



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?

Could nature prefer a handedness?



Clockwise (CW)

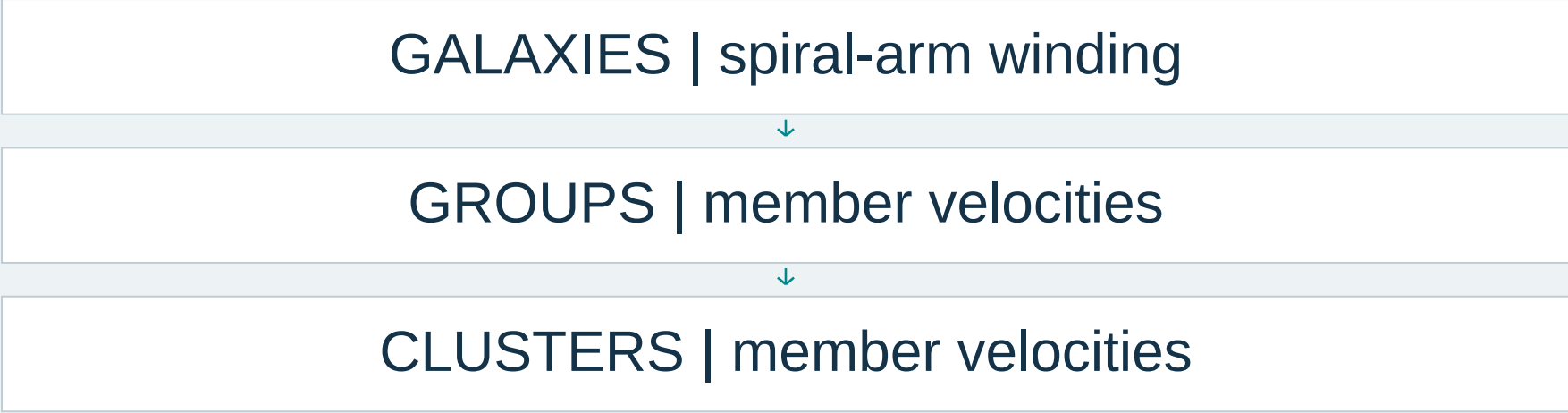


Anticlockwise (ACW)

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

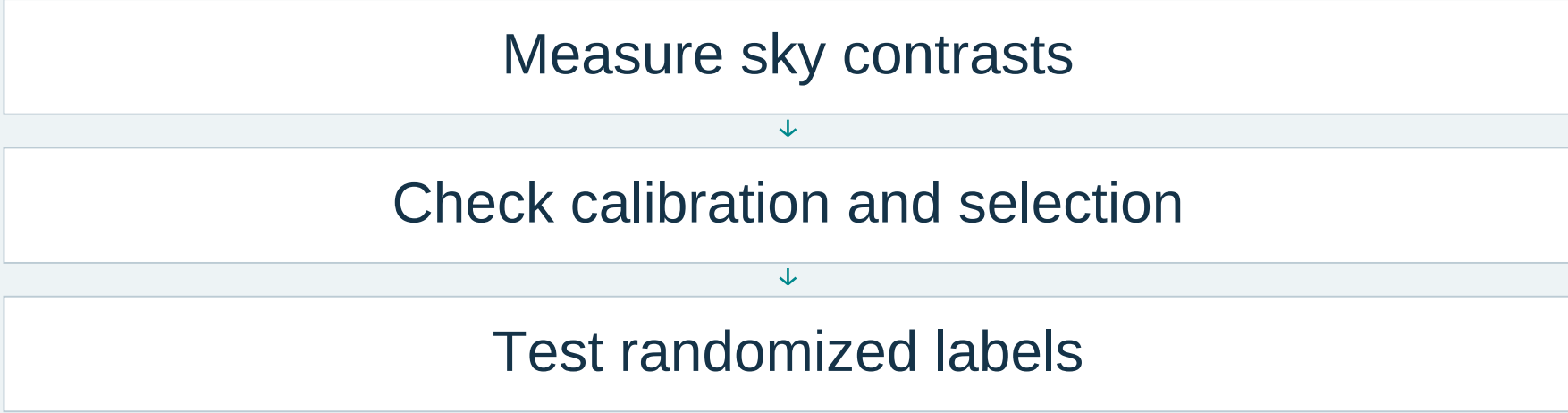
Schematic: outward arm winding, not rotation arrows.

