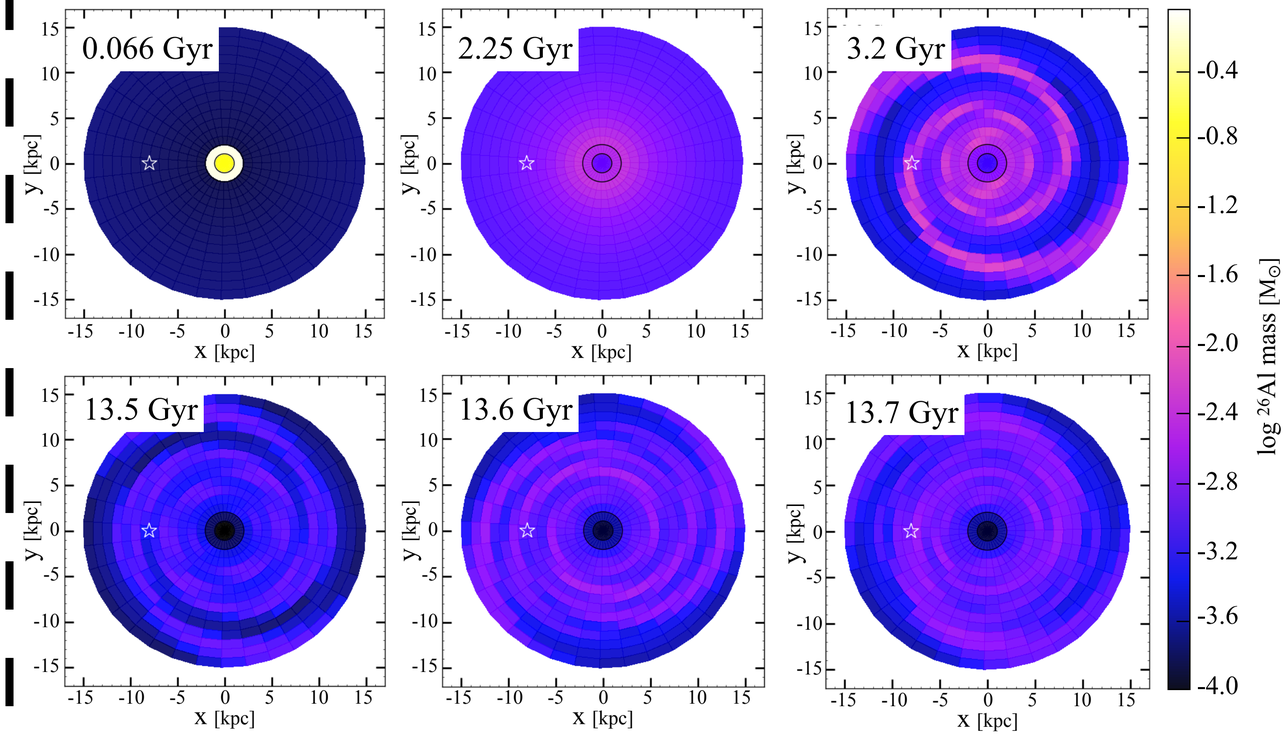

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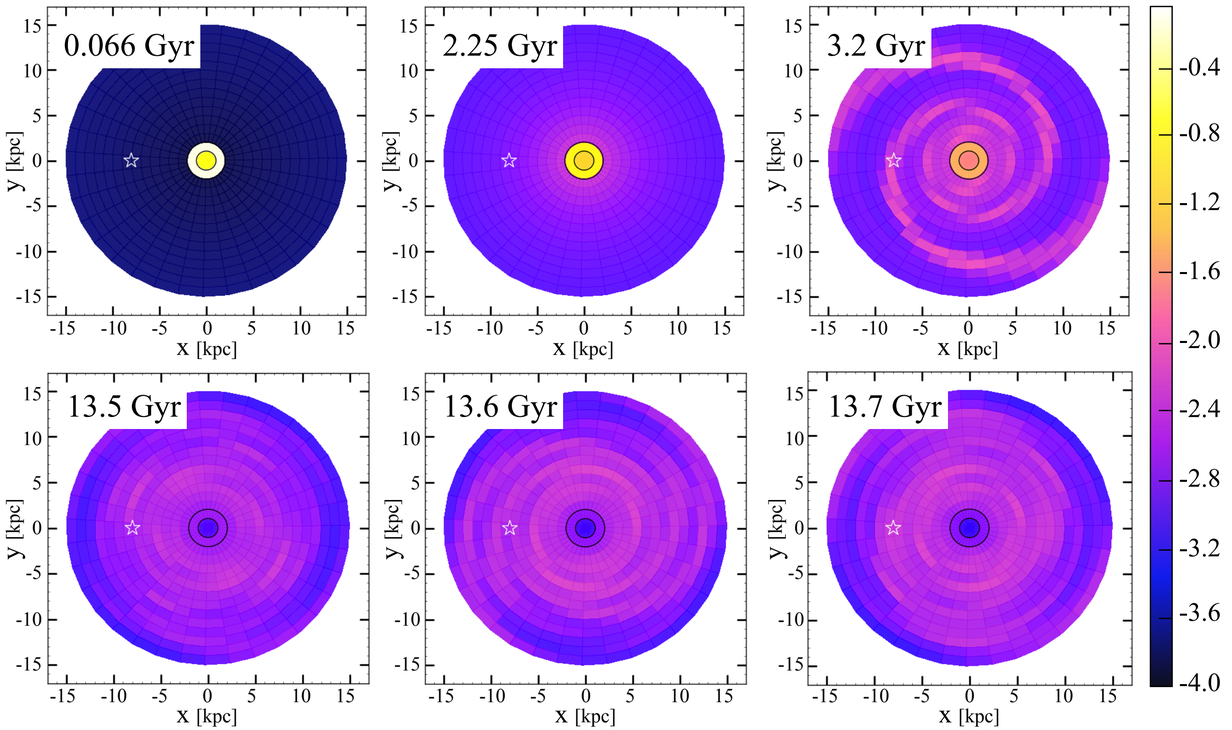

