Feedback of Massive-Star Groups on the Surrounding ISM

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Interstellar Medium in the Nearby Universe 27.03.2018

^{26}Al Production and Decay

Production

Destruction

Emission

^{25}Mg(p,γ)^{26}Al
NeNaMgAl-Cycle
Explosive Burning

^{26}Al

^{26}Al(n,α)^{23}Na
He-burning

β^{+}-decay
$T_{1/2}$ = 0.7 Myr

^{26}Al$_{m}$
τ = 9.15 s, T $\gtrsim$ 400 MK

^{26}Mg*

γ
1.8 MeV

Production Sites:

- Explosive Ne/C-Burning
- Convective Shell C-Burning
- Convective Core H-Burning

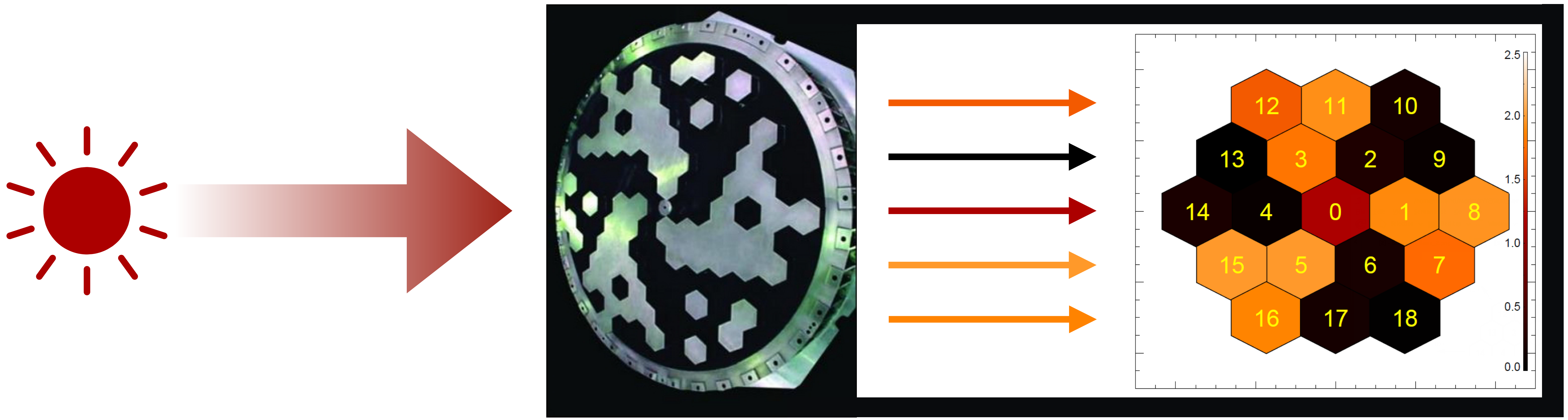
Measurements:

- Galactic ISM (1.8 MeV γ-Line)
- Meteorites (^{26}Mg Excess)
- Presolar Dust Grains (^{26}Mg Excess)

The INTEGRAL Satellite

The International Gamma Ray Astrophysics Laboratory (INTEGRAL)

The Spectrometer on INTEGRAL (SPI)



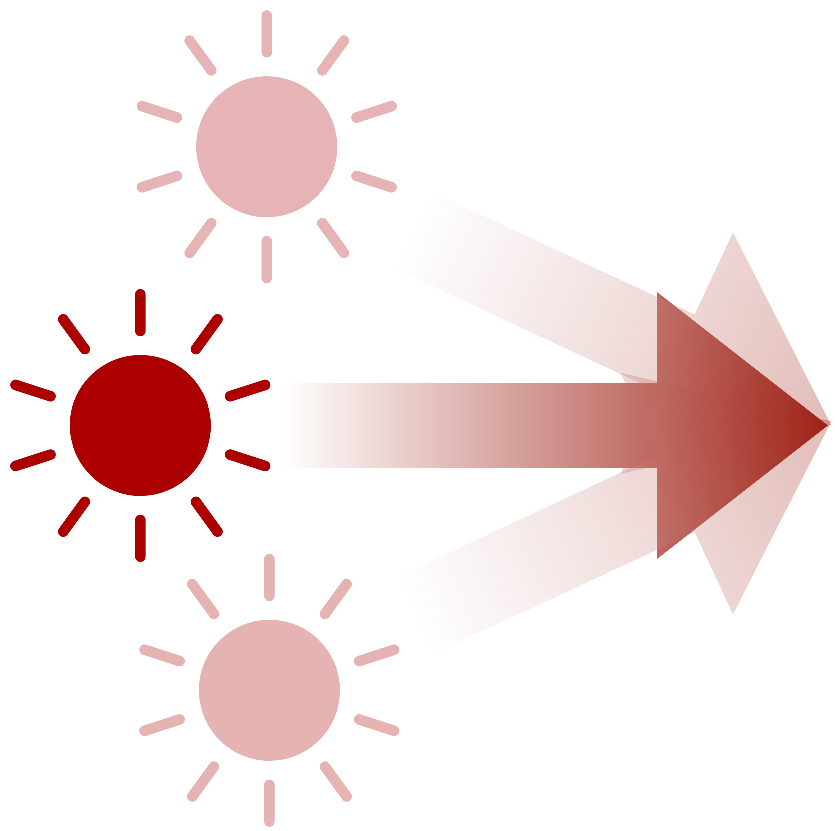
Source

Coded
Mask

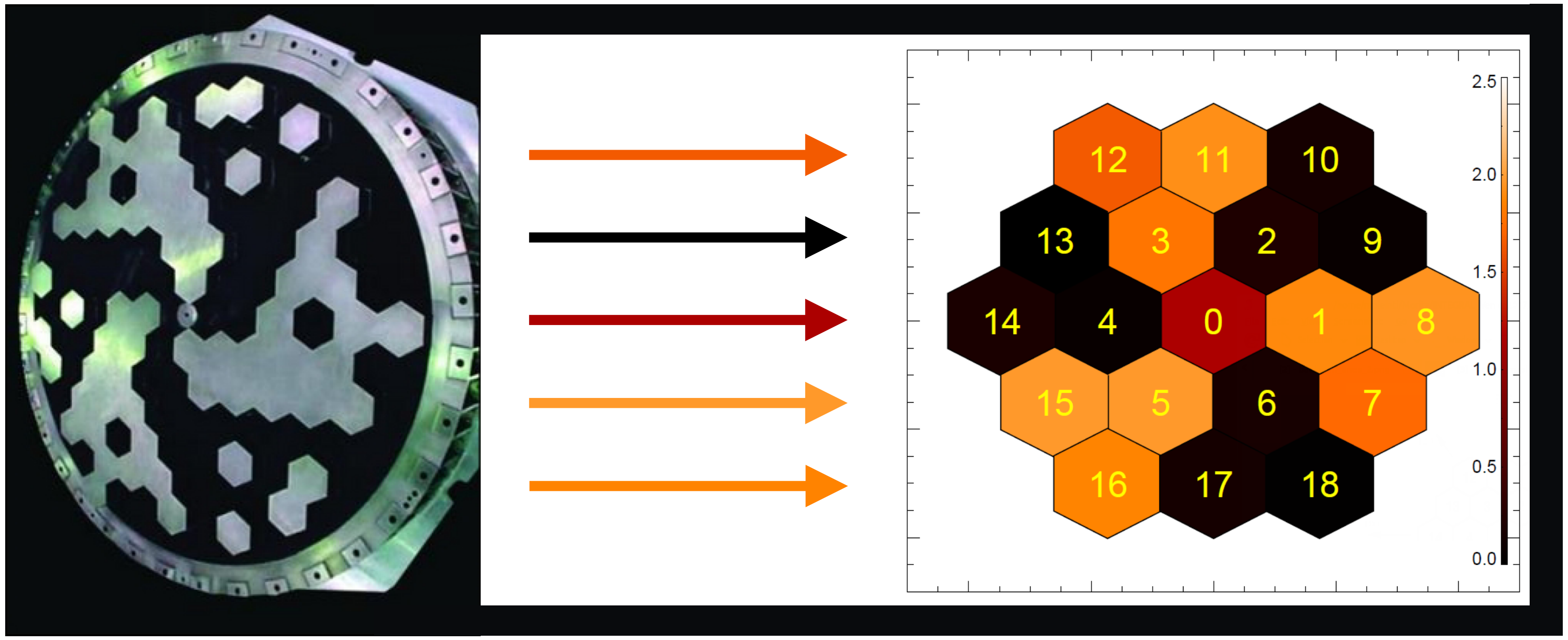
Ge-Detector
Array

Siegert (2017)