Why compare different scales?



Compare complementary tracers: does a sky pattern persist beyond individual galaxies?

Could selection mimic a signal?



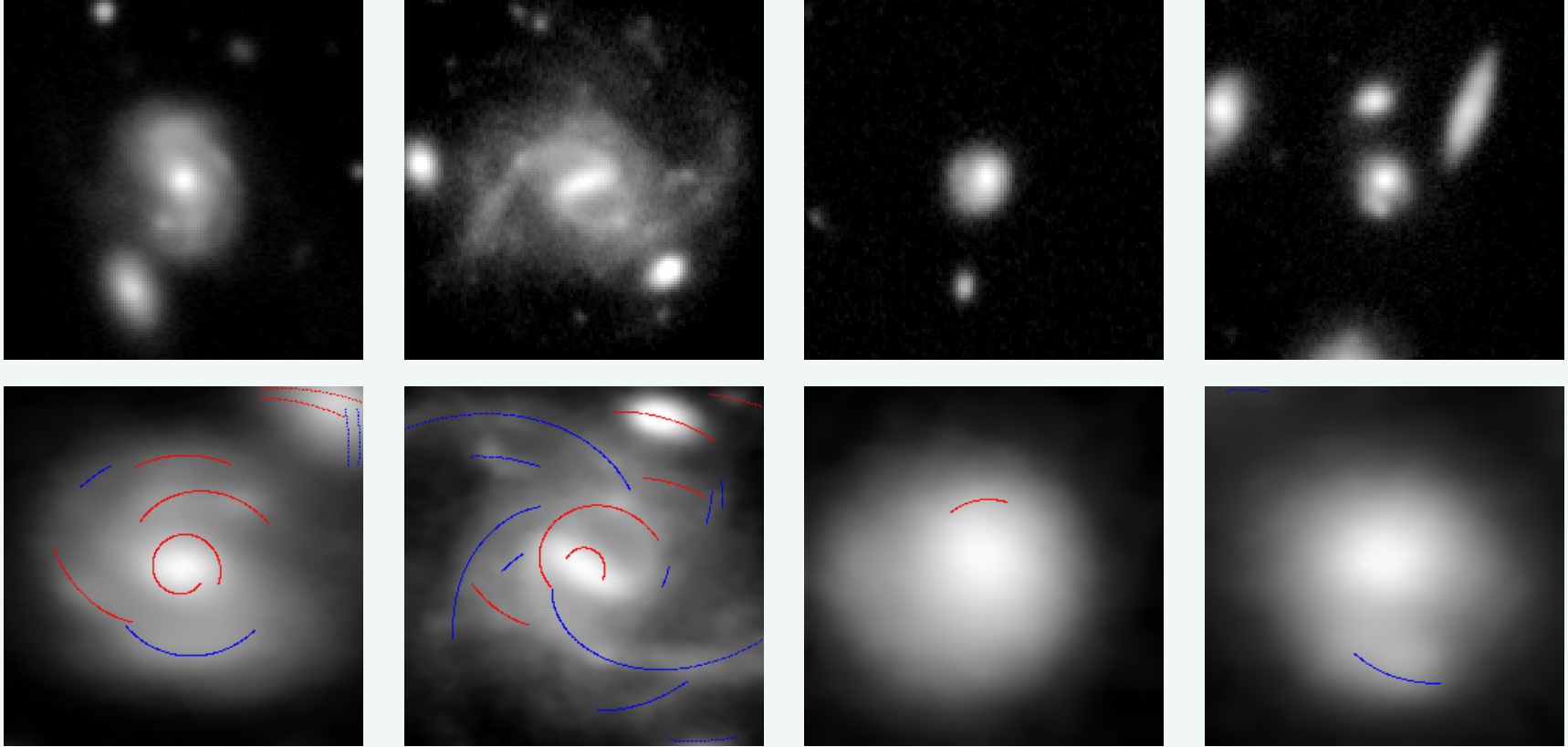
Winding and projected motions are proxies, not full 3D spin. A dipole alone is not proof of parity violation.

Context: Land et al. (2008); Hayes et al. (2017); Shamir (2021); Patel & Desmond (2024); Philcox (2022). 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.

