MAGIC

Science of the Cosmos

Contribution ID: **90** Type: **not specified**

A Minimal Test for Isotropy Using Jet Spin Parity

We propose a minimal and geometrically grounded test of cosmological isotropy using a pseudoscalar diagnostic based on extragalactic jet spin. The test is built on the scalar quantity $\sigma = \mathrm{sign}\left[(\mathbf{S} \times \mathbf{L}) \cdot \mathbf{O}\right]$ which is invariant under global rotation but changes sign under spatial reflection, making it a direct probe of large-scale parity violation—an aspect of isotropy that scalar-field tests are fundamentally insensitive to. Our method requires only the spin direction of each jet $\mathbf{S}$, its sky position $\mathbf{L}$, and a reference axis $\mathbf{O}$,

We suggest a reference axis can be selected from a wide range of possibilities depending on the symmetry being probed—for example, the CMB dipole (as a proxy for the cosmological rest frame), or the Galactic or supergalactic poles (to test for structure- or foreground-related systematics). The test is robust to sample sparsity: a curated set of $\sim$30–50 jets per hemisphere, drawn from VLBI datasets such as MOJAVE (North) and TANAMI or AT20G (South), is sufficient to detect a hemispheric asymmetry in σ. A statistically significant skew would constitute direct observational evidence of isotropy breaking in the spin sector; conversely, a null result places meaningful, falsifiable constraints on parity-violating extensions to ΛCDM.

This diagnostic represents a uniquely simple and physically grounded test of isotropy using real astrophysical vector observables. It offers immediate application to existing datasets and motivates broader searches for directional parity asymmetries on cosmological scales. The scalar test provides a simple binary observational challenge to isotropy: either parity is preserved across hemispheres, or it is not

Author: JAMES, Dan (independent researcher)

Presenter: JAMES, Dan (independent researcher)