大質量星形成領域 W33 の星間雲と磁場構造

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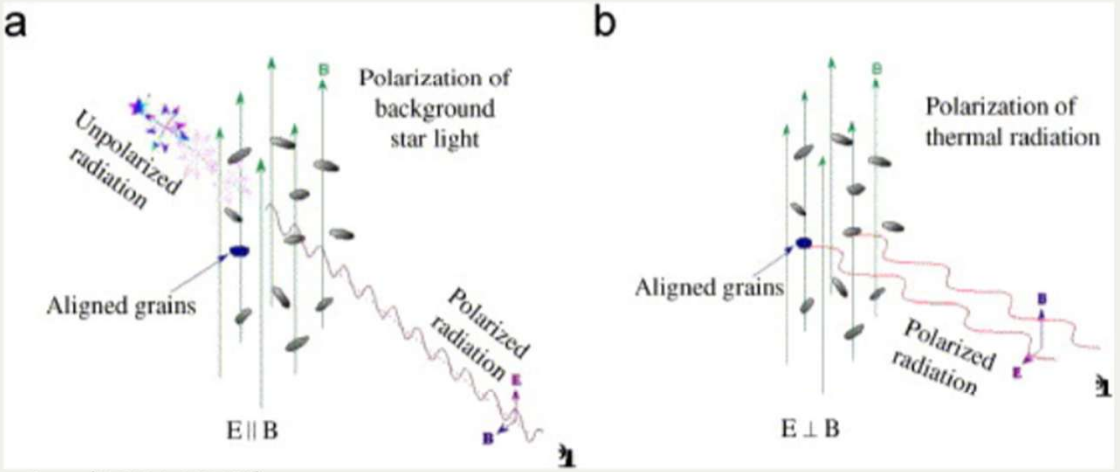
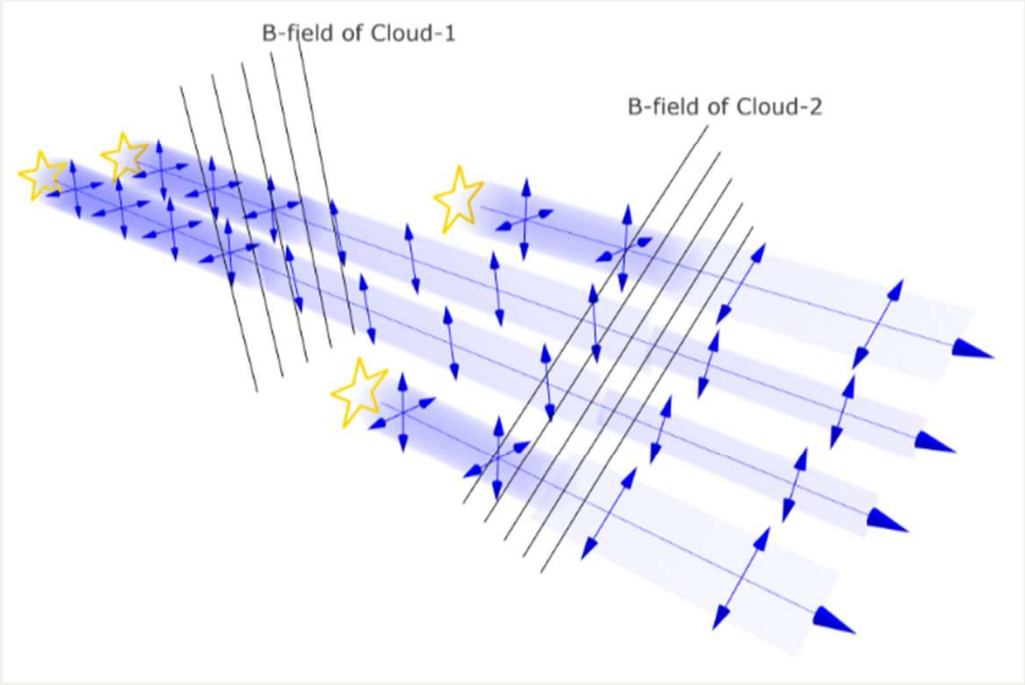
Magnetic Field Tomography



Lazarian (2007, 2008)



References:

Doi et al. (2021), ApJ, 914, 122.
Doi et al. (2024), ApJ, 961, 13.

link to moveable version

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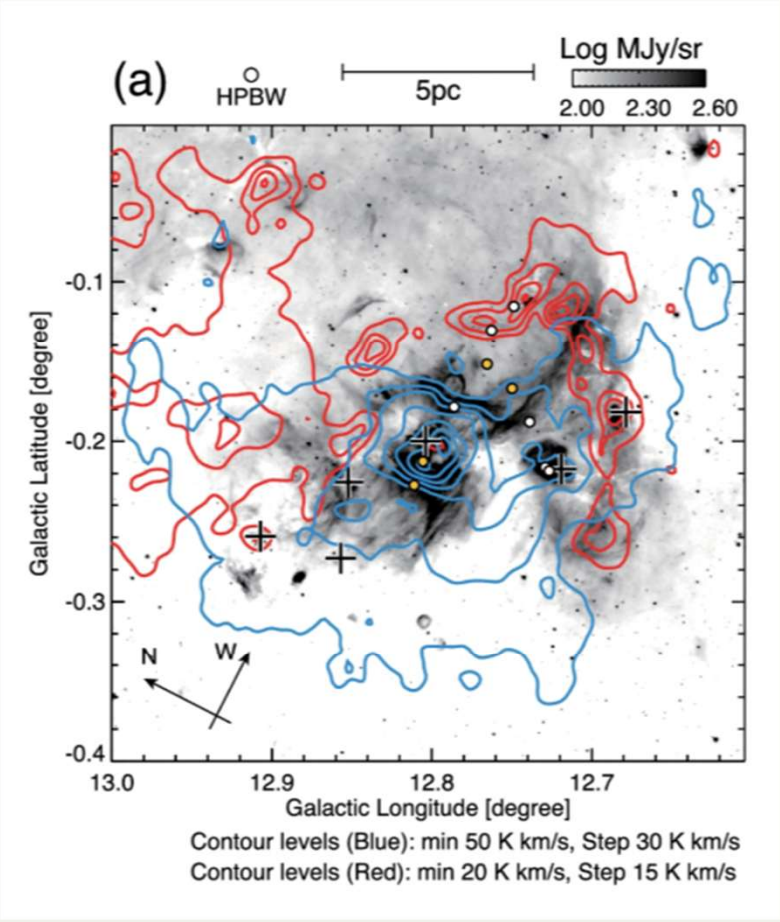
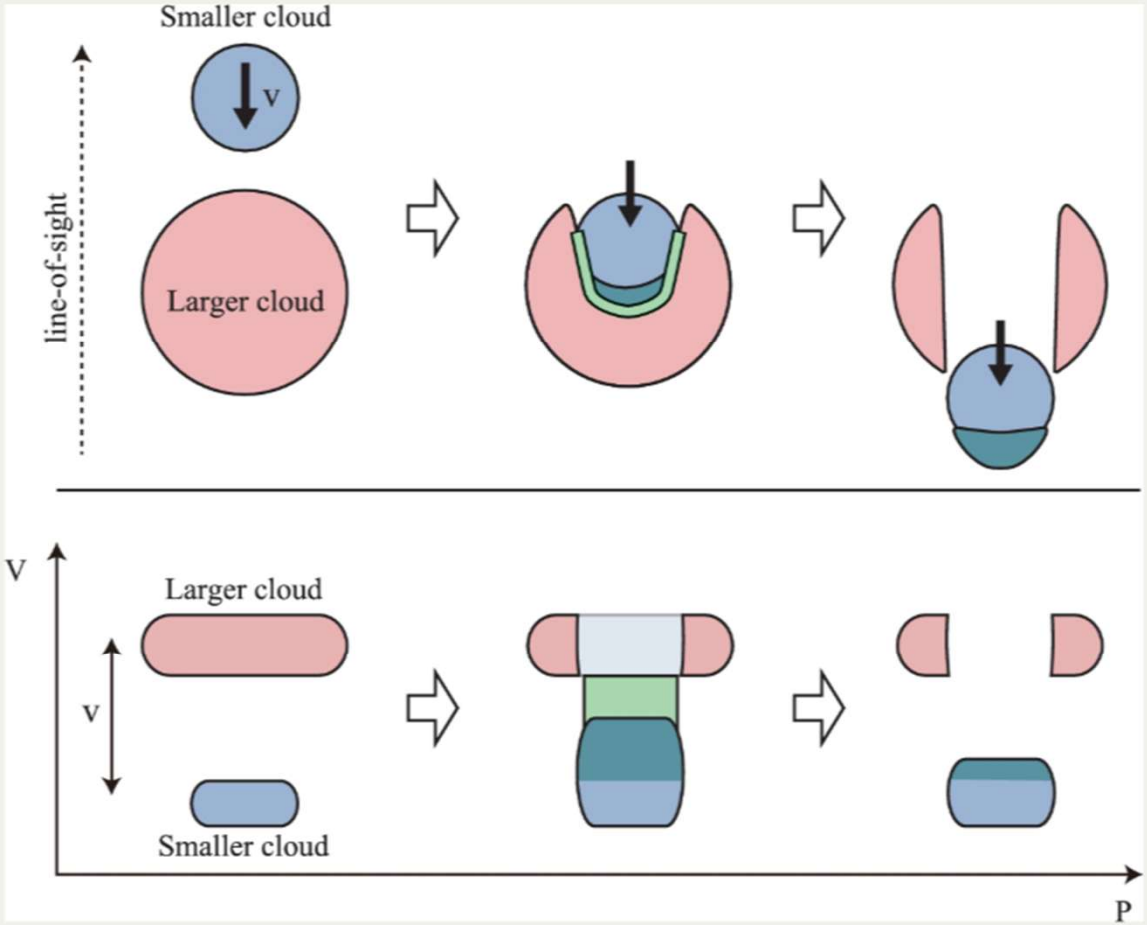
W33: High-mass Star Formation by CCC!?