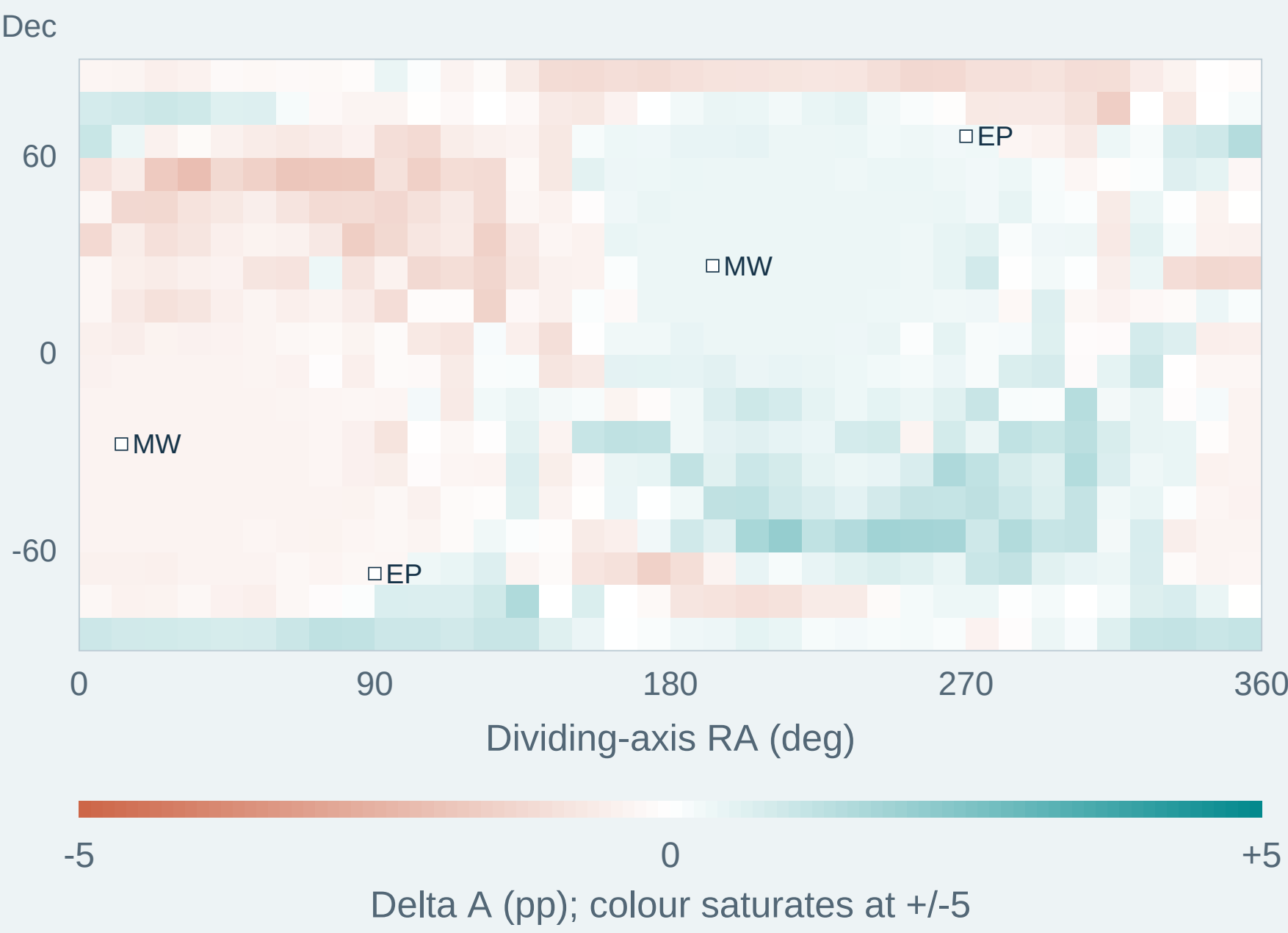
DESI: 7,905 positional matches; 4,920 also resolved.

