



Testing spin parity in galaxies, groups and clusters

Galaxy winding and projected group / cluster motions across the sky

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1 Why study spin parity across scales?

Does the cosmos favour a handedness?

Compare clockwise and anticlockwise outward winding across the sky.



Clockwise (CW)



Anticlockwise (ACW)

Mirror symmetry predicts no ensemble preference. Image winding is a proxy for spin, not a direct rotation measurement.

Could early physics leave a trace?

Primordial chirality -> halo spins

Simulations show that an initial handed pattern can survive in later halo spins [1].

Rotating black-hole universe (BHU)

A speculative proposal links a rotating parent black hole to a preferred axis and possible spin-direction asymmetry [2].

Rotation or an axis alone does not prove parity violation. We do not test these specific models.

Standard LambdaCDM: no preferred hand

Tidal torques can align spins [3].

Alignment can preserve mirror symmetry.

Correlated spins are allowed.

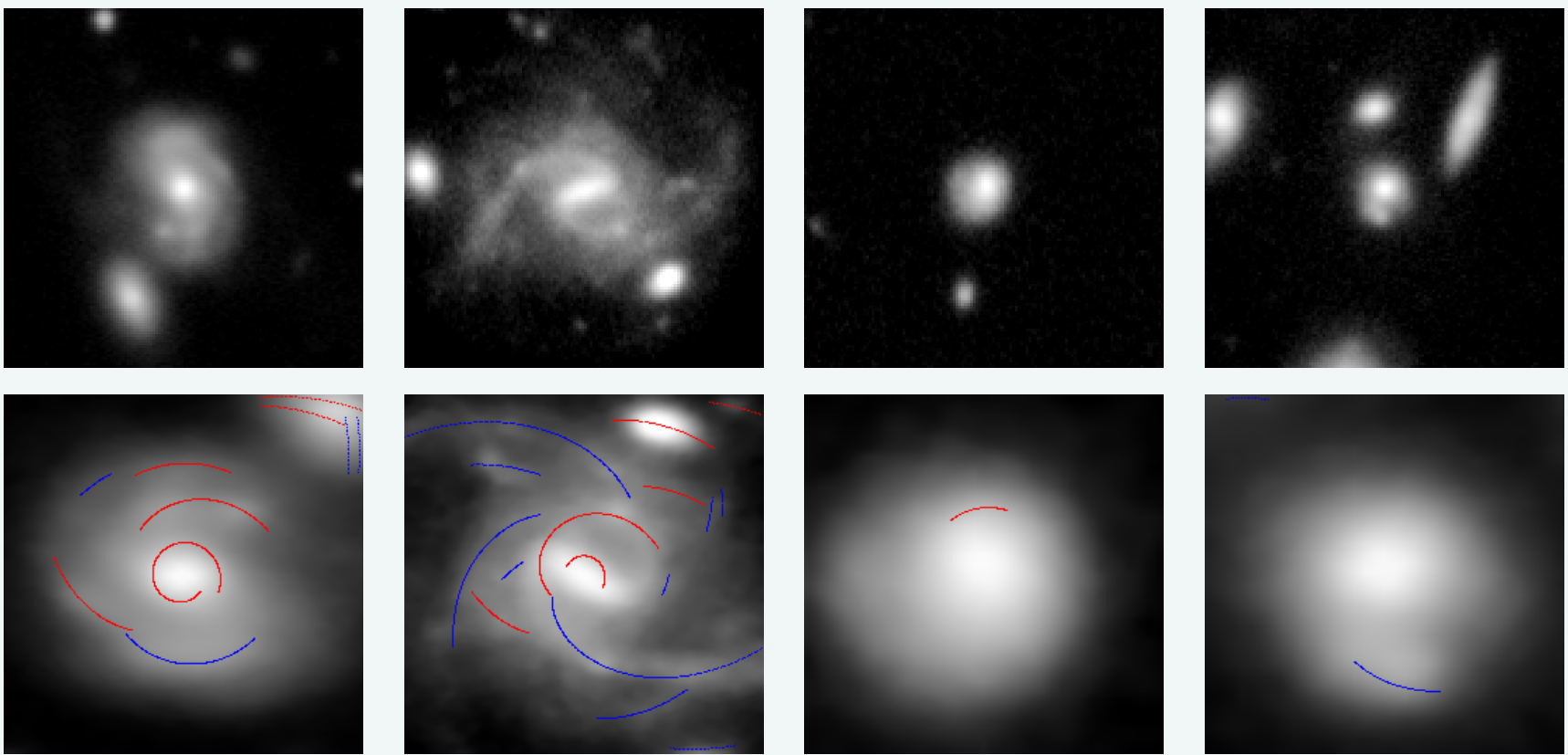
With parity-symmetric initial conditions, no ensemble handedness preference is expected. A finite sample can still be imbalanced.