- **CCC**: Cloud collisions between 35 km/s and 58 km/s components, potentially triggering large-scale star formation (Kohno+2018)

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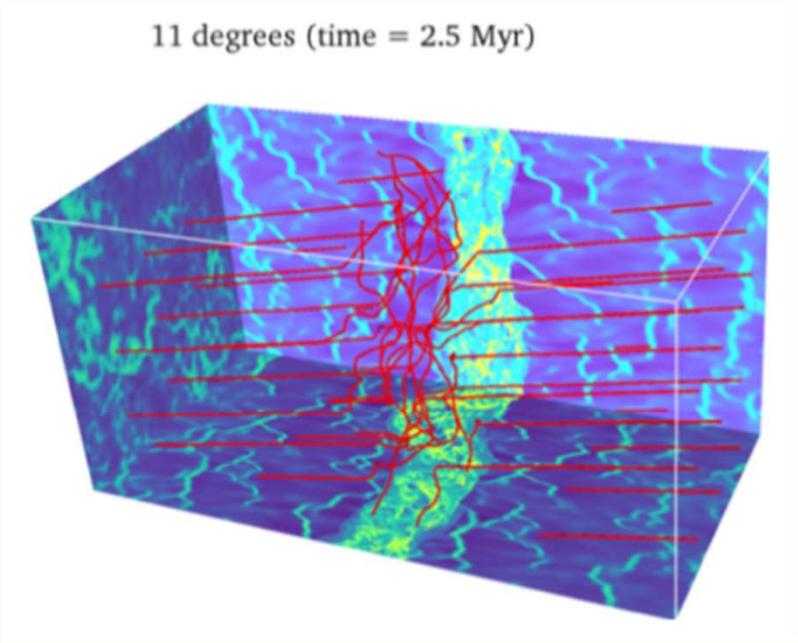
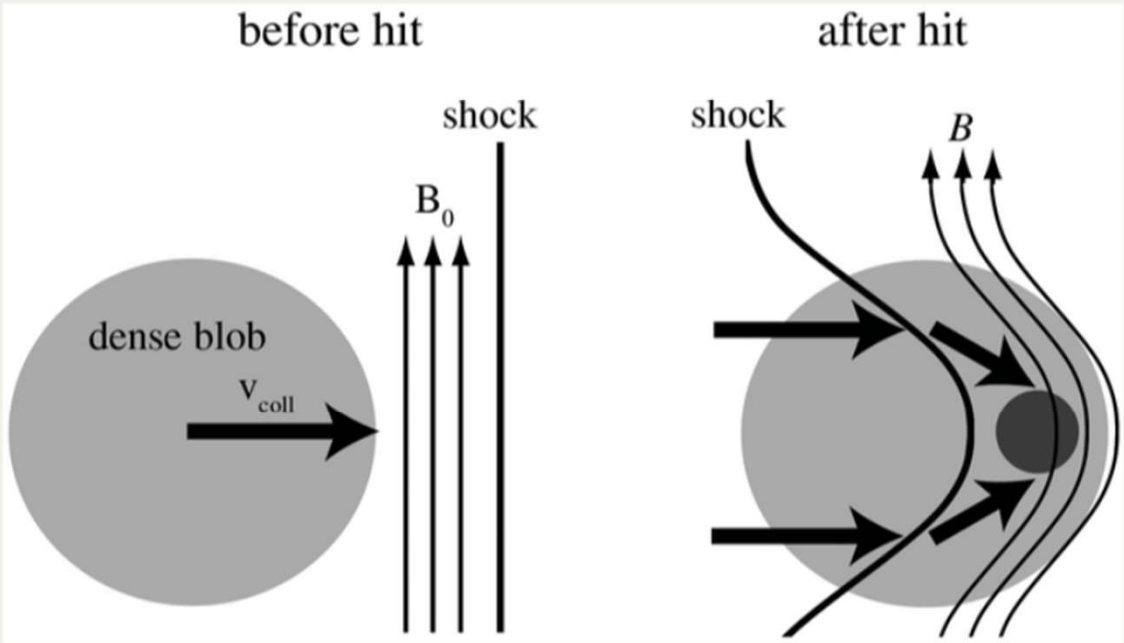
The *B*-field Regulates the Compression of Colliding Gas Clouds



Iwasaki et al. (2019)



Inoue & Fukui (2013)