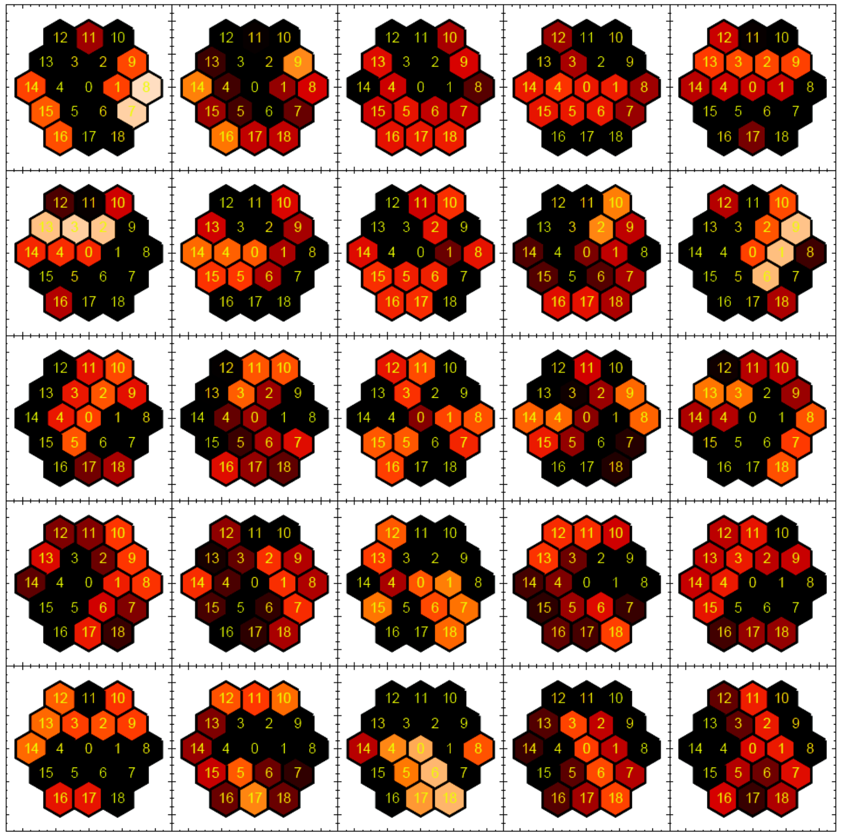
The Spectrometer on INTEGRAL (SPI)



Source



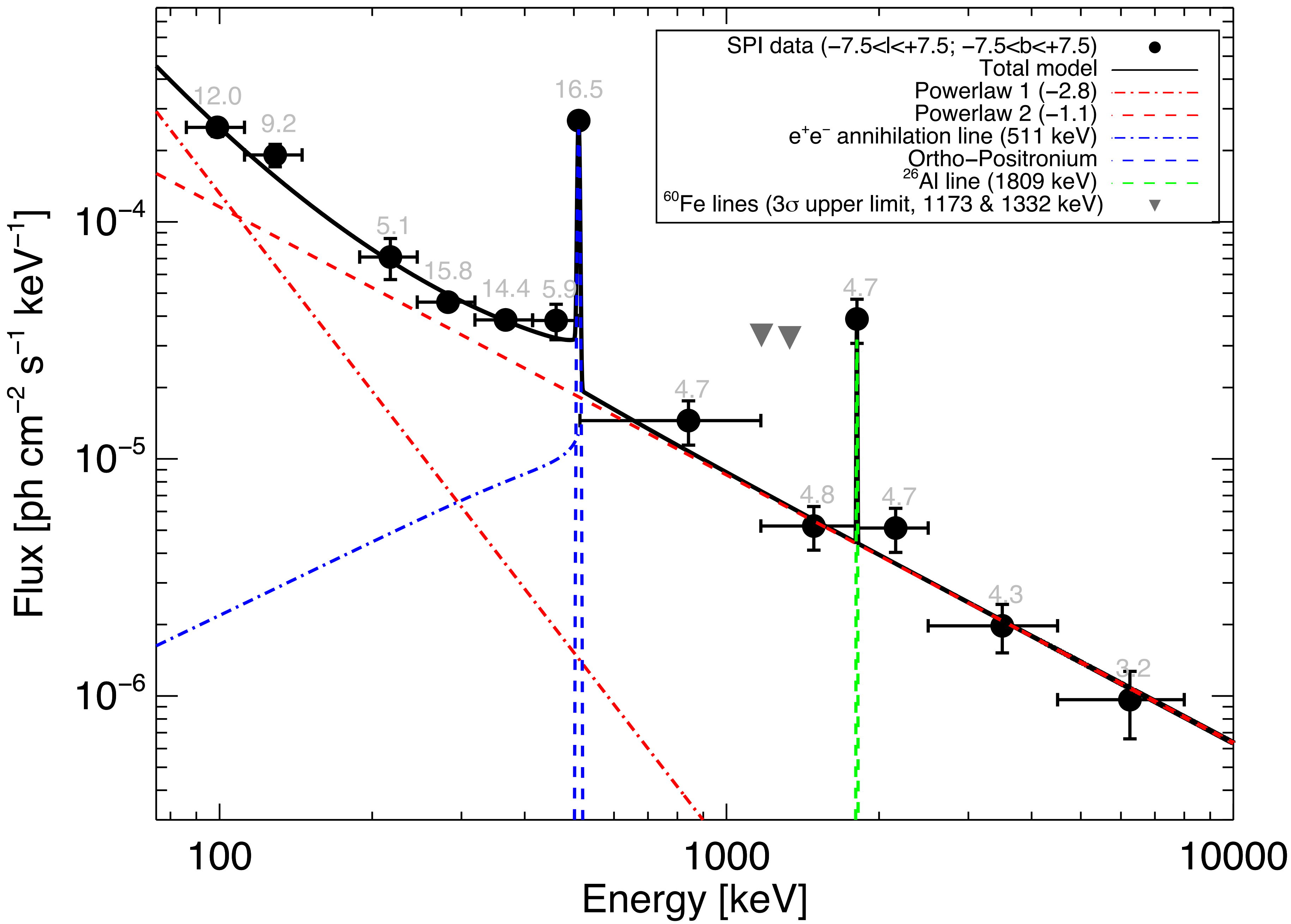
Coded
Mask



Siegert (2017)

Gamma-Ray Observations with SPI

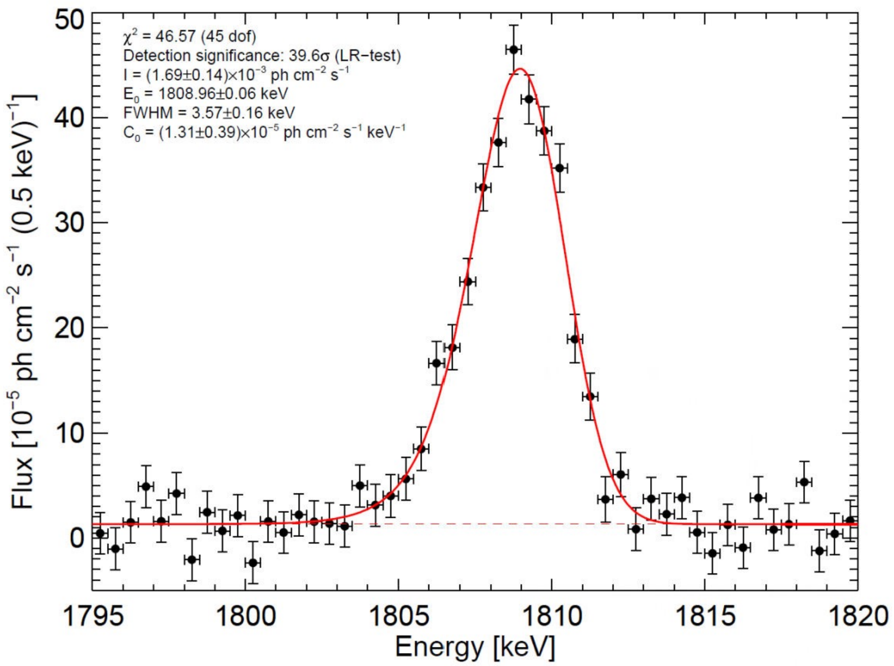
Gamma-Ray Spectrum of the Inner Galaxy



Siegert et al. (2018, in prep.)