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

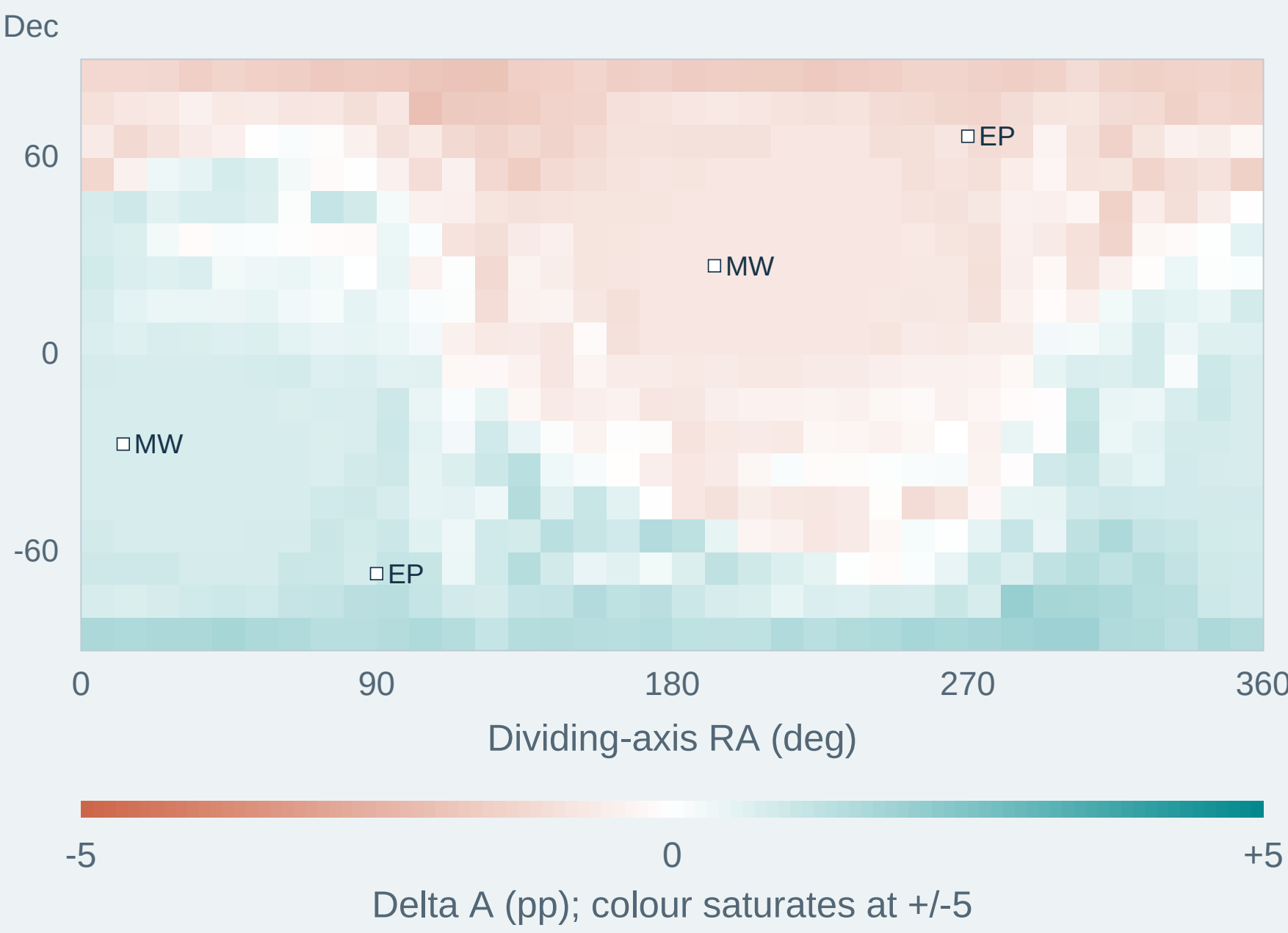
Map cells: -2.1 to 2.1 pp (not a confidence range)
Saved SpArcFiRe-only directional fit: dipole 2.27% [0.00%, 7.79%], approx. 95%. Global shuffle $p = 0.684$.

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.

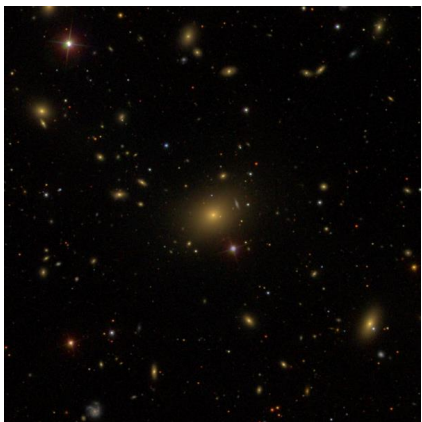
Two algorithms, one 49,211-target inventory; resolved sets differ. CW/ACW share one display orientation. Maps are observed contrasts, not detections. Both resolve 30,910 (18,791 agree). SpArcFiRe GZ/CzSL: -0.06% [-4.44%, +4.32%], assuming shared errors. Cohort differences: [-19.07%, +11.10%].