Theory: [1] Shim et al. (2025 revision), arXiv:2406.06080; [2] Poplawski (2025 revision), arXiv:1910.10819; [3] Lee & Pen (2001), ApJ 555, 106. Full references: QR.

2 Galaxy winding: dipole as the main directional test

Our galaxies: images and fitted arms

Brighter CW $r = 15.05$ **Brighter ACW** $r = 15.96$ **Fainter CW** $r = 17.64$ **Fainter ACW** $r = 17.69$



Our input cutouts (top) and stored arm fits (bottom).

Development examples, not validation. Brighter ACW chosen for visible structure. Curves are stored fits, not proof of spin. Smaller r = brighter.

30,910 resolved / 49,211 images

CW: 15,479

ACW: 15,431

Observed imbalance +0.155%

$A = (CW - ACW) / \text{resolved}; 18,301$ unresolved

Selection: 46.7% of smallest vs 75.2% of largest resolve.

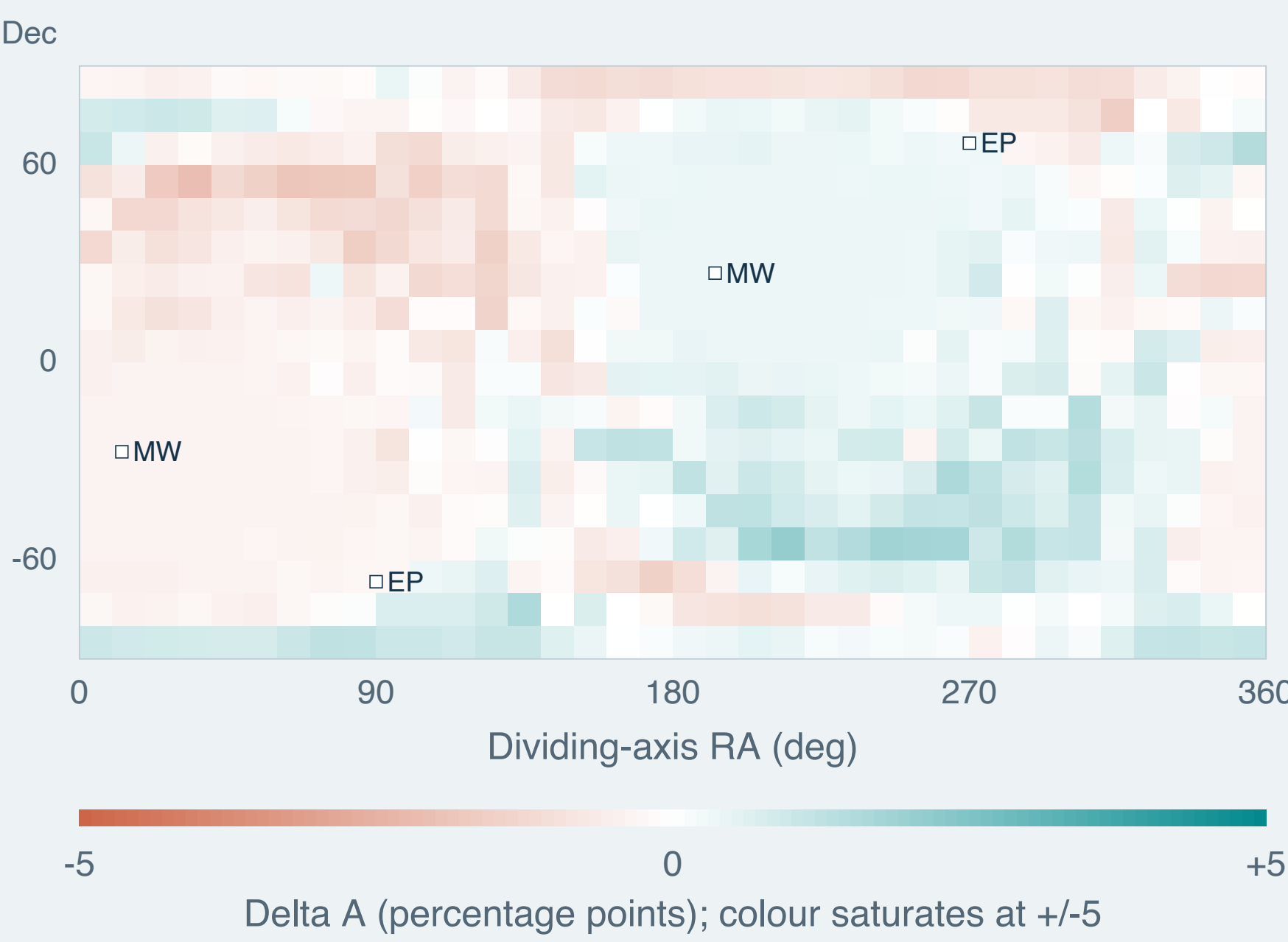
DESI: 7,905 positional matches; 4,920 also resolved.