^{26}Al Emission at 1.8 MeV

Full Galactic Emission at 1.8 MeV



Galactic ^{26}Al Mass

$2.0 \pm 0.3\ M_\odot$

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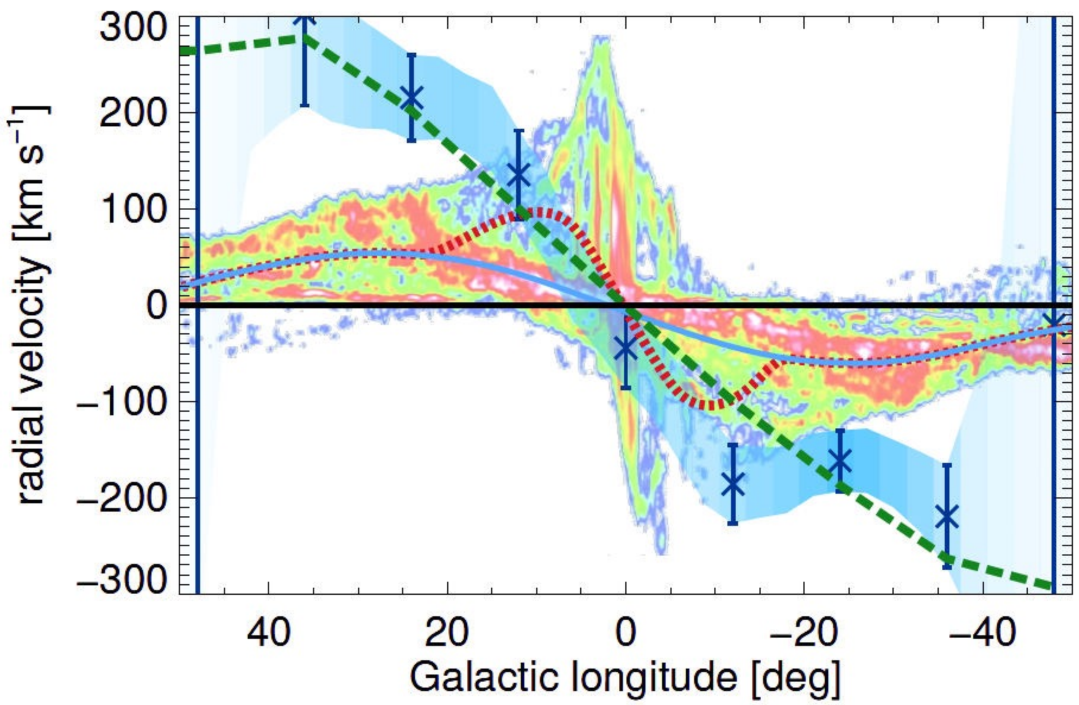
cc-SN Rate

1.5 ± 0.5 per century

Siegert (2017)

^{26}Al Longitude-Velocity Diagram



Velocity Excess

for Massive-Star Ejecta

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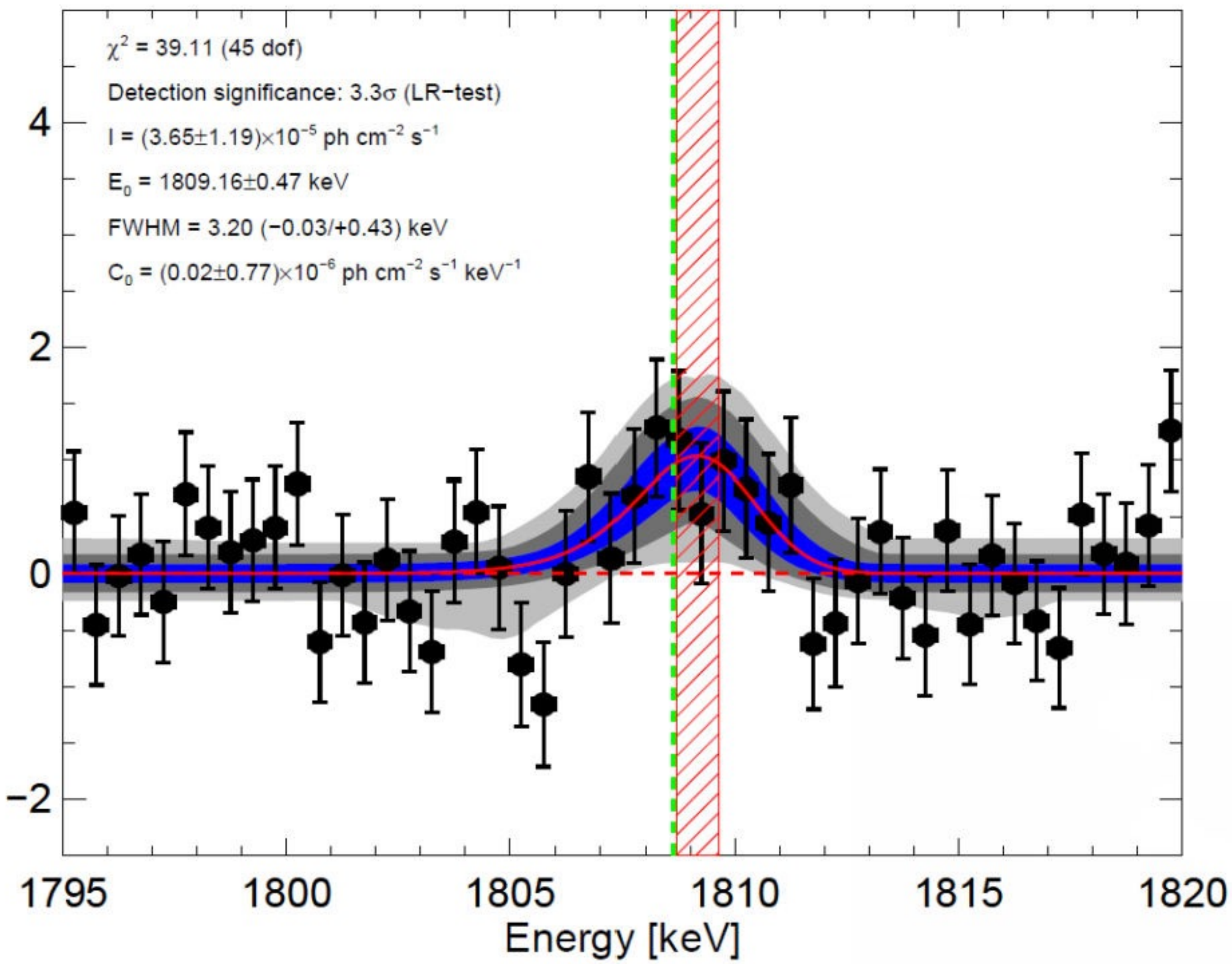
Superbubble

Dynamics

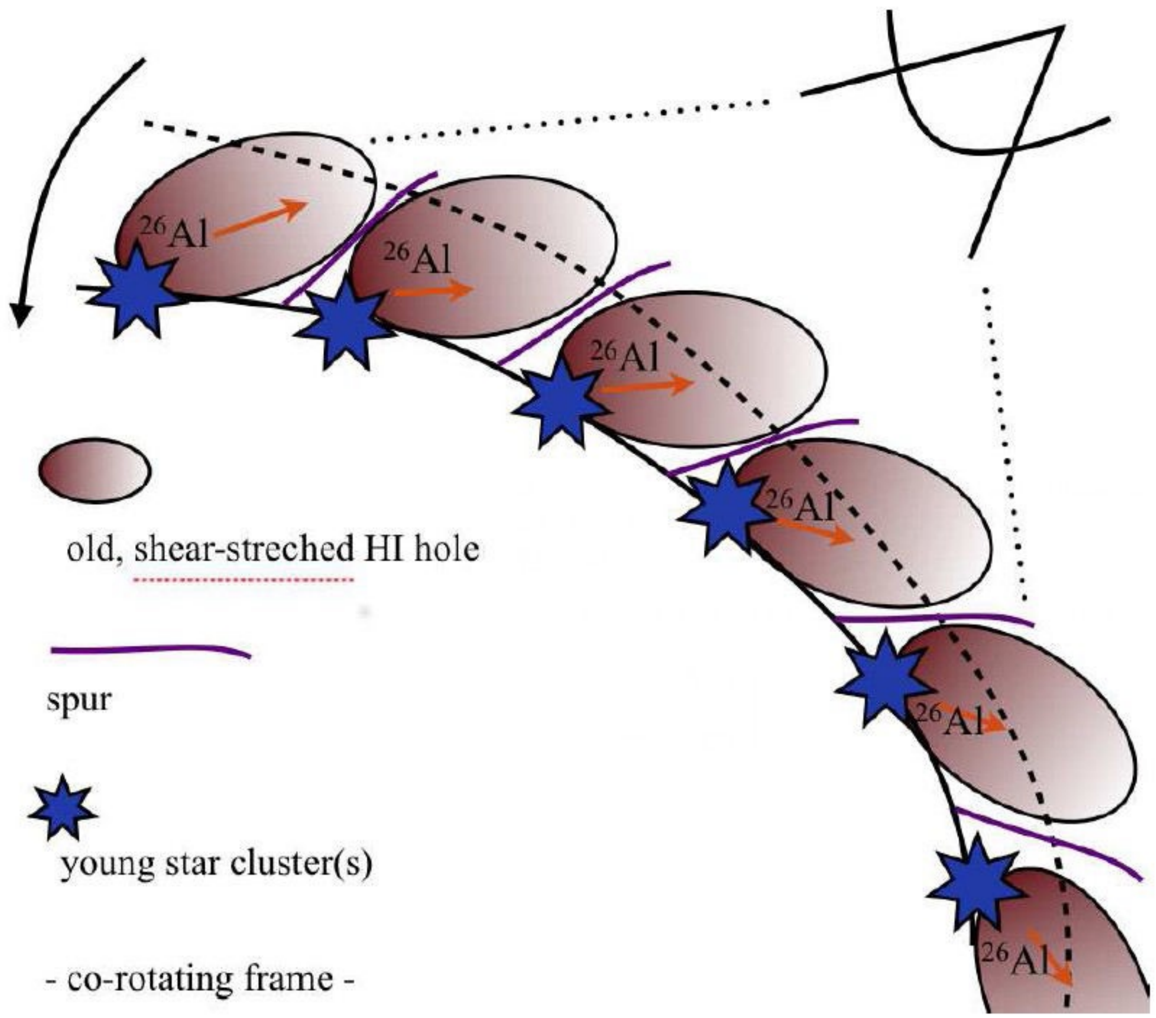
Kretschmer et al. (2013)