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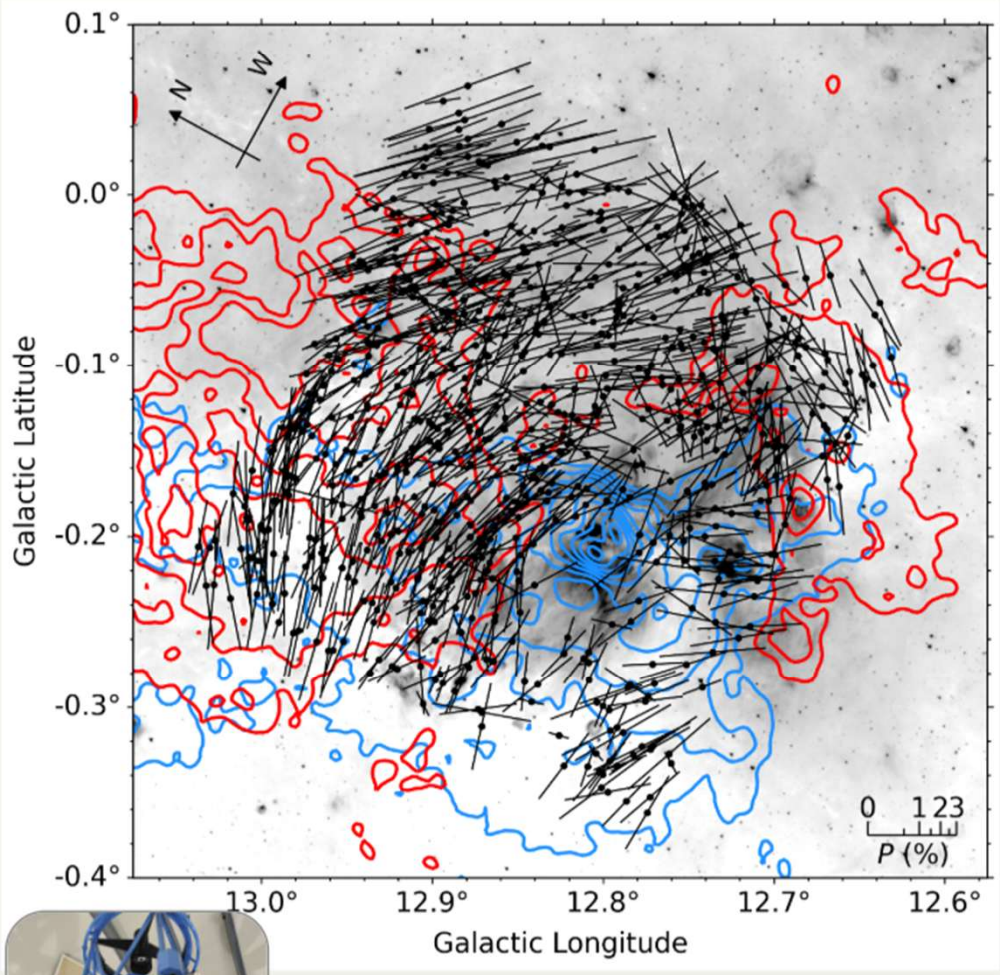
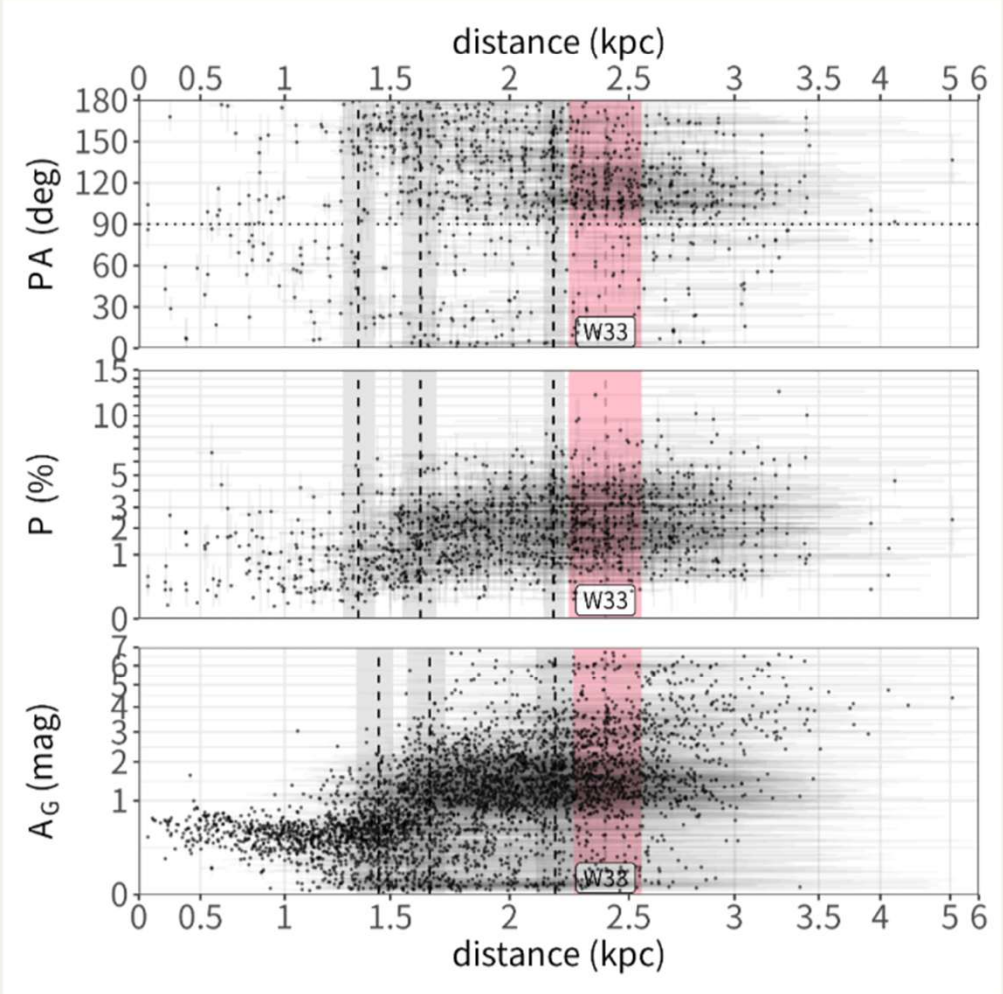
Optical Polarimetry Data





$$cf.\ A_{\rm G} \simeq 1\,({\rm mag}) \leftrightarrow 2.8 \times 10^{21}\ {\rm cm}^{-2}$$

HONIR on KANATA 1.5-m telescope, Hiroshima

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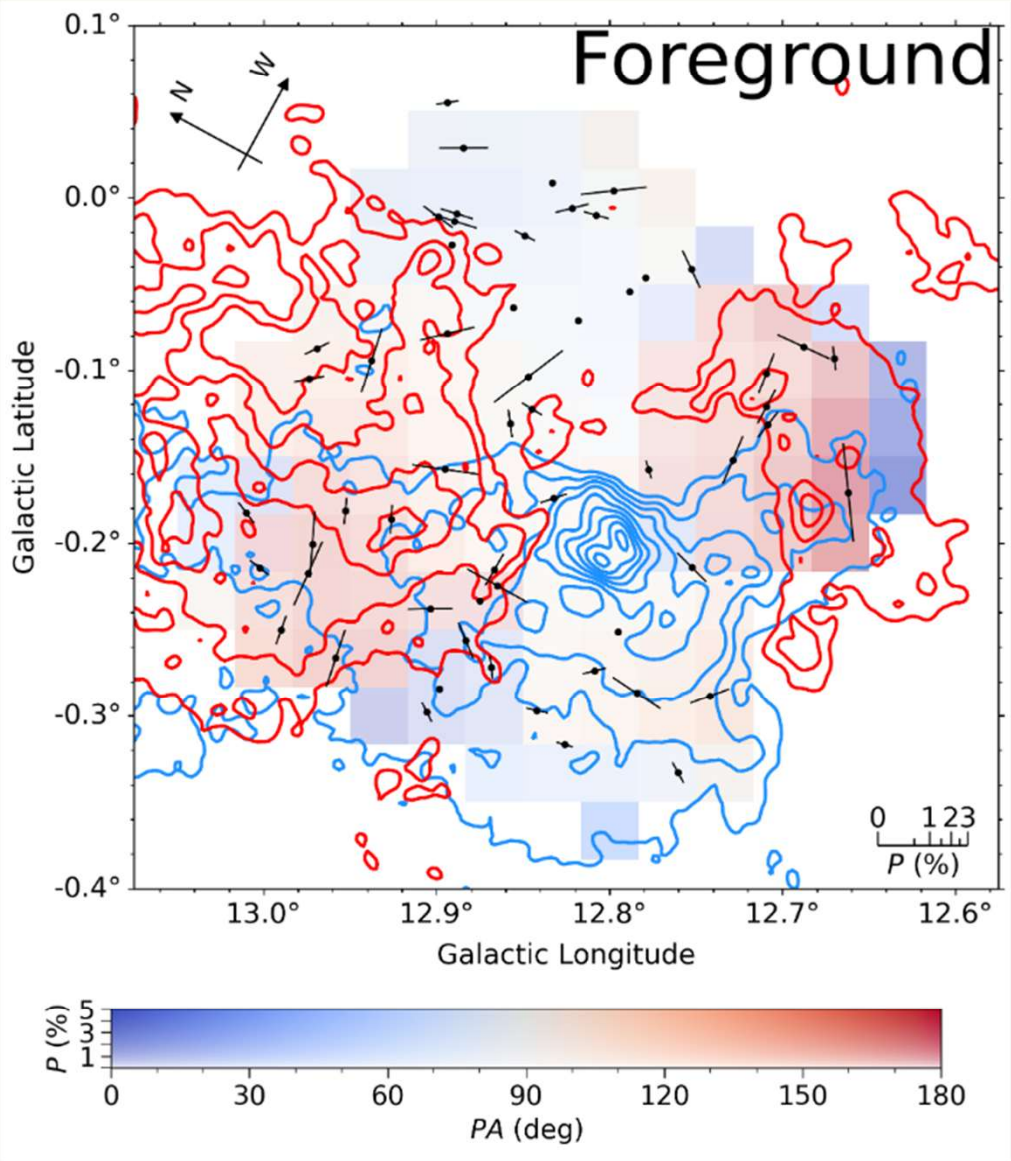
Intrinsic Magnetic Field Structure



