

1 Why study spin parity across scales?

Could nature prefer a handedness?



Clockwise (CW)



Anticlockwise (ACW)

Spin-parity violation is a cosmic handedness preference. Standard LambdaCDM predicts no preference; a confirmed signal would challenge it.

Schematic: outward arm winding, not rotation arrows.

Could cosmic physics leave a trace?

Primordial chirality -> halo spins

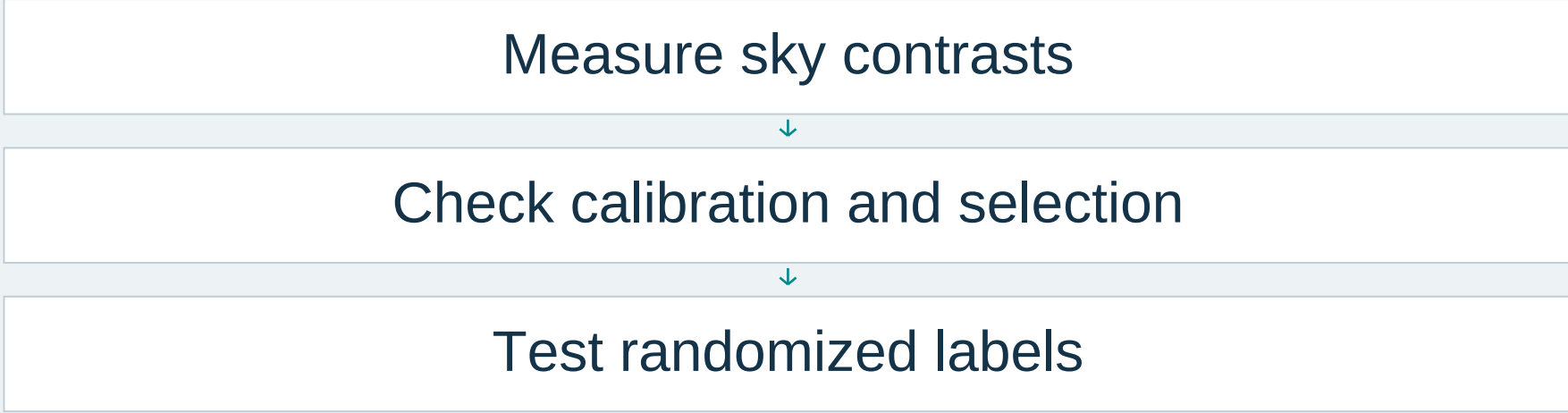
Simulations show that an initial handed pattern can survive in later halo spins [1].

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 a preferred axis alone does not prove parity violation. No model is tested here.

Could selection mimic a signal?