Kinematics of Superbubbles

^{26}Al Emission from Orion



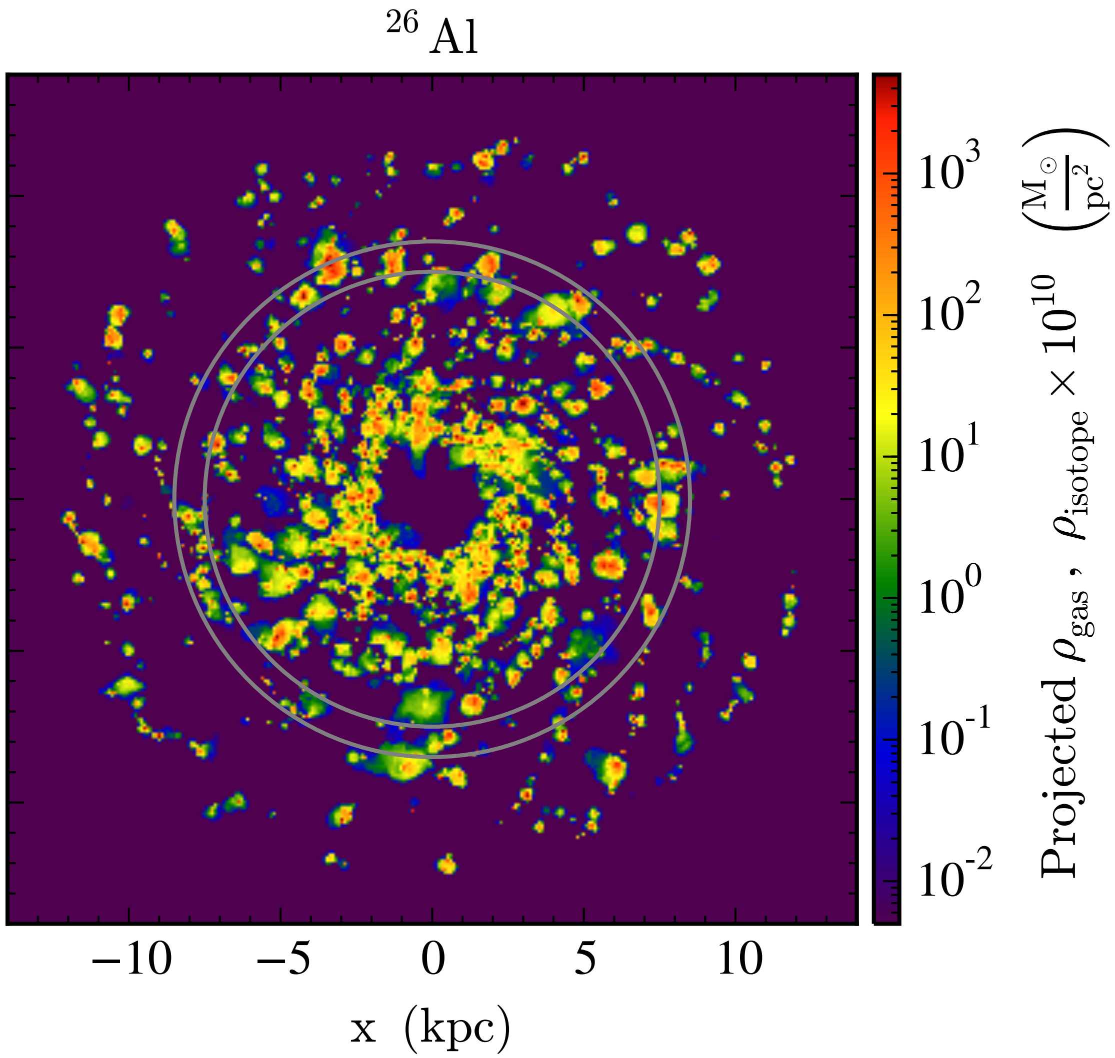
Superbubble Kinematics

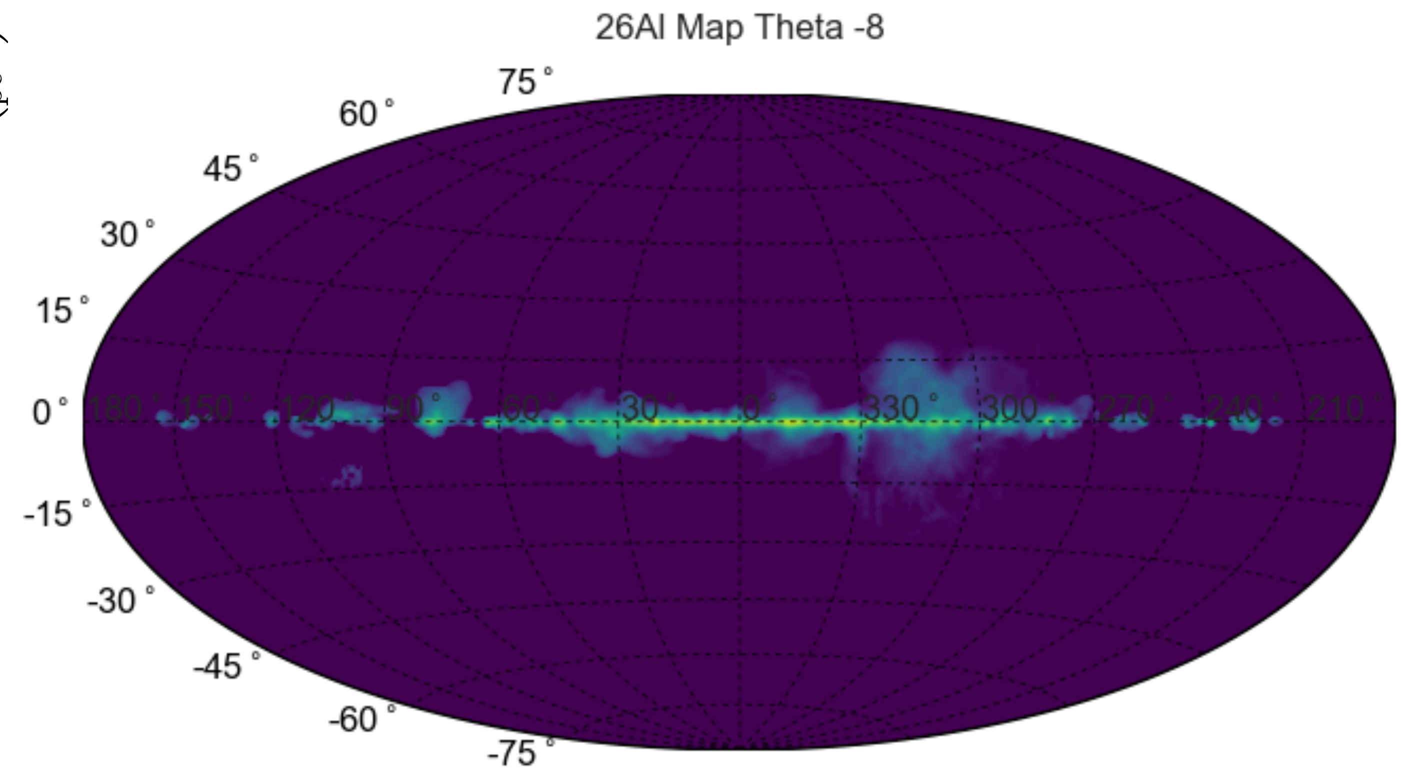


Siegert & Diehl (2016)