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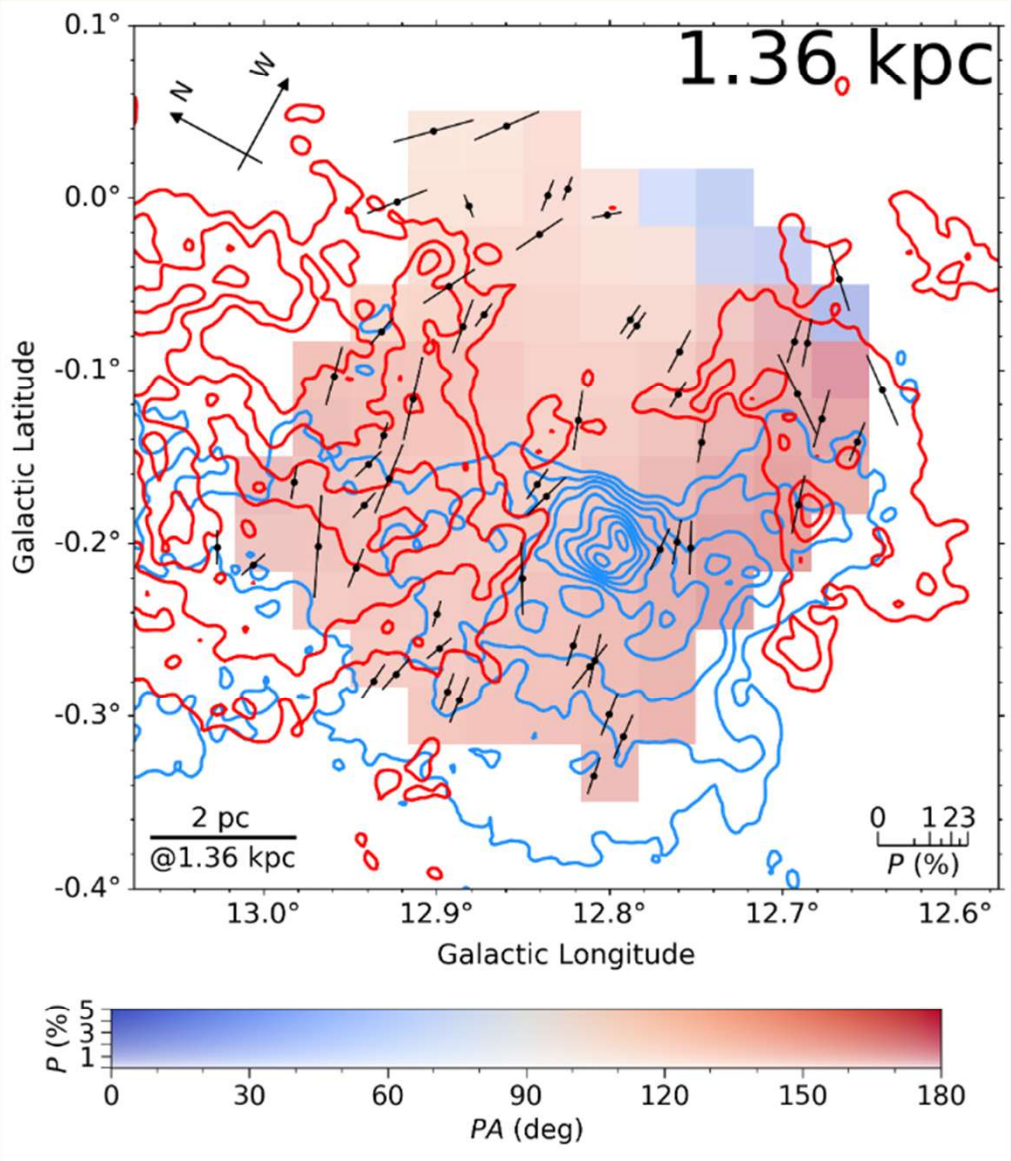
Intrinsic Magnetic Field Structure



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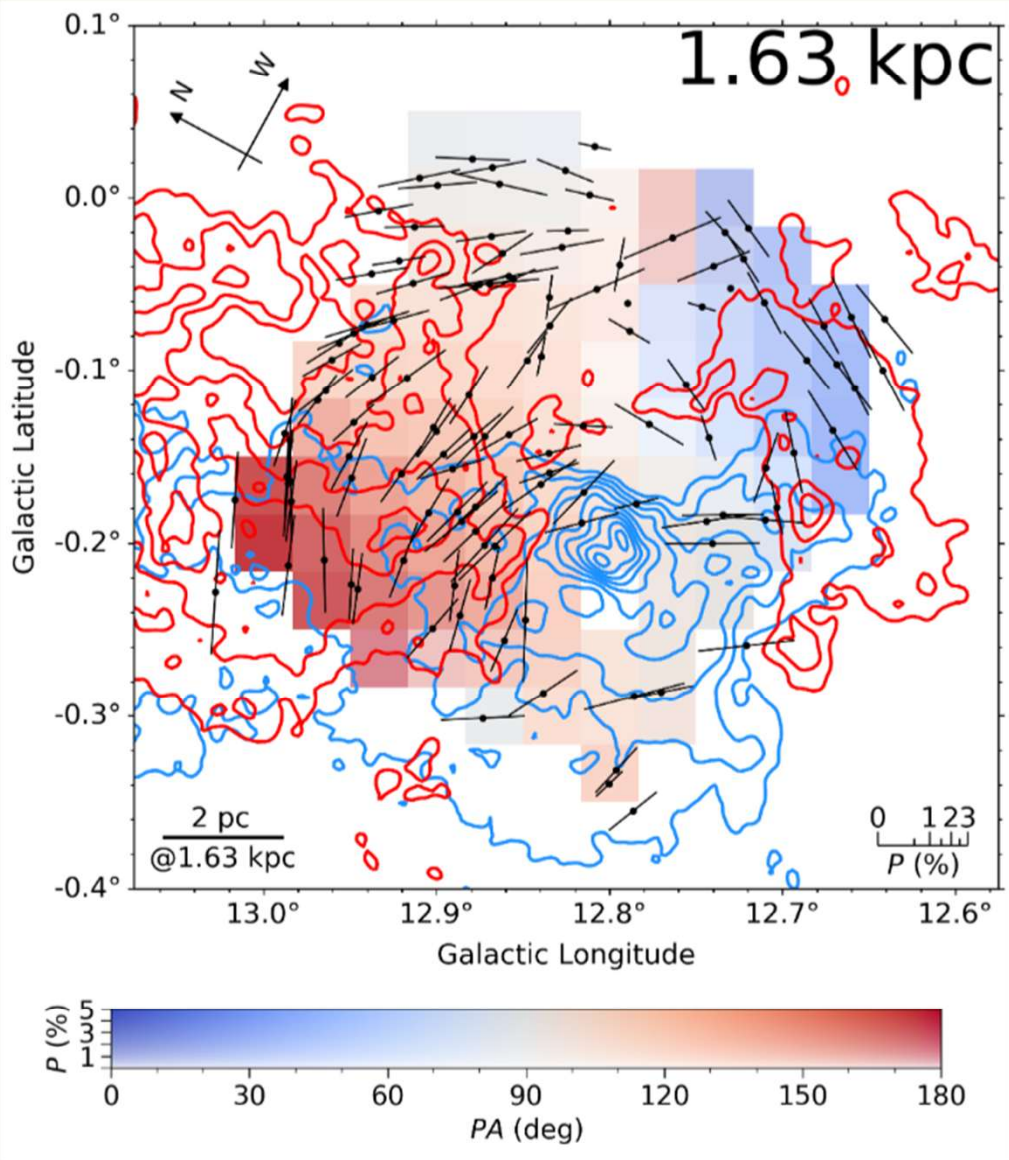
Intrinsic Magnetic Field Structure