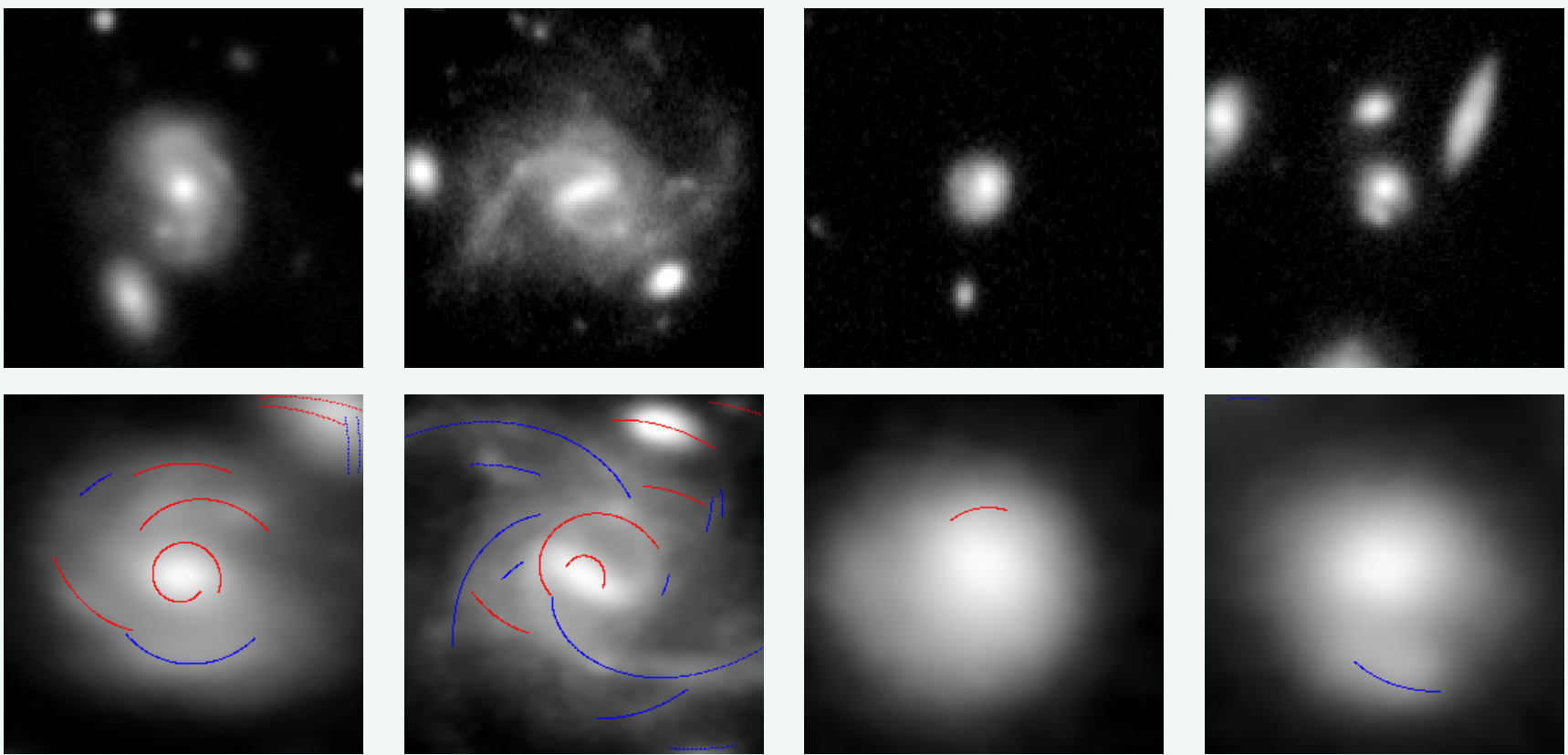
Winding and projected motions are proxies, not full 3D spin. A dipole alone is not proof of parity violation.

Theory: [1] Shim et al. (2025 revision), arXiv:2406.06080; [2] Poplawski (2025 revision), arXiv:1910.10819. Methods and full references: QR link.

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.