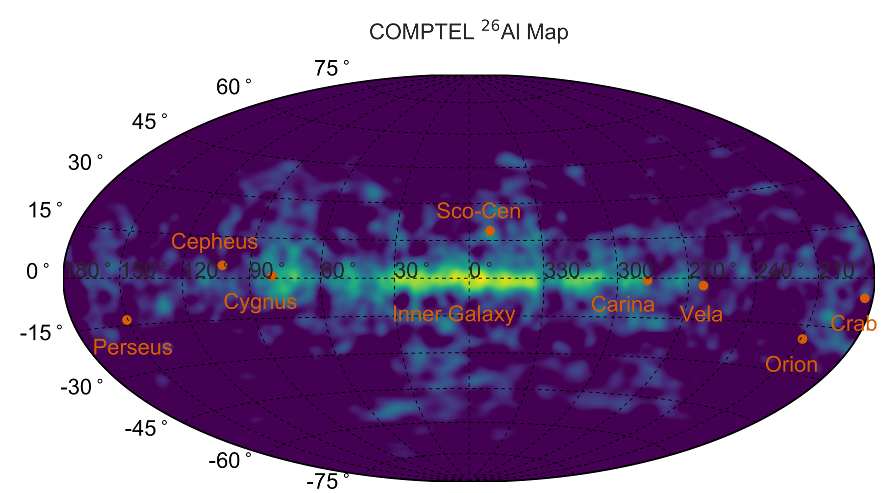
Krause et al. (2015)

Testing Simulated ^{26}Al Maps





Chemodynamical Simulations by Fujimoto et al. (2018)



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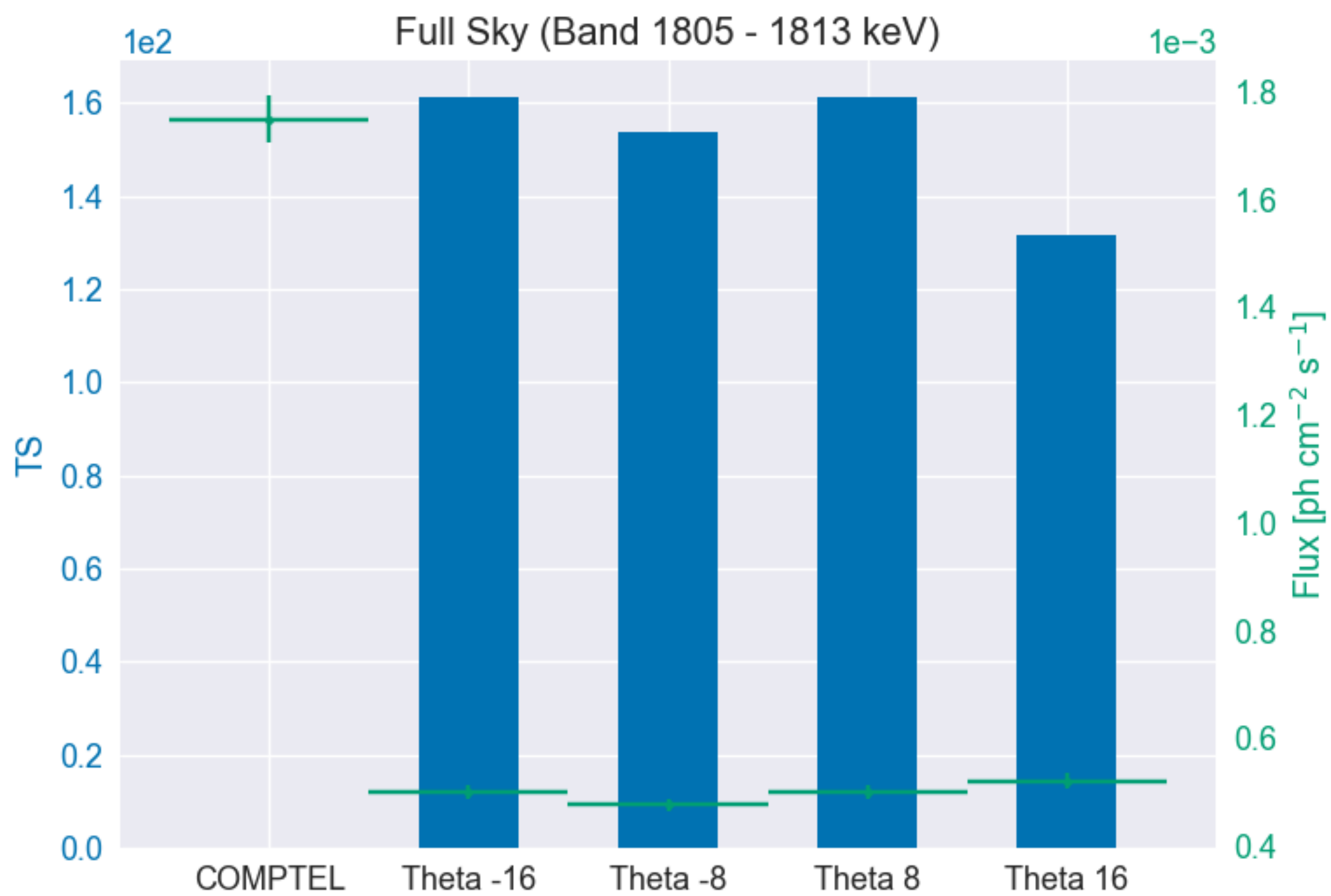


Logarithmic Poissonian Likelihood (Cash 1979)

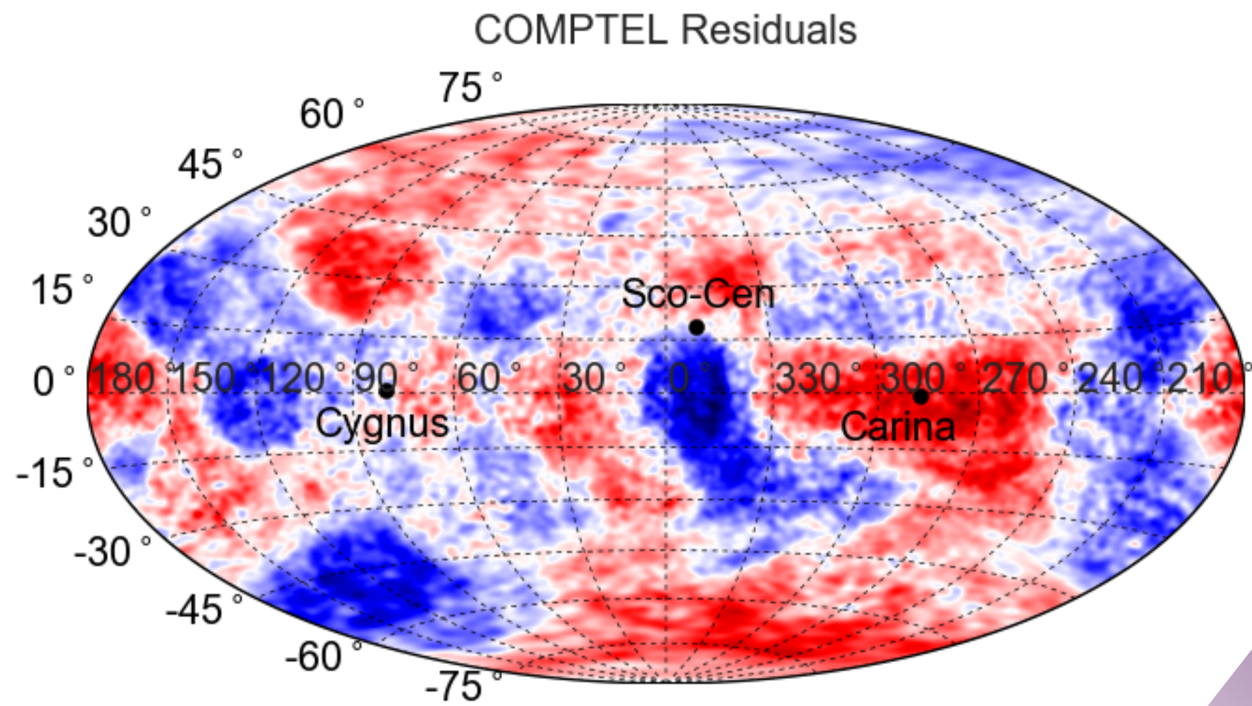
$$\mathscr{C}(\boldsymbol{\theta}|D) = 2\sum_{k=1}^{n}[m_k - d_k \ln(m_k)]$$