3 Groups and clusters: exploratory motion patterns



Our DESI group: real core image

One fixed group with 15 spectroscopic members. Legacy Surveys DR9, 10-arcmin core; not the full membership footprint.

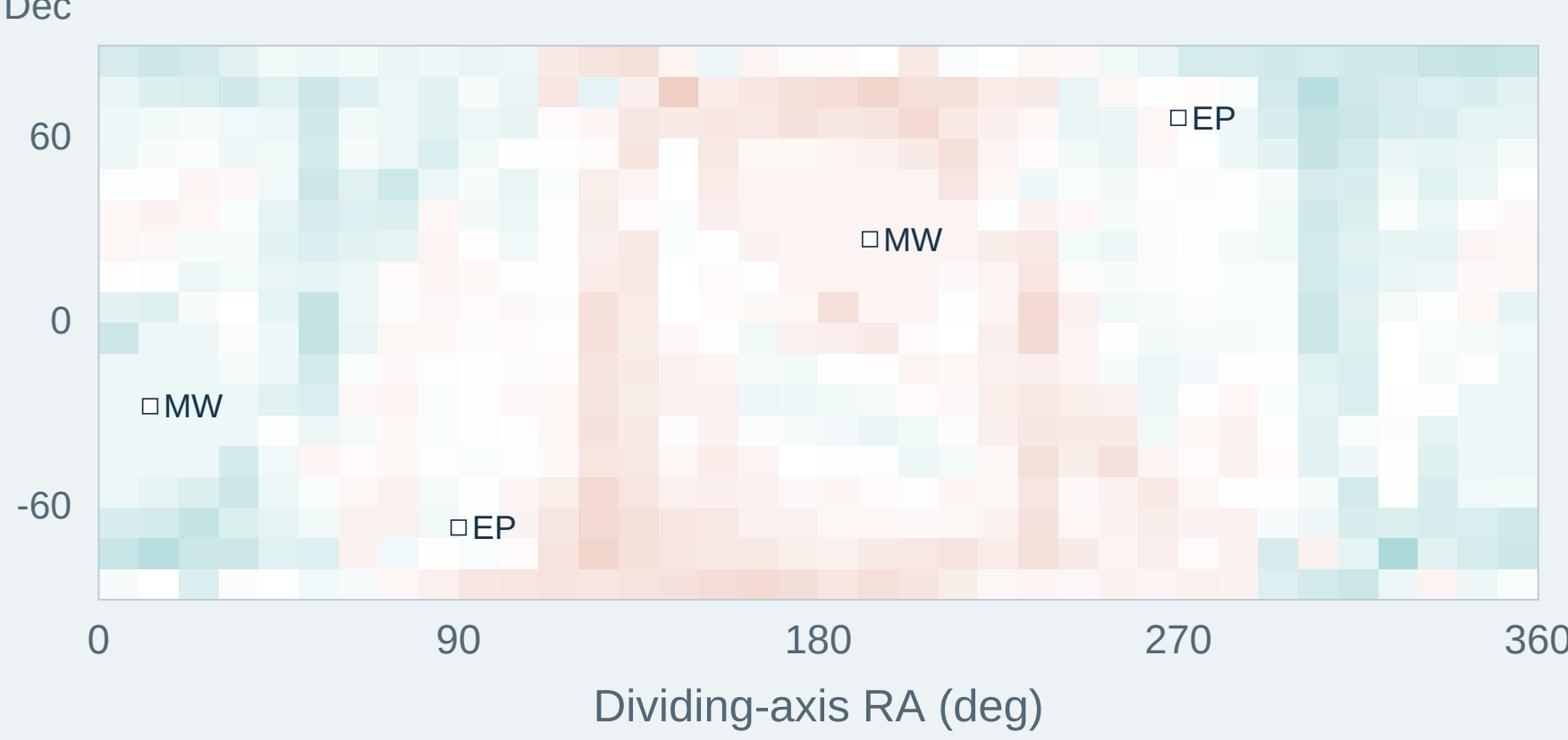


A2107: separate case study

SDSS, 10-arcmin field. These photographs illustrate our targets; neither demonstrates physical spin.