DESI associations are provisional. Added dipole/quadrupole terms did not improve held-out prediction.

SpArcFiRe | 30,910 resolved

Stored spiral-arm fits; same 49,211 targets

Colour: imbalance toward the axis minus the opposite half.



CW 15,479 | ACW 15,431

Map cells: -2.1 to 2.1 pp (not a confidence range)

Historical dipole: 2.27%

Approx. 95% Wald: 0.00-7.79%

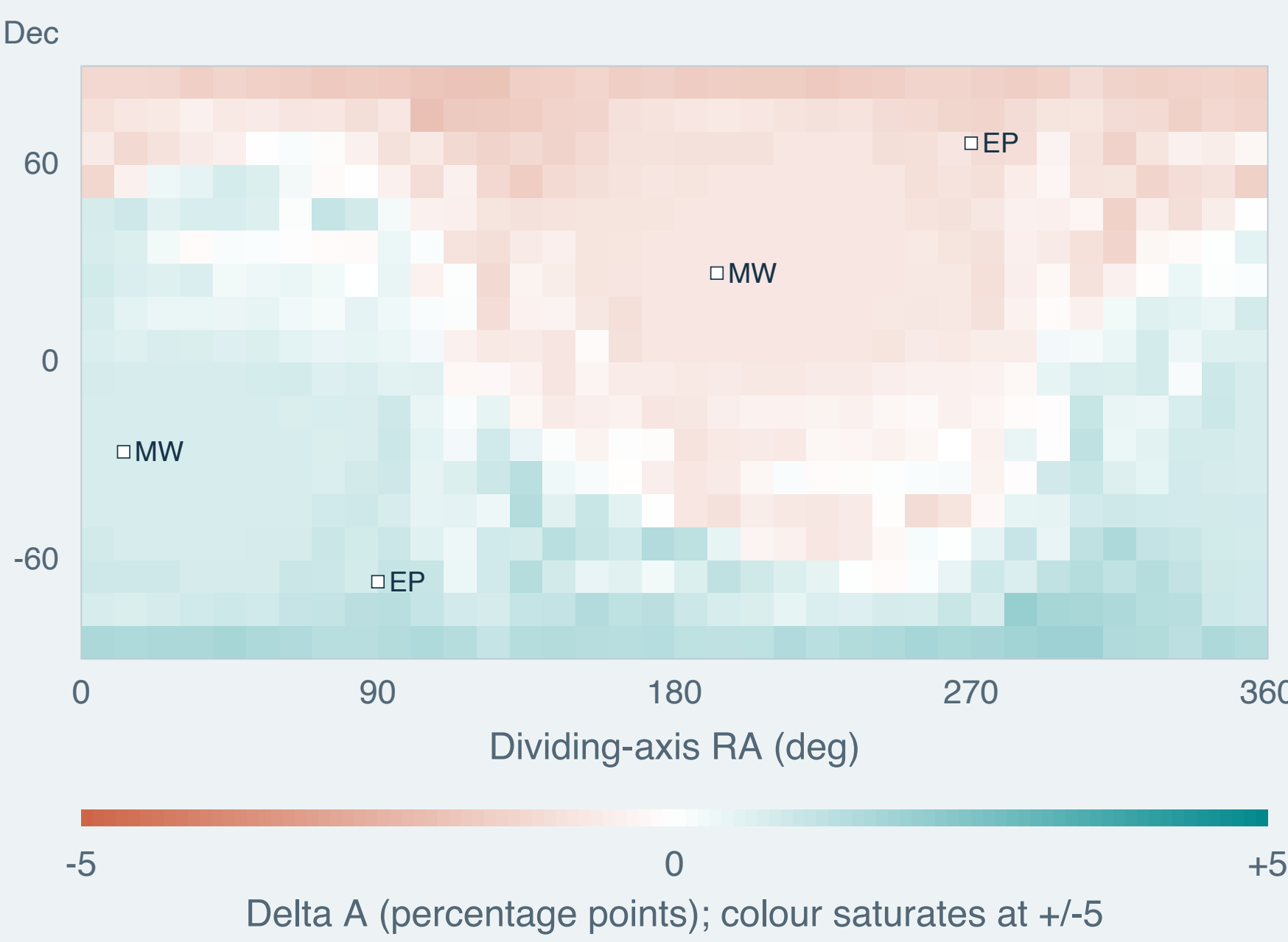
Conditional global shuffle $p = 0.684$

The map shows hemisphere contrast, not dipole amplitude. No preferred direction established.

Fourier | 49,007 assigned

Frozen image-pattern estimator; same targets

Colour: imbalance toward the axis minus the opposite half.



CW 24,644 | ACW 24,363

Map cells: -2.0 to 2.0 pp (not a confidence range)

Full dipole: 1.65% [0.00-6.03%]

Shared sample: 2.16% [0.00-7.68%]

Approx. 95% Wald envelopes; shared $n = 30,910$.

Four new tests: Bonferroni $p = 1.0$ each

Conditional shuffles; classification and selection biases remain. No population calibration transfer.

Shared sample: 30,910 galaxies; 18,791 labels agree. Maps above use each method's full resolved/assigned set and one display orientation. SpArcFiRe GZ/CzSL: -0.06% [-4.44%, +4.32%], assuming transferable shared class errors and equal CW/ACW resolution. Cohort-specific errors: [-19.07%, +11.10%] under a different model and joint confidence construction. Calibration details: QR.

3 Groups and clusters: exploratory motion patterns

How we measure projected motion

Regression

Fit member line-of-sight velocity versus angle with a sine and cosine.

Half-plane

First harmonic of mean velocity contrasts across rotating half-planes.

Reading the maps

H summarizes pairs of fitted directions, with each system weighted equally.

$10^4 \times [H(\text{toward}) - H(\text{opposite})]$.

Not speed or a fraction of rotating systems.