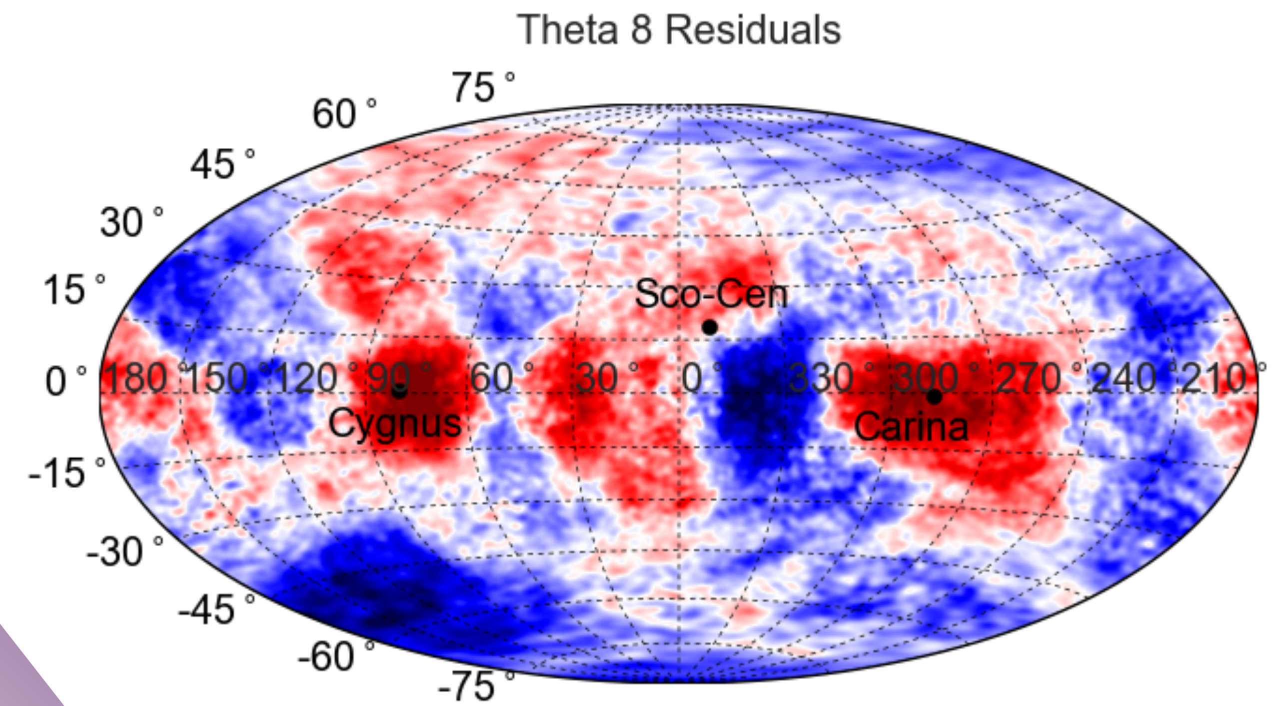
Test Statistic

$$TS = \mathscr{C}(M_i|D) - \mathscr{C}(M_{\mathrm{COMPTEL}}|D)$$

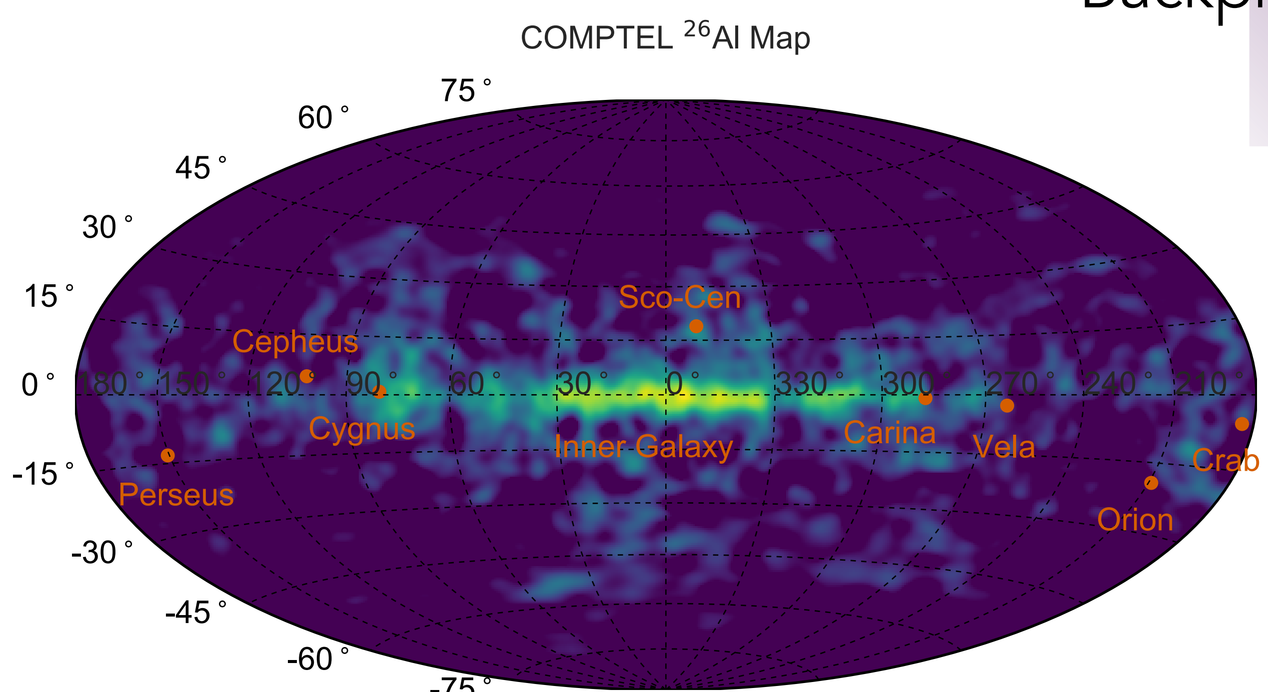
Pleintinger et al. (in prep.)