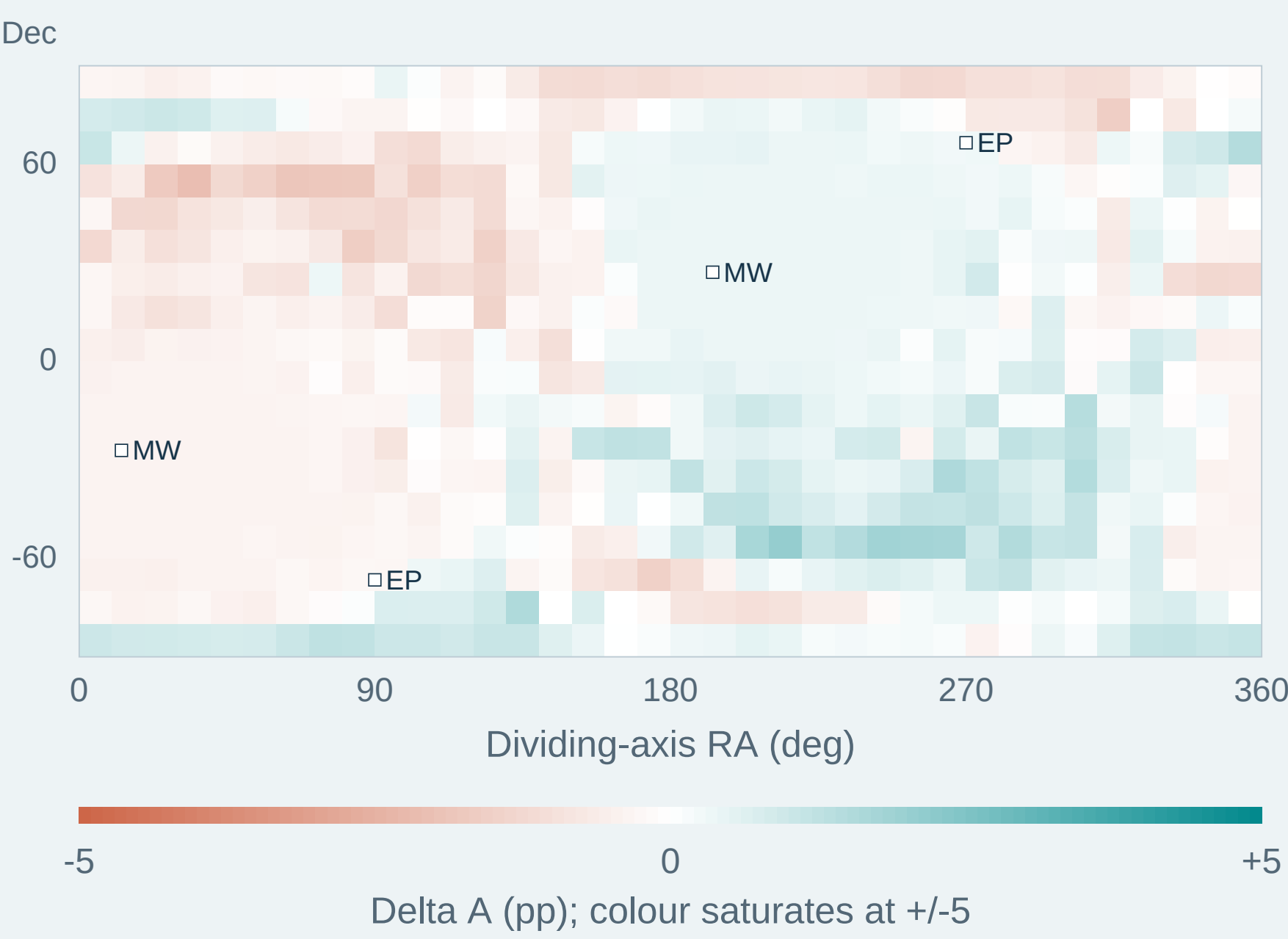
DESI: 7,905 positional matches; 4,920 also resolved.