Limits

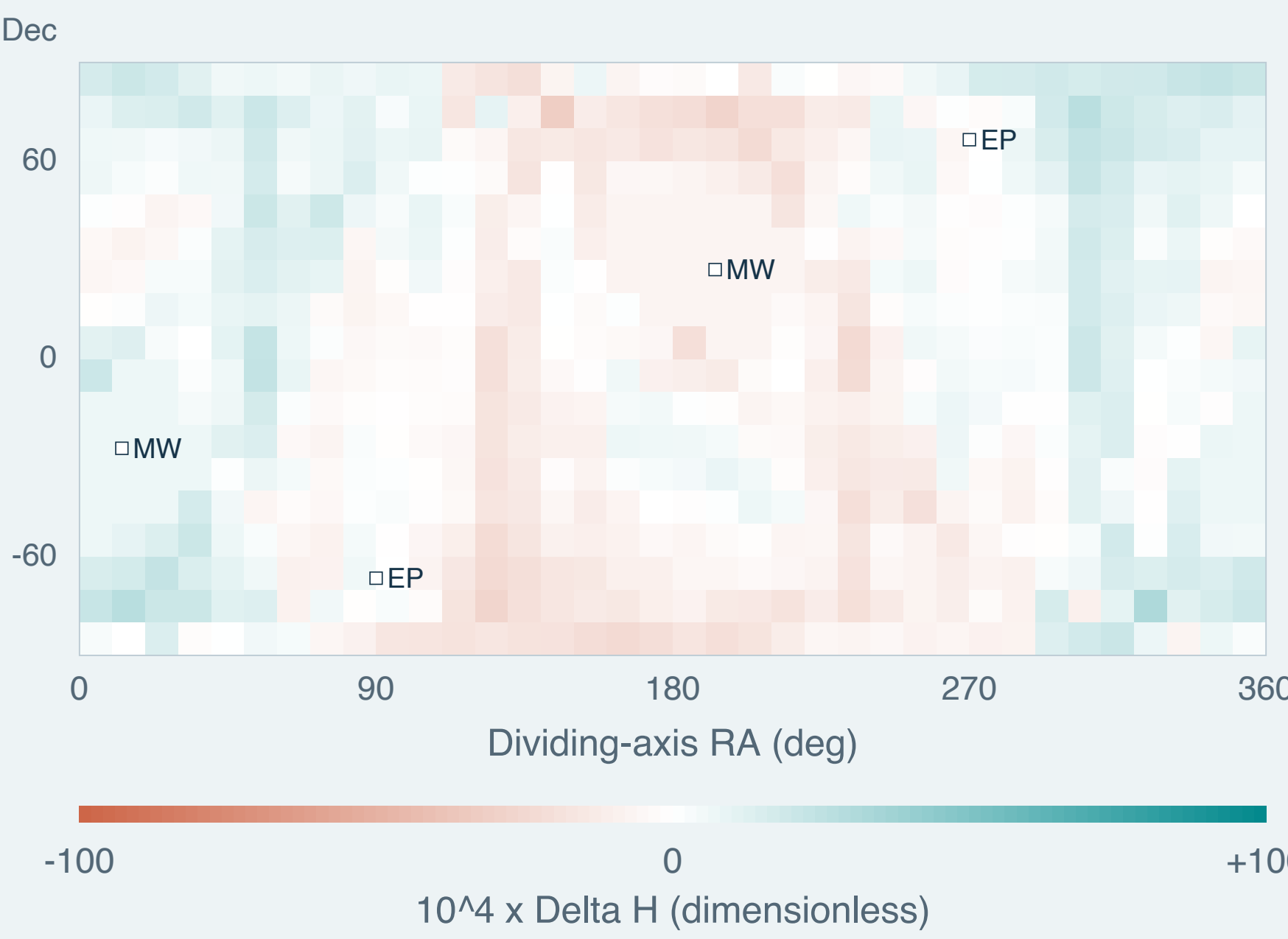
Conditional sign-null tests: adjusted $p = 1$.

Formal errors are not total uncertainty;

native membership/centre calibration is open.