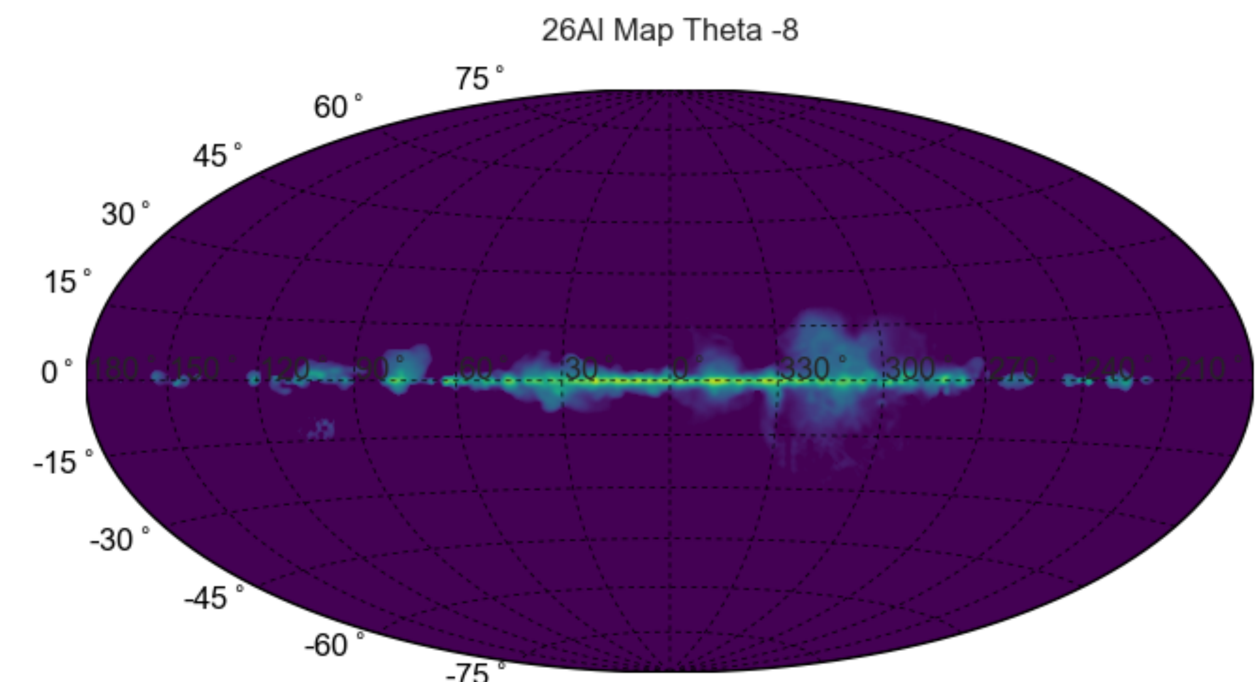
Testing Simulated ^{26}Al Maps





Residual
Backprojection

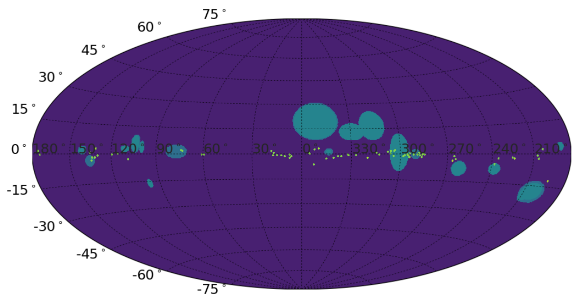


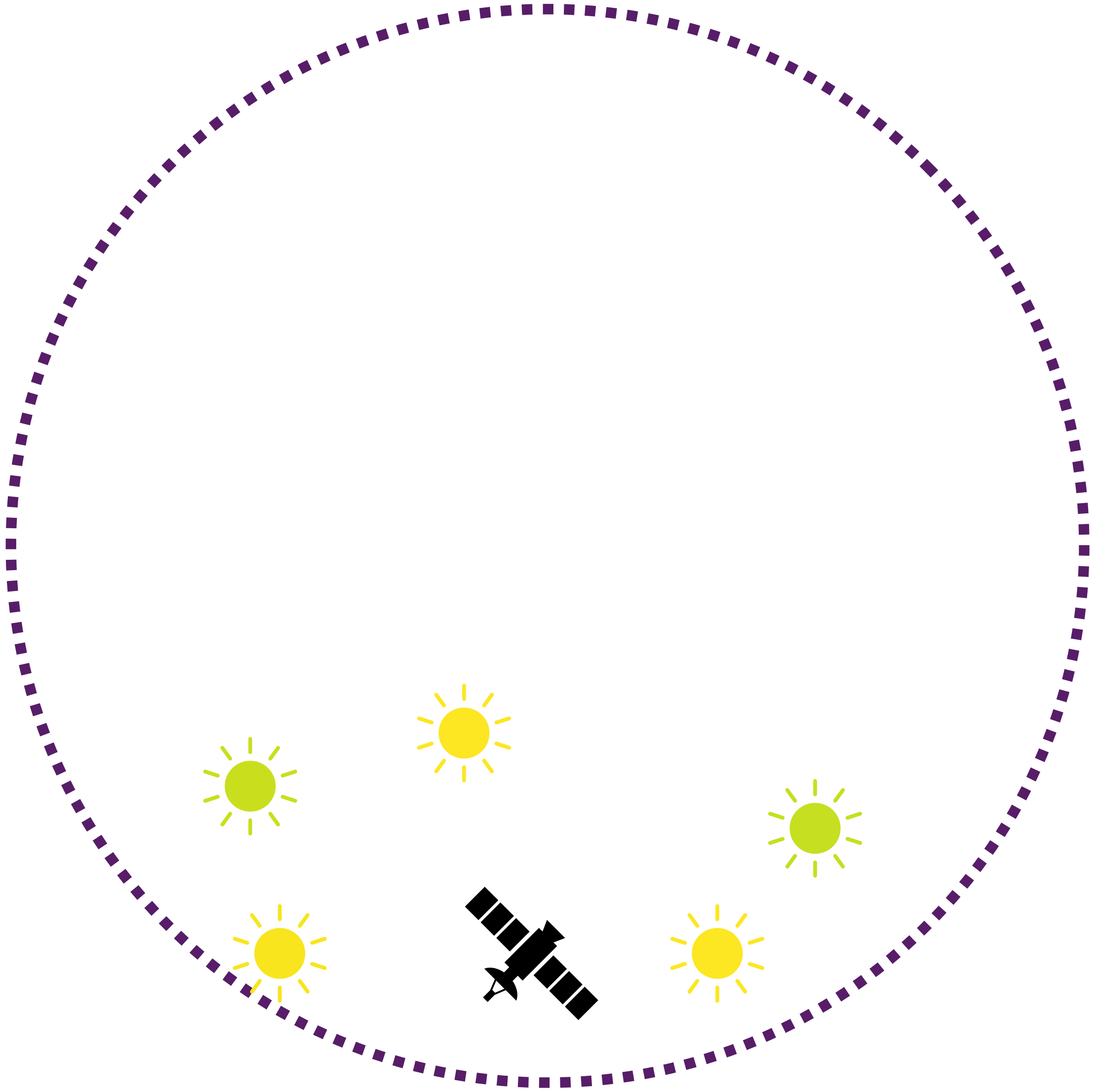


Pleintinger et al. (in prep.)

Galactic Population Synthesis

Nearby
OB Associations





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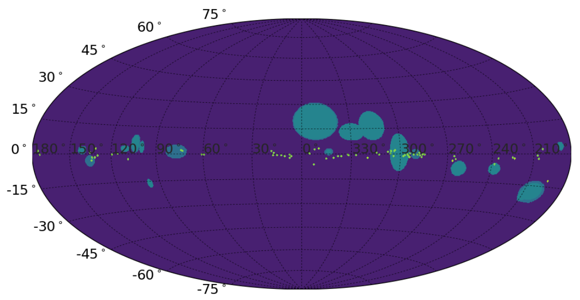

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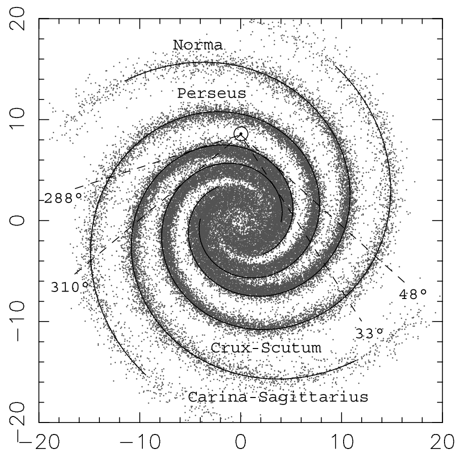
Galaxy Model



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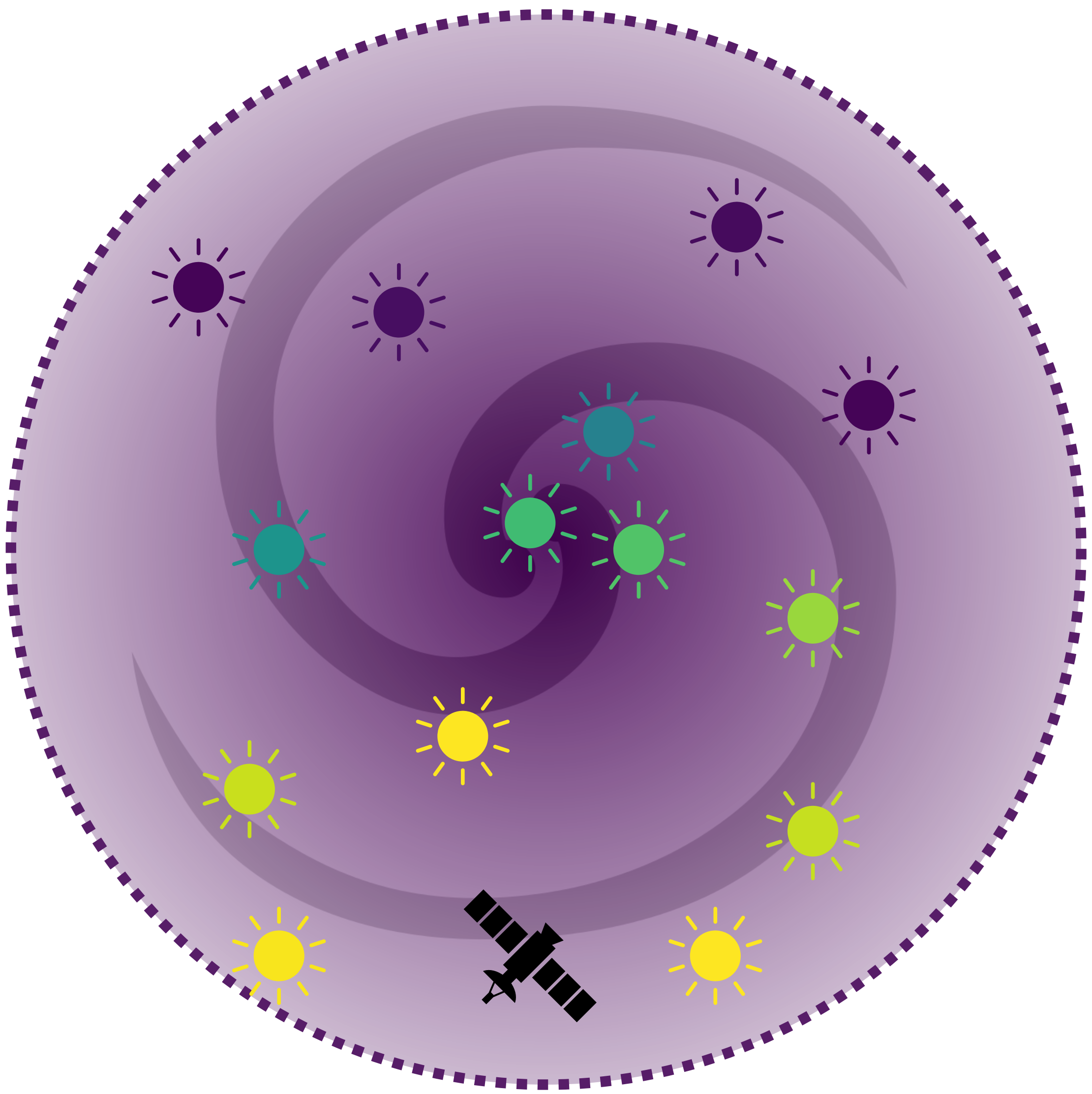