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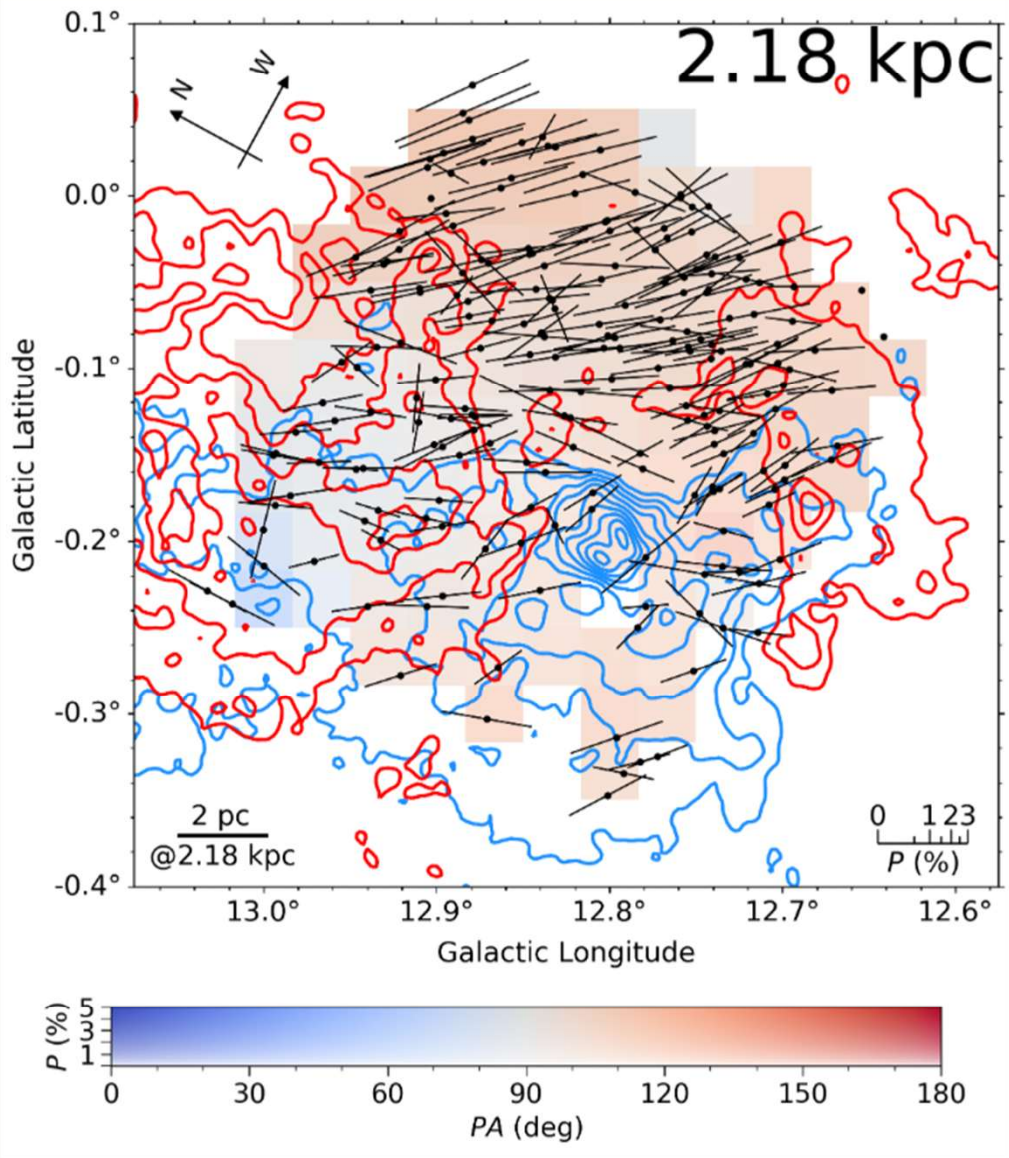
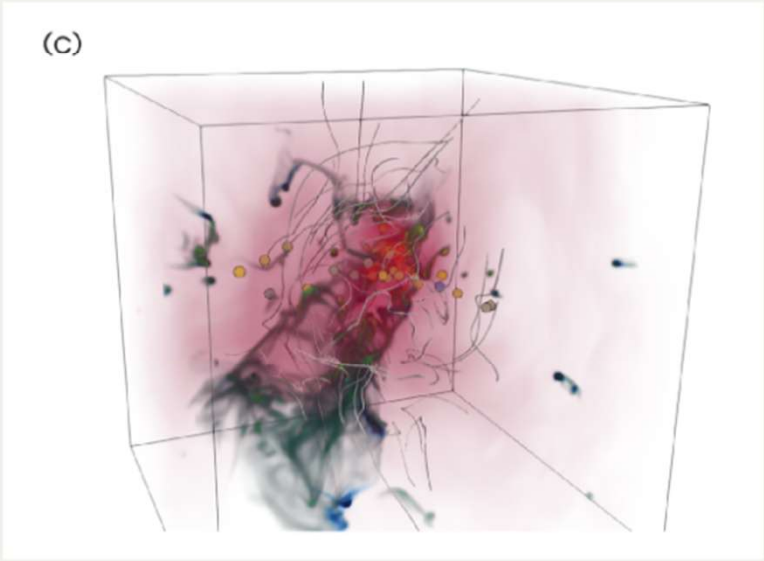
Intrinsic Magnetic Field Structure (W33)





Kim et al. (2021); stellar feedback simulation

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Power-law Fitting

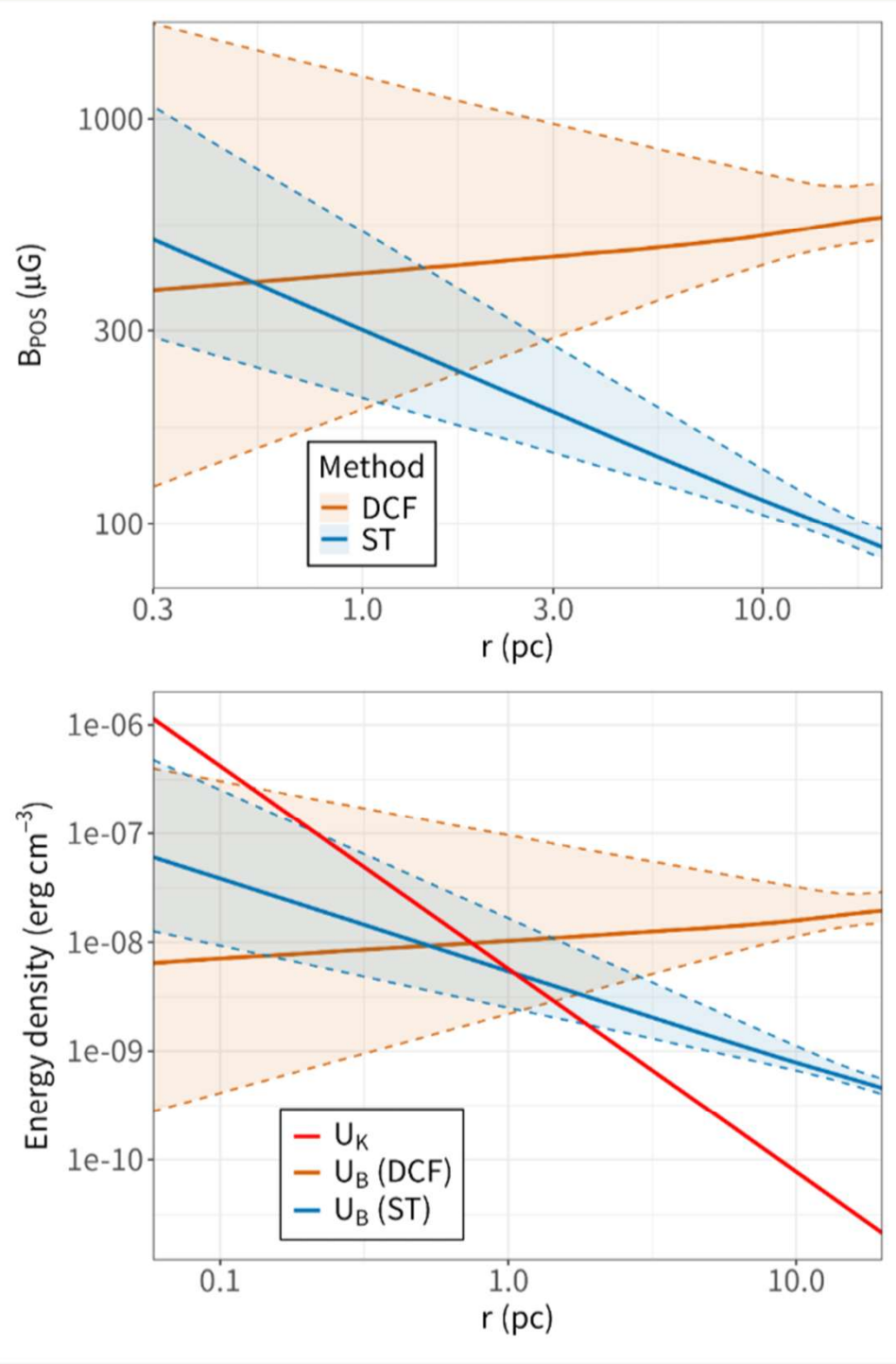
B-field Strength & Energy Density

– Davis (1951), Chandrasekhar & Fermi (1953)