Same 1,722 systems in all three maps: 1,713 groups + 9 clusters. Published-only systems stay online.

1 Regression

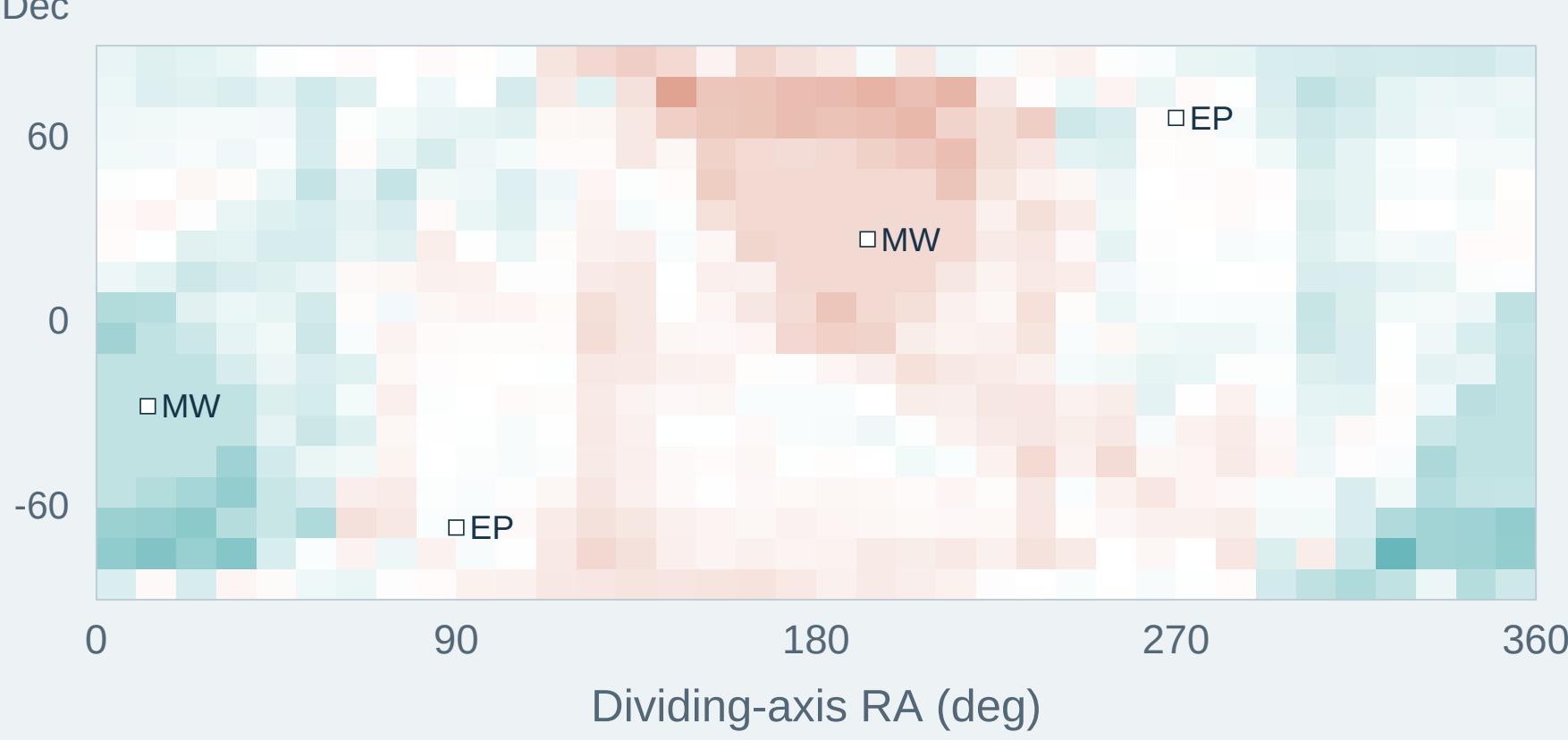


Colour: 10^4 Delta H; saturates at bar ends.