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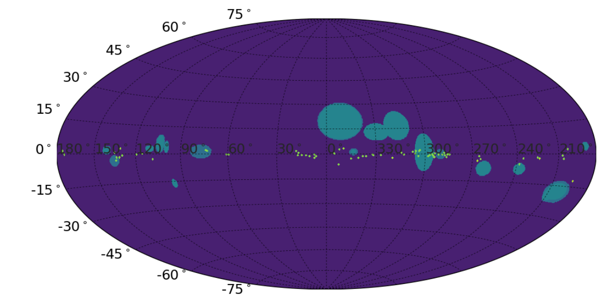

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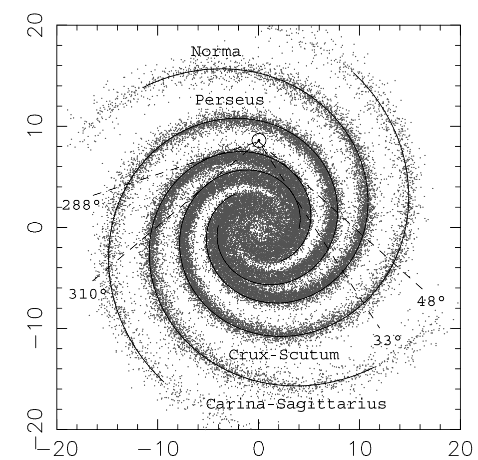

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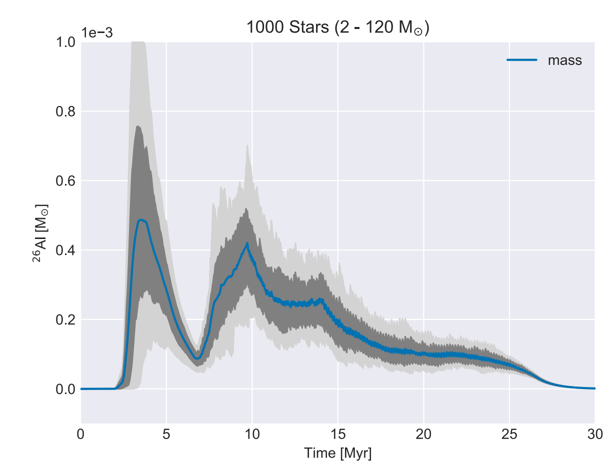
Population Synthesis
Calculations



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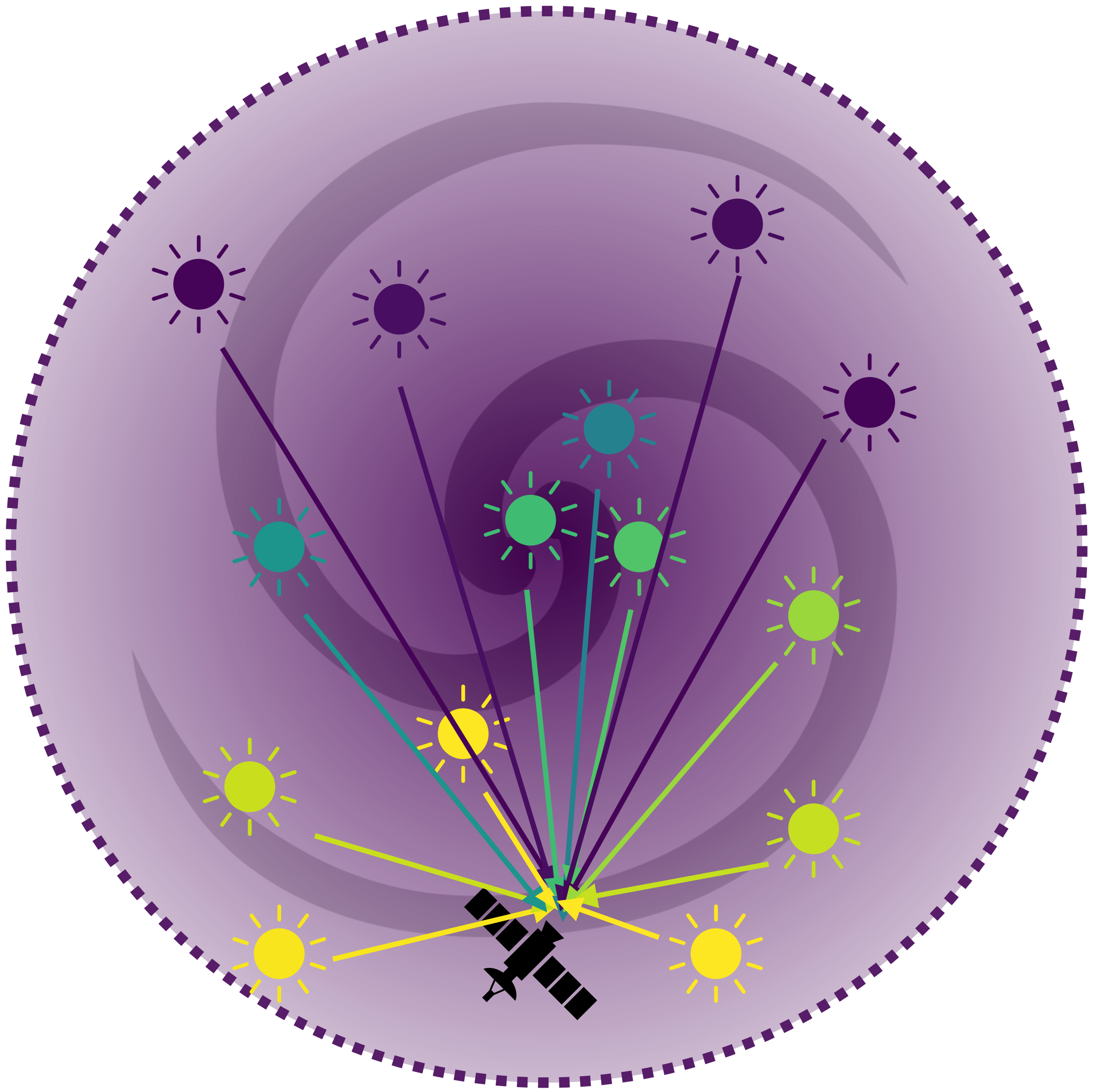

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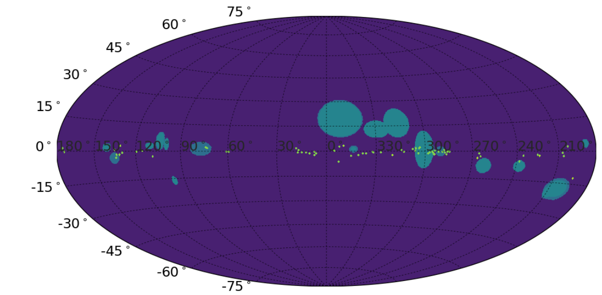

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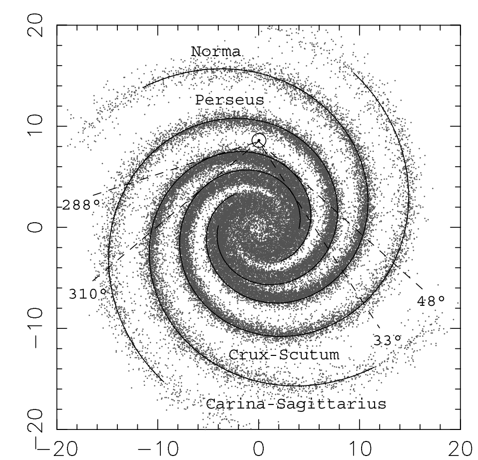

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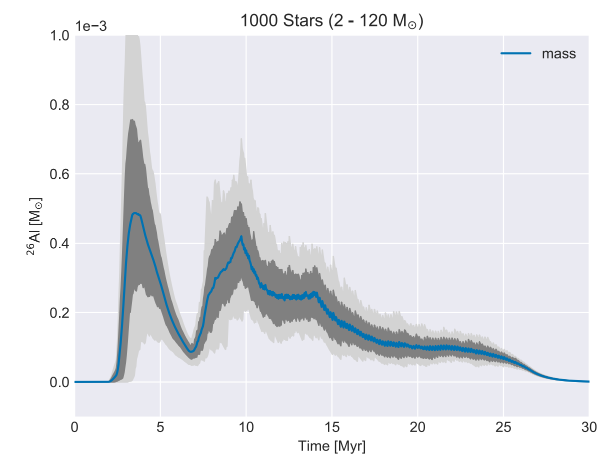

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Flux Map