$$B_0 = q\sqrt{4\pi\rho}\frac{\delta v}{\delta\theta}$$

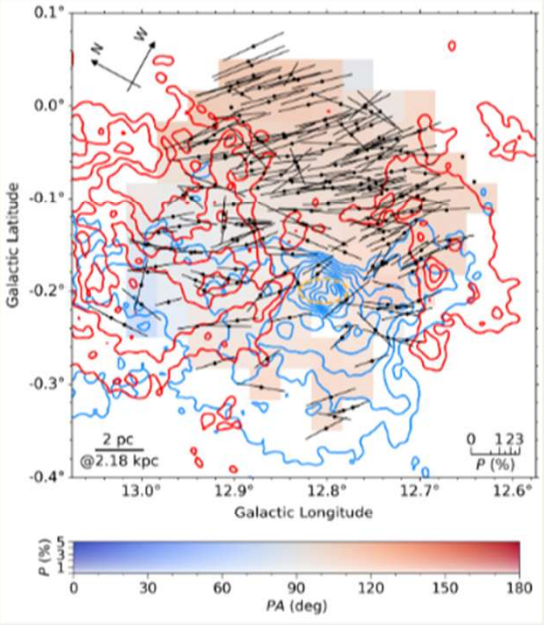
– Skalidis & Tassis (2021)

$$B_0 = \sqrt{2\pi\rho}\frac{\delta v}{\sqrt{\delta\theta}}$$

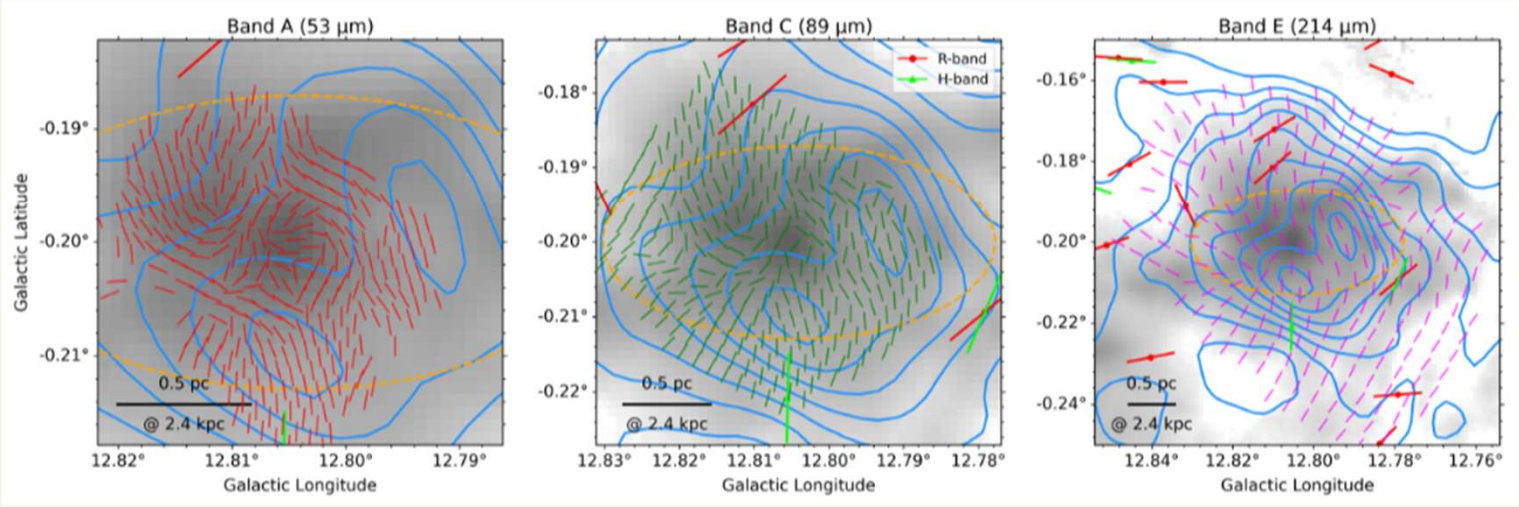


構造

B-field vs. Matter Dominance



This work (optical)



HAWC+ *FIR* observation

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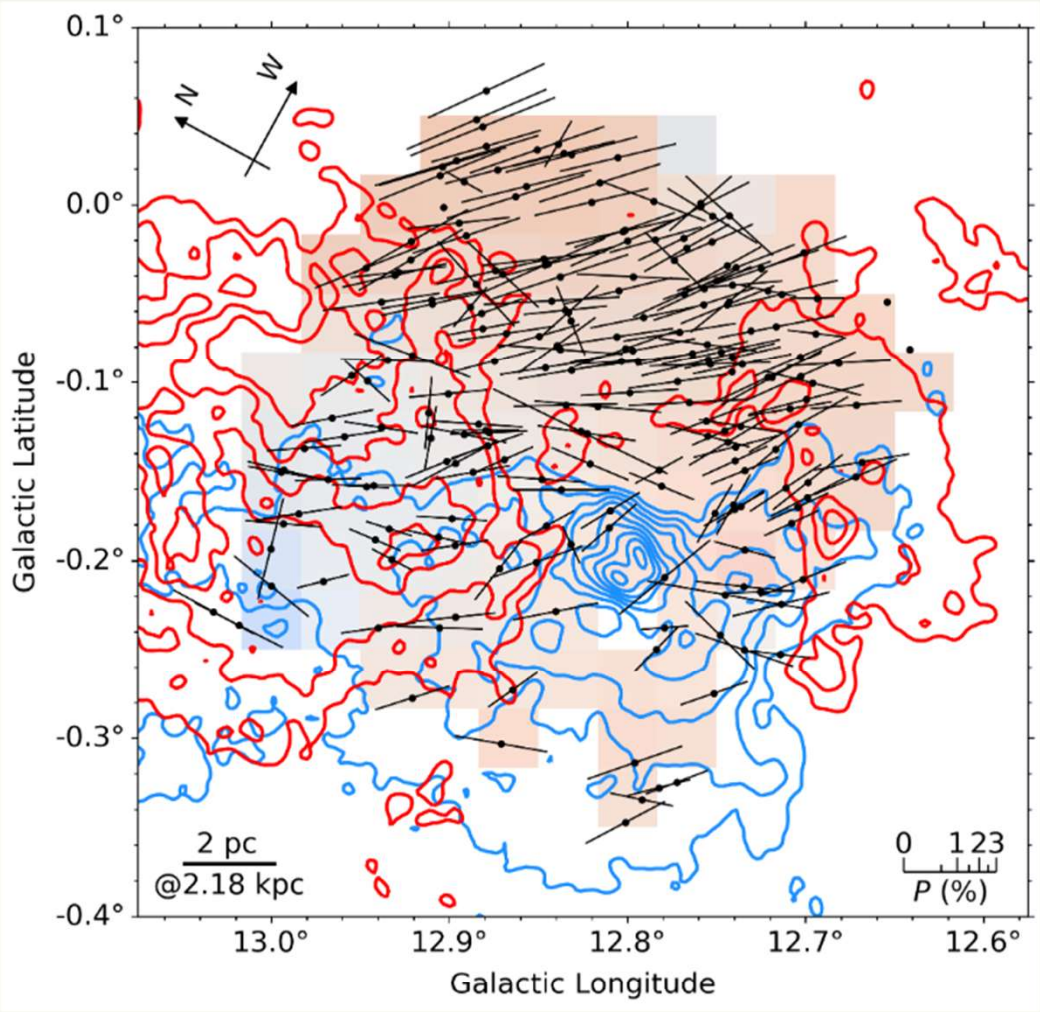
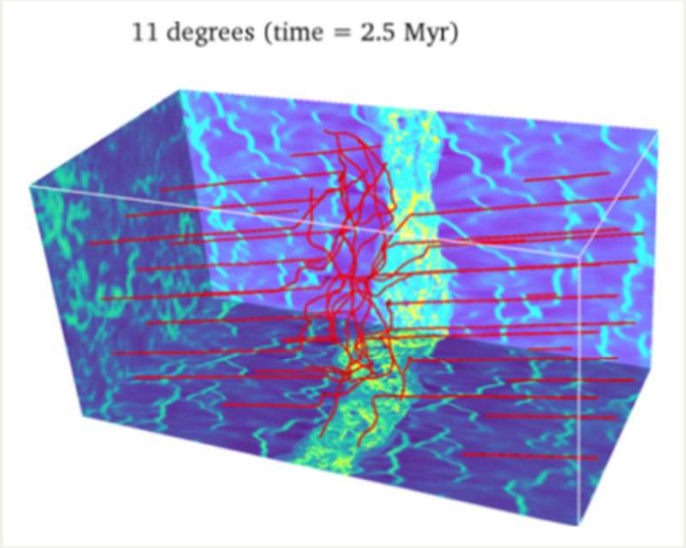
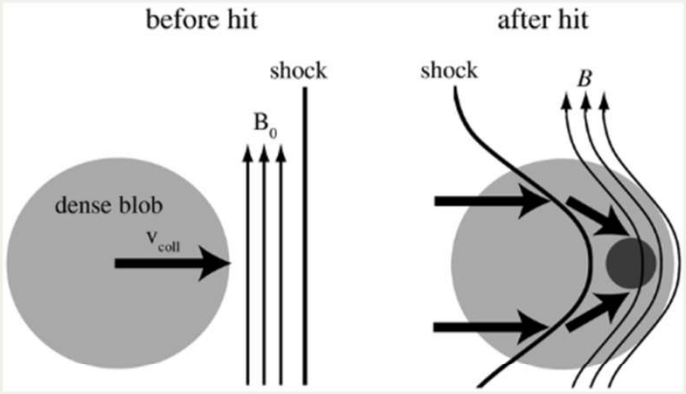
Evidence for CCC?