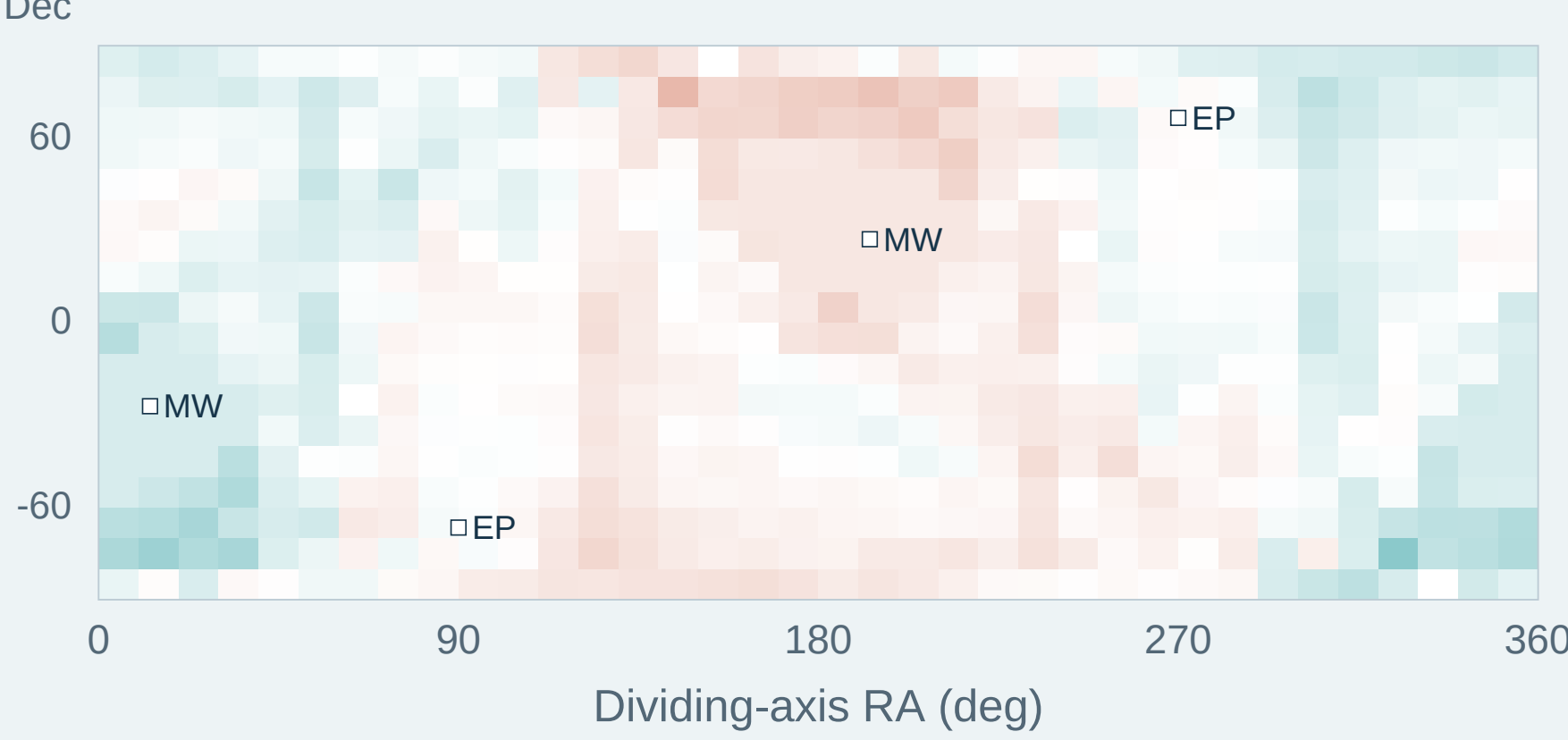
Grey: fewer than 3 systems in a half.

H is a dimensionless pair-handedness statistic, not speed or CW/ACW %. The mean adds no independent evidence. 1,929 of 1,934 eligible groups have a fit.

2 Half-plane



3 Mean of the two



Mean = (regression + half-plane) / 2.

EP / MW: ecliptic / Galactic reference poles.

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

Research details and references: nebulamind.net/studies/spin-parity-2026.html

Duho Kim | KAS 2026 Fall | v53, Oct 2026 | Method maps are exploratory; no parity detection.