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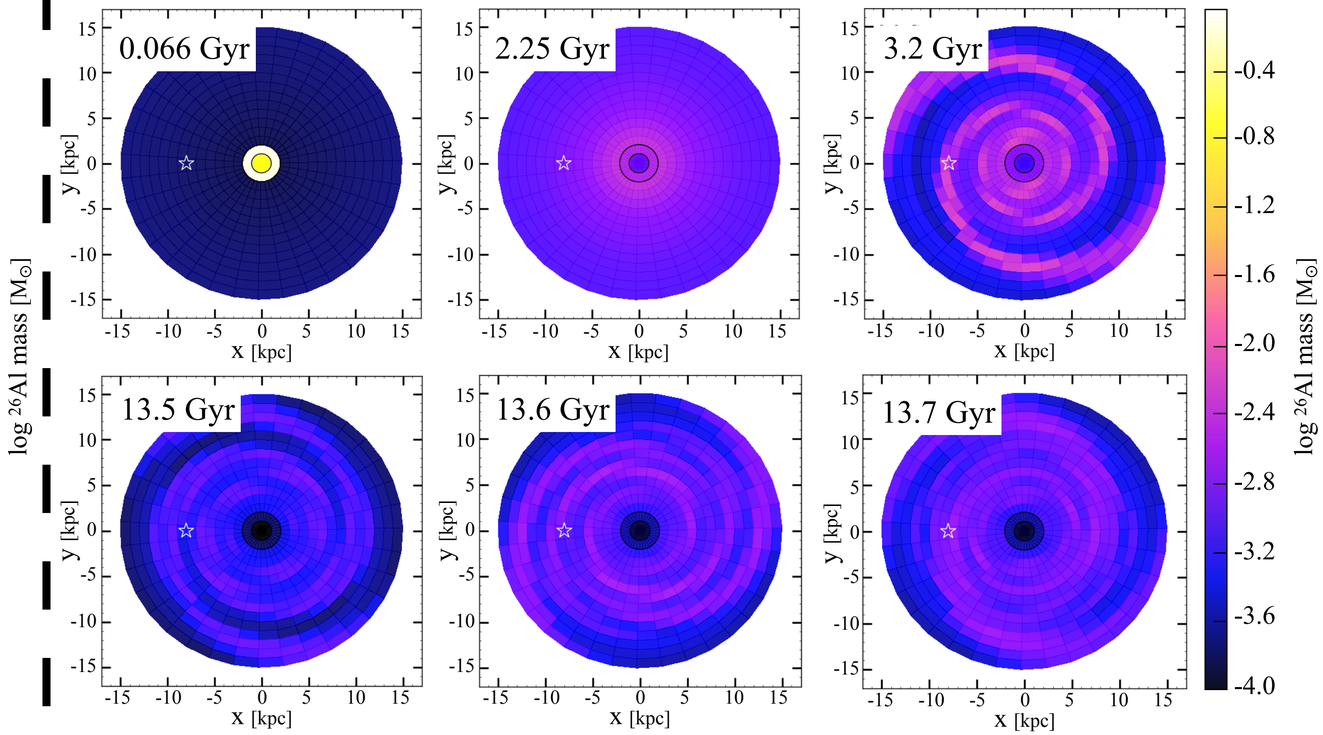

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x 10 bulge novae: 2.8 $M_\odot$

Conclusions

^{26}Al has a half-life of $\sim$ 1 Myr and is produced by massive stars, therefore it is a star formation tracer

We already estimated the ^{26}Al in the Galaxy with a 1D chemical evolution model in Vasini+22

Nova systems also produce ^{26}Al $\longrightarrow$ how much the nova contribution influence the tracing of the SFR?

We adopted the 2D chemical evolution model from Spitoni+19,+23 and the prescription from Vasini+22 and Tested to nucleosynthesis models: **M1 with novae**, and **M2 without novae**

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We already estimated the ^{26}Al in the Galaxy with a 1D chemical evolution model in Vasini+22

Nova systems also produce ^{26}Al ⟶ how much the nova contribution influence the tracing of the SFR?

We adopted the 2D chemical evolution model from Spitoni+19,+23 and the prescription from Vasini+22 and Tested to nucleosynthesis models: **M1 with novae**, and **M2 without novae**

We found that:

- as expected, the nova distribution does not trace the spiral arms. The peaks of novae is in the SFR minima
- ^{26}Al distribution traces the spiral arms better in model M2
- In model M1 the peaks of ^{26}Al is ∼33% higher than the minima, for model M2 they are ∼126% of the minima

None of the two models reproduce the ^{26}Al observed. **Model M1 can reproduce the observations only if the novae in the bulge produce 10 times more ^{26}Al** (Izzo & Della Valle 2020)