This Work



Iwasaki et al. (2019)



Inoue & Fukui (2013)

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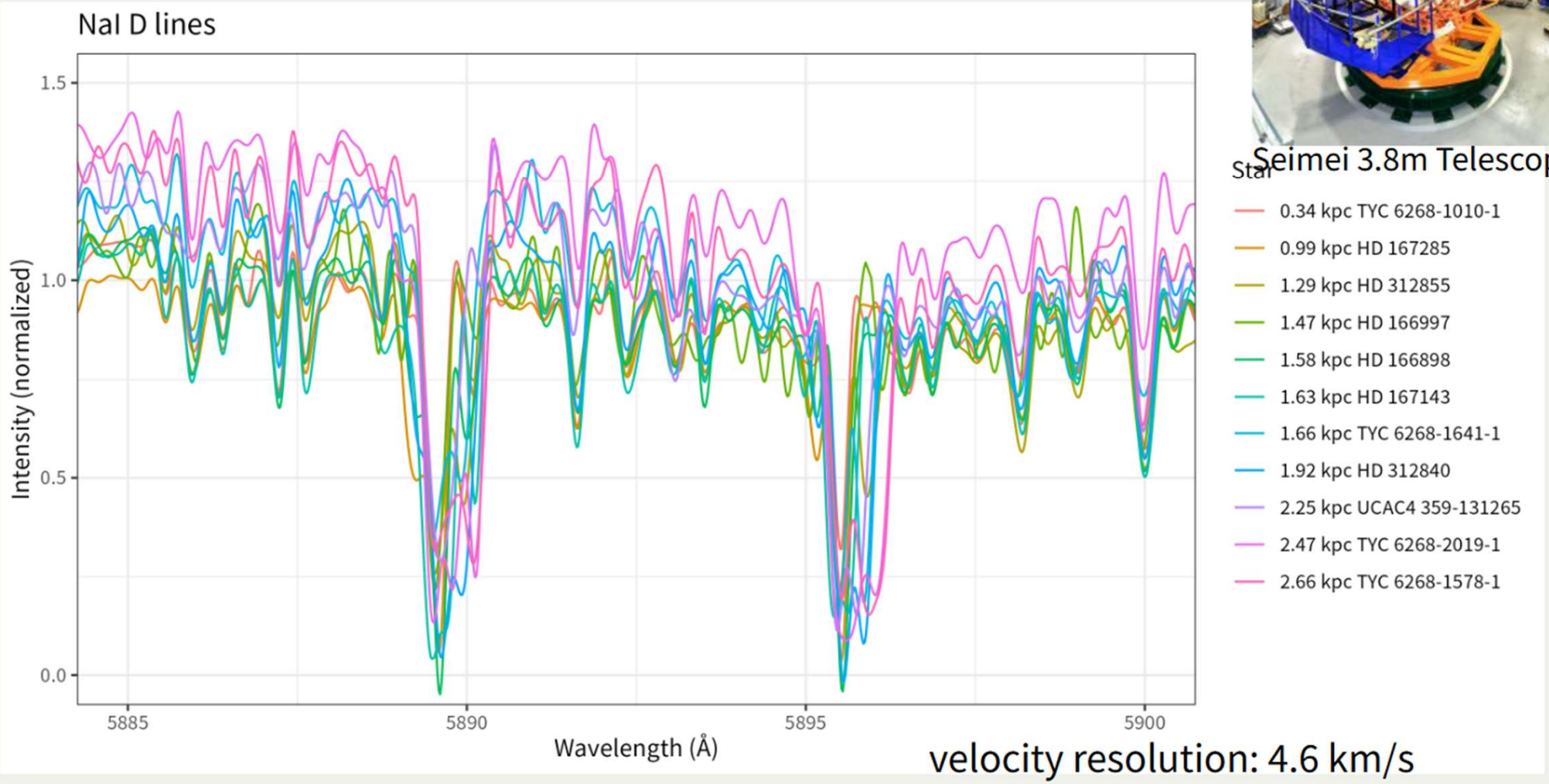
Na D absorption in W33

- 25A-N-CN07 2025/5/26-31

Seimei 3.8m Telescope



velocity resolution: 4.6 km/s

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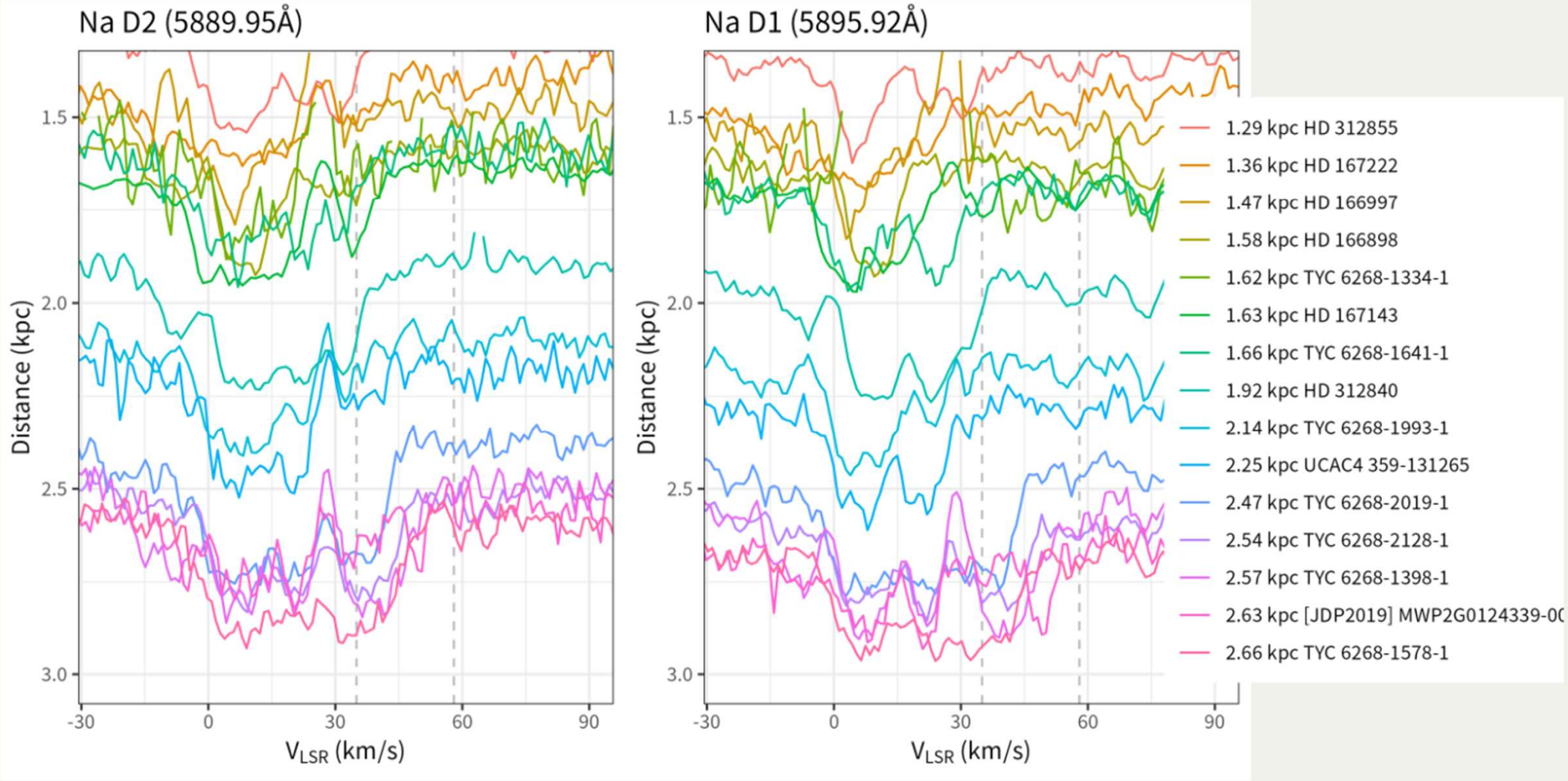
Cloud V_{LSR} in W33