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

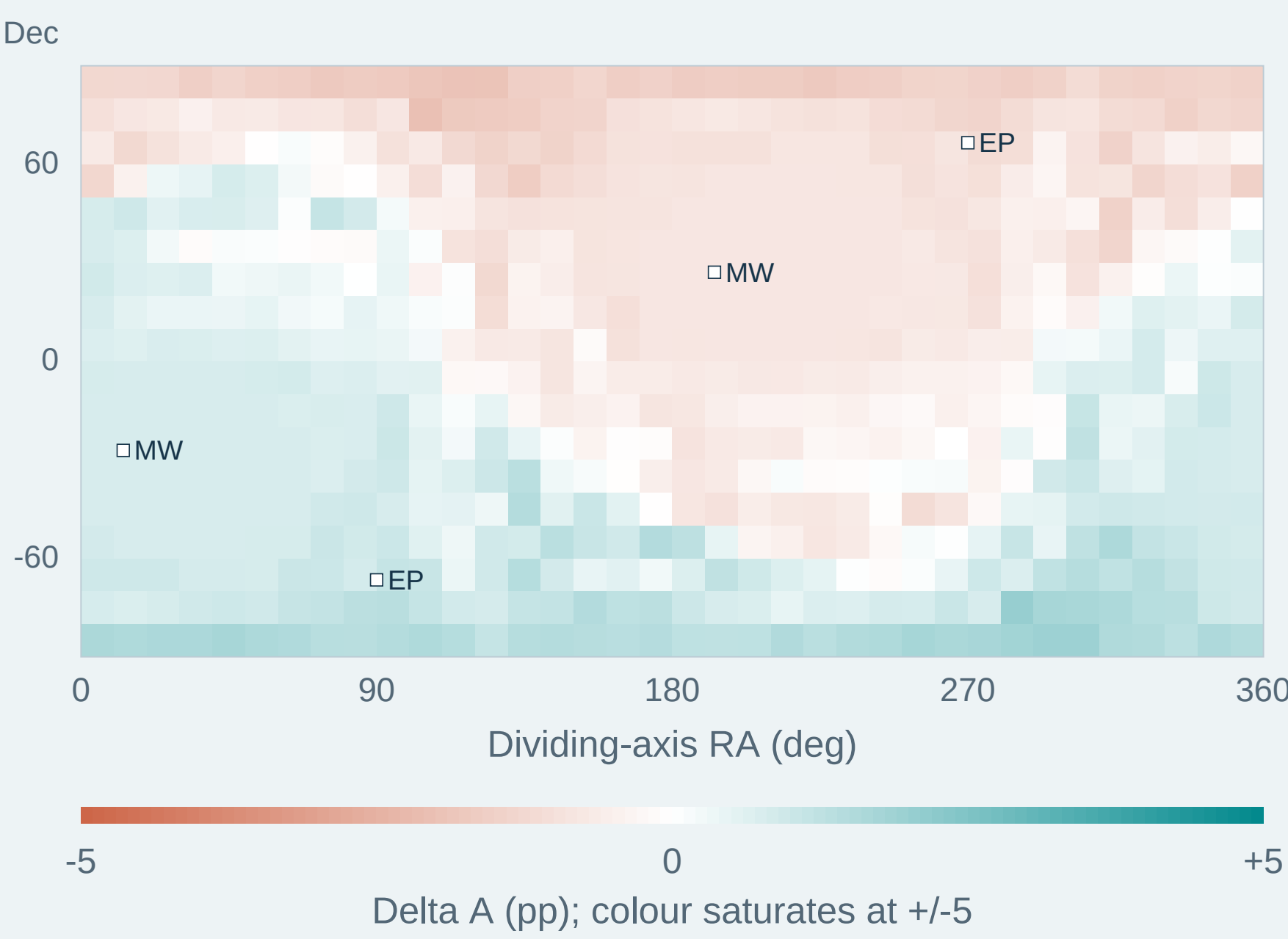
Map cells: -2.1 to 2.1 pp (not a confidence range)
Saved SpArcFiRe-only directional fit: dipole 2.27% [0.00%, 7.79%], approx. 95%. Global shuffle $p = 0.684$.

The contrast map is not dipole amplitude. No preferred direction established.

Fourier | 49,007 resolved

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)
Second algorithm, same inventory: 49,007 images attempted once; 49,007 resolved; 204 missing. Pooled $A = +0.573\%$.

No calibration transfer and no new significance test. Grey: fewer than 30 per half.

Two algorithms, one 49,211-target inventory; resolved sets differ. CW/ACW share one display orientation. Maps are observed contrasts, not detections. Both resolve 30,910 (18,791 agree). SpArcFiRe GZ/CzSL: -0.06% [-4.44%, +4.32%], assuming shared errors. Cohort differences: [-19.07%, +11.10%].

3 Groups and clusters: exploratory motion patterns

How we measure projected motion

1 Regression

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

Velocities -> angular fit -> direction

2 Half-plane

Rotate a dividing line; compare the two mean velocities and extract the first harmonic.