1 Regression

1,713 groups + 9 clusters after screening



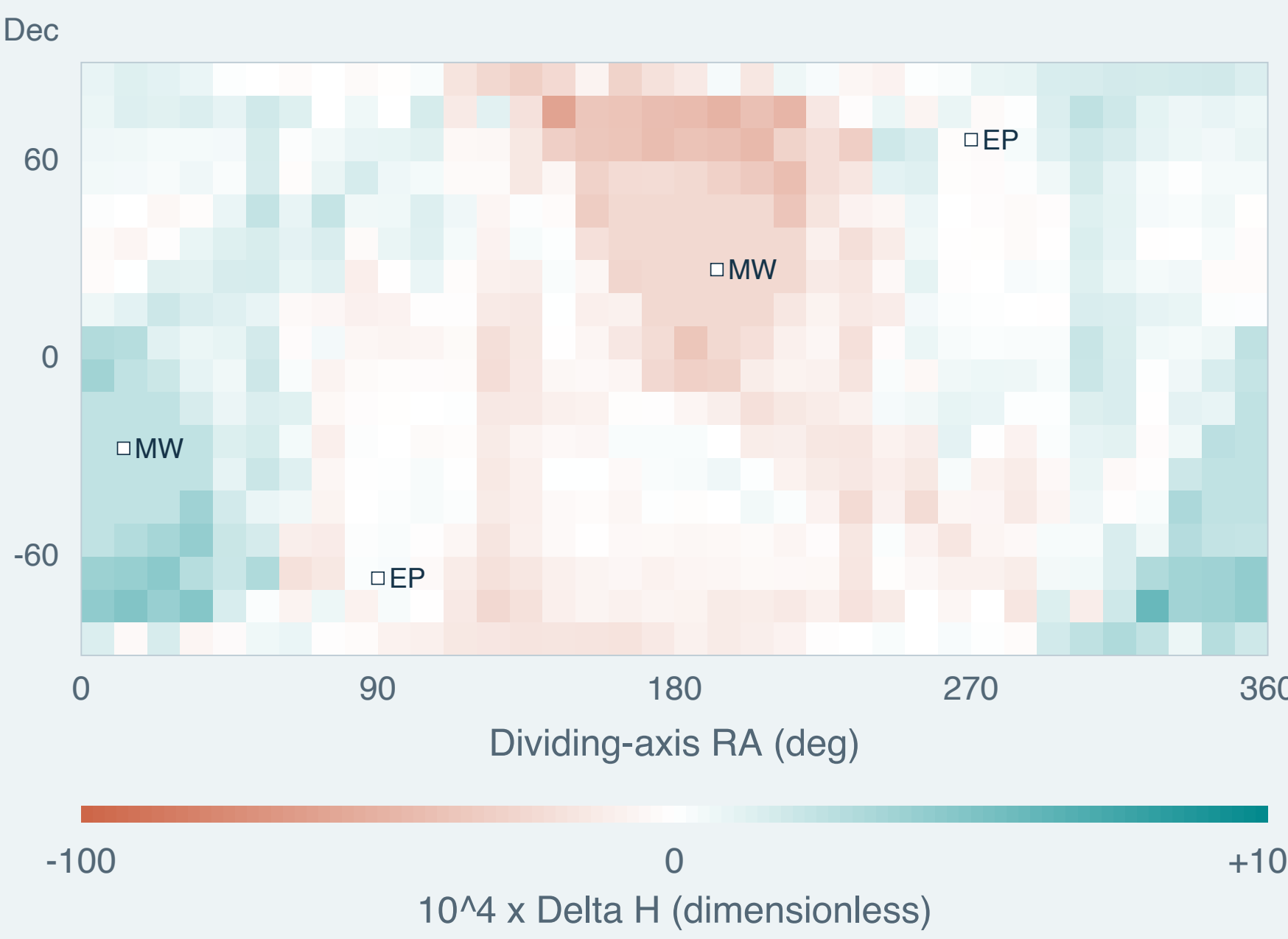
All-system $10^4 H = +0.674$

Leave-one-system $10^4 H$: +0.023 to +1.319

Sensitivity, not a confidence interval.

2 Half-plane

1,713 groups + 9 clusters after screening



All-system $10^4 H = +0.211$

Leave-one-system $10^4 H$: -0.416 to +0.839

Sensitivity, not a confidence interval.

Take away

- Galaxies: neither method establishes a preferred sky direction under the reported conditional tests. Agreement between winding labels is not accuracy.
- Group/cluster H depends on selection and centre choice; conditional sign-null tests show no excess.



Background
References

Maps show hemisphere contrast across dividing-axis directions, not object positions.
Opposite axes reverse sign by construction. EP / MW: ecliptic / Galactic reference poles.
Background and references: nebulamind.net/studies/spin-parity-2026.html

Duho Kim | KAS 2026 Fall | 12 October 2026