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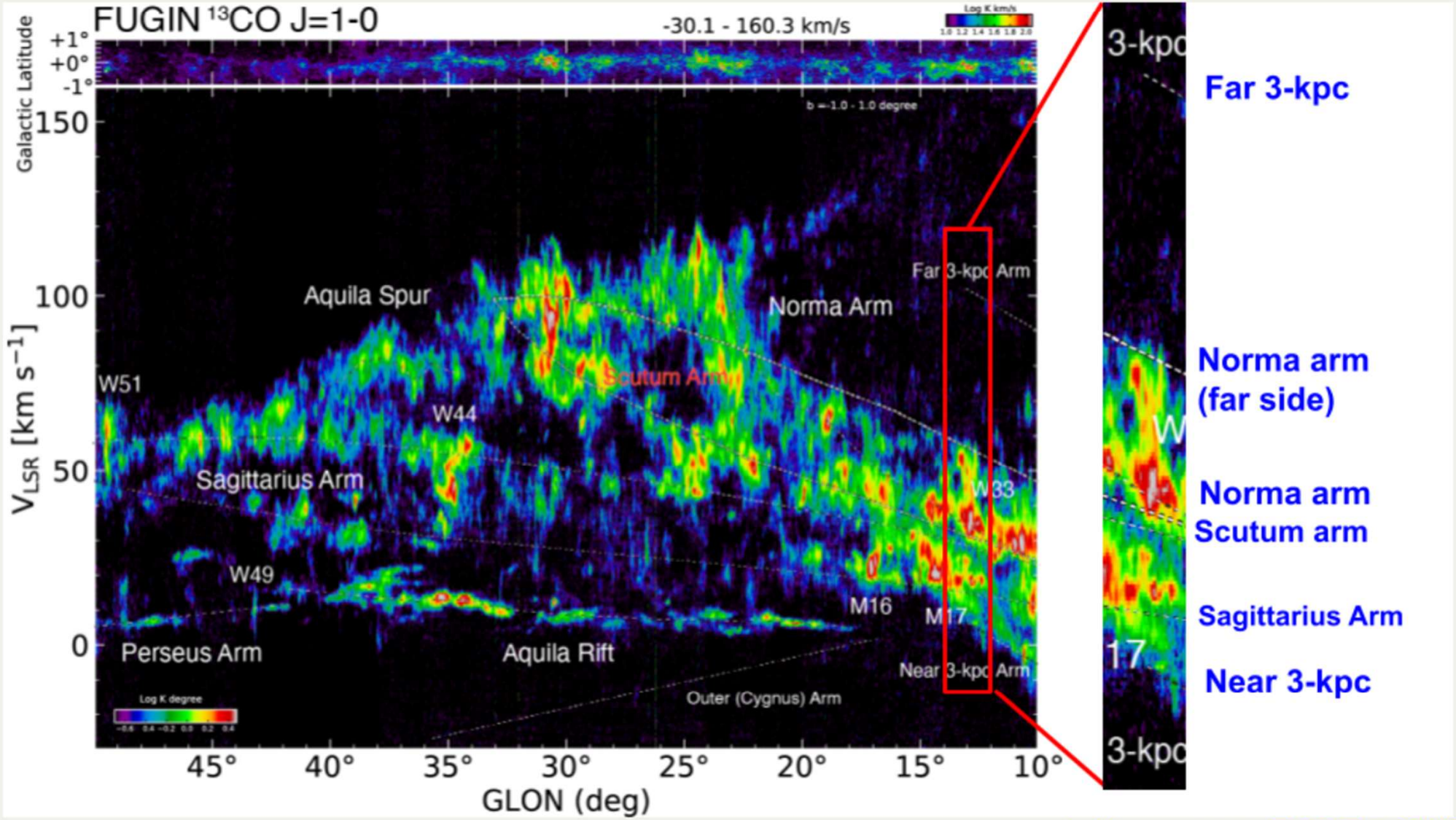
Gas Kinematic Distance



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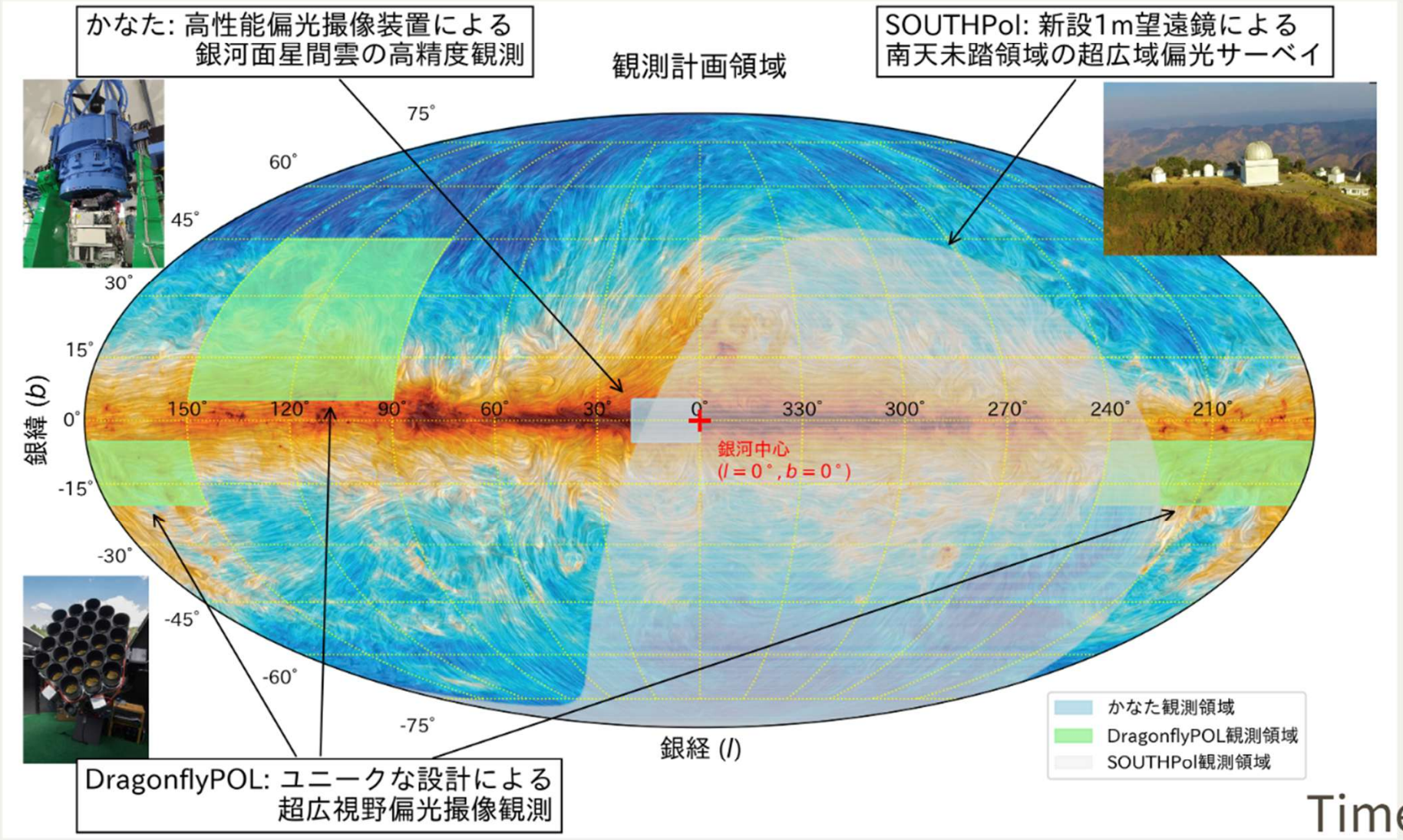
Summary & Future Prospects

- First direct optical polarization map of the W33 magnetic field. It's surprisingly smooth and ordered.
- Magnetic energy dominates over gas kinetic energy, which explains the smooth structure.
- We used **GAOES-RV spectroscopy** and **Gaia's absolute distances** to confirm star formation is happening in a single cloud. No evidence for a cloud-cloud collision.
- **Seimei 3.8m telescope** will be a **powerful tool** for determining the 3D distribution of molecular clouds.

Upcoming Projects ``All-sky" Polarization Surveys



Timeline

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