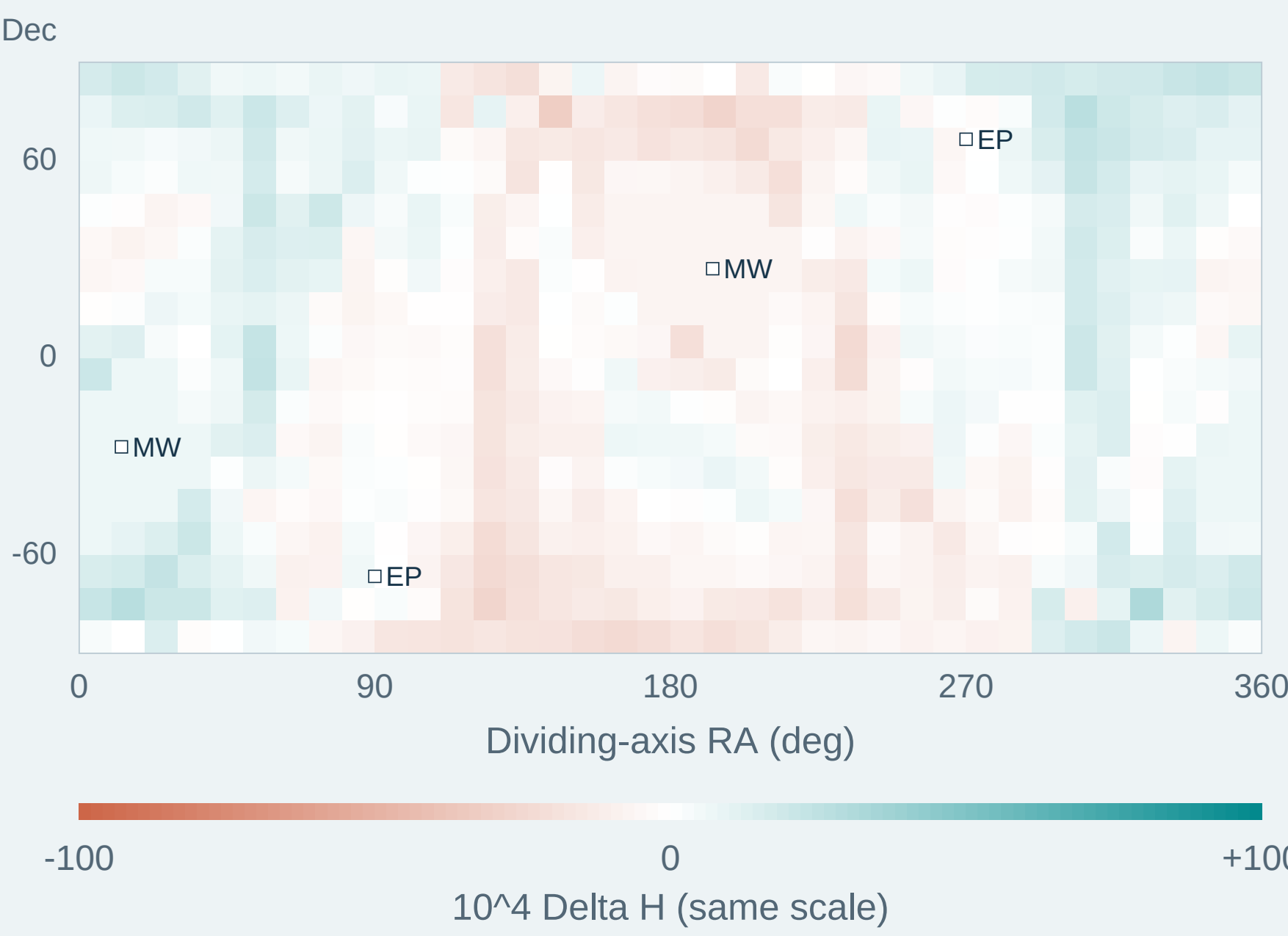
Two halves -> contrast -> direction

H summarizes pair handedness of projected directions. Map colour is $H(\text{toward}) - H(\text{opposite})$.

H is dimensionless, not speed or CW/ACW %.

1 Regression

1,713 groups + 9 clusters after screening



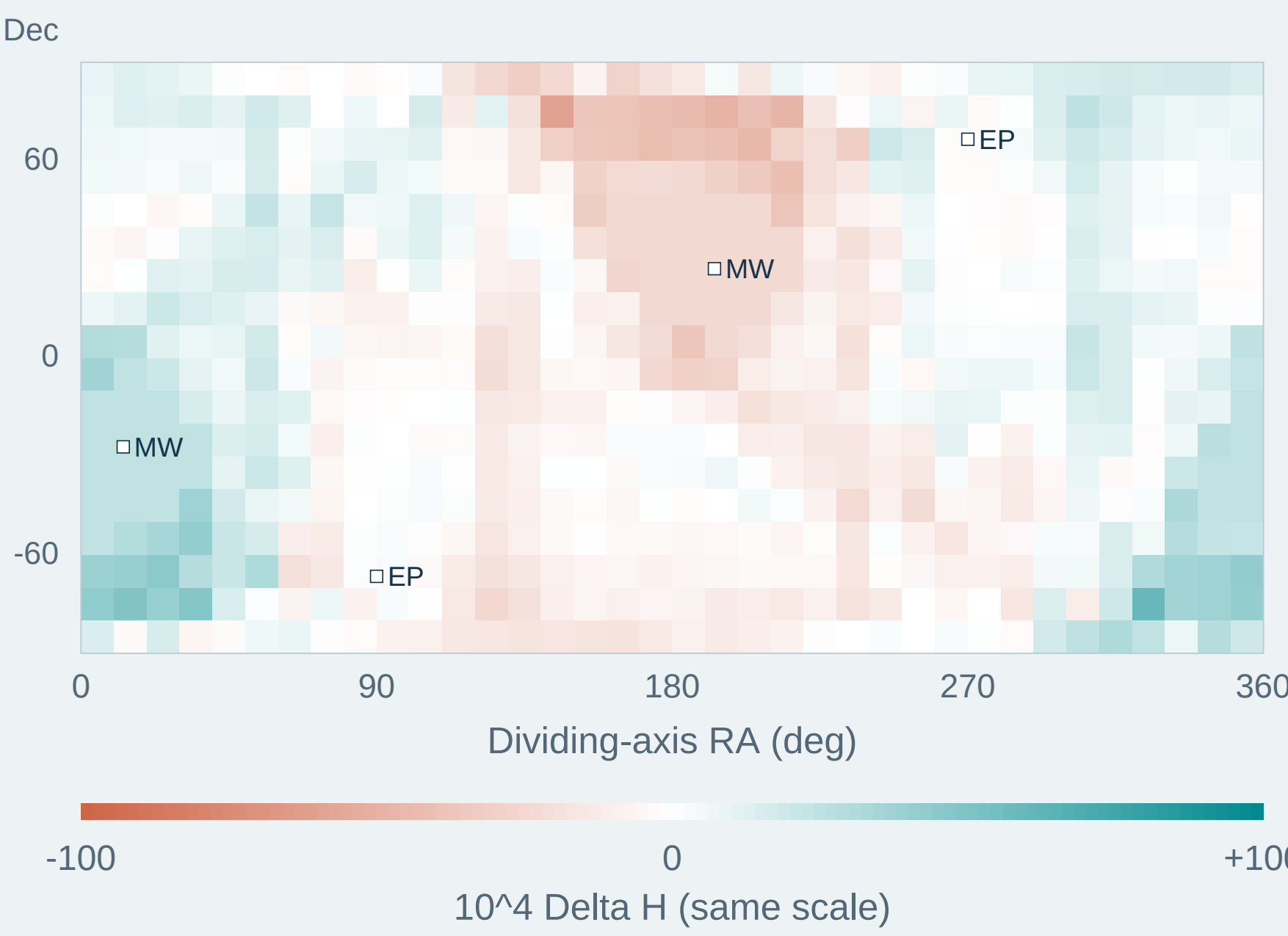
All-system $10^4 H = +0.674$

Leave-one range: +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 range: -0.416 to +0.839

Sensitivity, not a confidence interval.

Take away

Galaxies: no preferred sky direction established. SpArcFiRe dipole 2.27% [0.00%, 7.79%]; global shuffle $p = 0.684$.

Both algorithms cover 49,211 targets. SpArcFiRe calibration assumes shared errors: -0.06% [-4.44%, +4.32%]. Cohort differences widen this.

Groups / clusters: 1,722 systems, two estimators on the same systems. Motion patterns are not confirmed physical spin.

No robust spin-parity detection. A confirmed cosmic asymmetry would challenge standard cosmology.



Research details

NebulaMind