

PROXIMA-CENTRED INFRARED SKY

Consolidated methodology | Native08, equatorial and Galactic editions

1,966 stellar objects, including the Sun, are reconstructed in at least one band for a Proxima observer at **J2028.5270**. Local background estimates suppress remnants at old source positions. Both 4096 x 2048 coordinate editions represent the same conditional sky model.

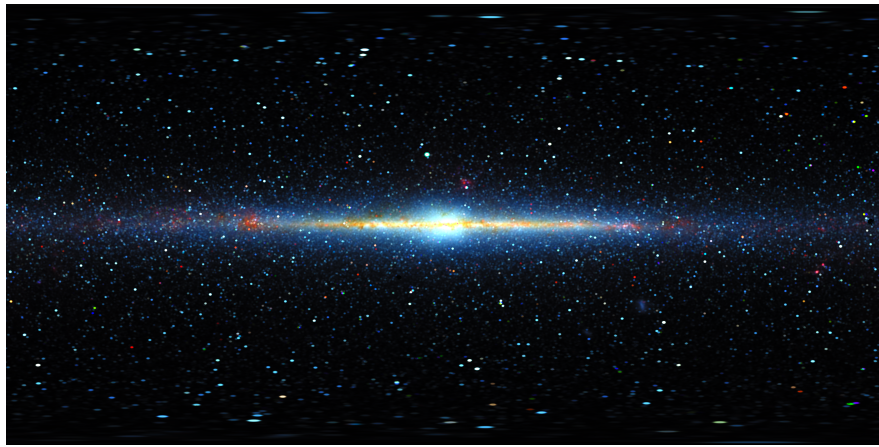


Figure 1. Galactic-coordinate edition for Proxima3D. The false colours encode infrared instrument bands, not naked-eye colours or calibrated RGB radiance. Reprojection changes sampling, not the astrophysical model or instrumental resolution.

1. Observations and native source model

The supplied Cosmoglobe DR2 reprocessing of COBE-DIRBE [1] supplies zodiacal-light-subtracted mission-average I_MEAN maps at 1.25, 2.2, 3.5, 4.9 and 12 micrometres. The legacy SPHEREx filename does not identify the data: no SPHEREx observations enter this product. The Near-IR label includes longer infrared bands.

The scientific grid is Galactic HEALPix NSIDE512, RING: 3,145,728 equal-area pixels per band, about 6.87 arcmin sampling, with float64 DIRBE-quoted MJy/sr. DIRBE's nominal 0.7 x 0.7-degree field sets a much coarser angular scale. Native noise, foreground, zero-level and missing-coverage limitations remain.

Unique bidirectional matches within 30 arcsec join 3,020 entries of the supplied 9,096-star Bright Star Catalogue [4] to the 11,788-source Smith DIRBE catalogue [2]. Price [3] provides additional photometry and variability labels. Identity, geometry and photometry screening yields 8,256 native source-band fits: 5,896 pass, supplemented by 31 retained prior terms. The total is **5,927 terms for 1,966 objects**.

$$I_{\text{model}} = I_{\text{Earth}} - \sum(F_{\text{old}}K_{\text{old}}) + \sum(F_{\text{target}}K_{\text{target}}).$$

The Sun is added only. The same positive, normalized beam is used for removal and insertion; pixel-averaged kernels convert quoted Jy into MJy/sr and conserve integrated source flux.

The radial beam is a forward fit to the supplied symmetrized coefficients through degree 1500, with 0.01-degree radial nodes, one-degree support and 256 child-pixel centres per native pixel. It approximates an incompletely known, scan-dependent response. The quantitative source-subtraction baseline retains negative intensities, invalid samples and exact native values outside correction support.

2. Geometry, photometry and fit limits

BAND (um)	1.25	2.2	3.5	4.9	12
Terms	1,632	1,586	1,519	1,080	110

New native fits and acceptance

Each target is fitted with catalogue neighbours and a planar background within 2.5 degrees. Alternative 2- and 3-degree fits, quadratic backgrounds, nonnegative neighbour fits and spatial holdouts test stability. Gates require positive amplitude, complete old/new kernel coverage, identifiable separation, flux span at most 25%, core residual RMS at most 35% of model RMS, peak-to-annular-residual ratio at least five and catalogue flux agreement within a factor of two. At least three usable held-out quadrants and a simultaneous source-group check must pass. These are engineering quality gates, not confidence levels; exact thresholds and decisions are archived.

Observer and retarded geometry

Reception epoch: **J2028.5270384688256 TDB**. The observer is the Proxima stellar geometric position, a local planetary-system barycentre proxy, at ICRS SSB coordinates [-97966.998171, -74776.687697, -238499.791526] AU. The old-map anchor is an effective J1990.0 SSB/Earth-observer proxy, not an individual DIRBE scan epoch.

Ordinary-star geometry retains supplied J2000 directions and adopted distances. Identity-matched Hipparcos proper motions [5] are transported from J1991.25 to the J2000 tangent frame.

Constant-velocity propagation solves relative light travel time: source at emission, observer at reception, without subtracting the Earth-reference light time twice. Original BSC angular precision is retained.

Unflagged spectroscopic radial velocities act as kinematic proxies; missing/flagged values assume zero. Distance endpoints and plus/minus 100 km/s velocity probes test sensitivity, without providing a full covariance or guaranteed error bound.

For unchanged luminosity and inherited extinction, $F_{\text{target}} = F_{\text{old}}(d_{\text{old}}/d_{\text{target}})^2$. The 5,896 new terms use native fitted fluxes. Sixteen retained terms for Diphda, Delta Andromedae, Arcturus, Kochab and Eltanin keep earlier one-degree common-resolution flux priors and frozen directions; expanded fit guarantees do not apply to those priors. Only passing new fits supplement their missing bands.

Alpha Centauri A/B and the Sun

Corrected retarded binary geometry [6] gives Alpha A/B a nominal 140.11-arcsec separation from Proxima, unresolved by DIRBE. Price measured combined means at 1.25-4.9 micrometres are split using CK04 atmospheres [7]. The 12-micrometre term is a full-bandpass photospheric model normalized by angular diameters [8], without a measured DIRBE Alpha anchor: 198.816 Jy old, 103,176.419 Jy target. The roughly 519-fold brightening is a distance-model prediction; finite orbital probes are not a complete uncertainty budget.

The Sun uses TSIS-1 HSRS v2 at 1.25/2.2 micrometres [9] and the Rieke spectrum at 3.5/4.9/12 micrometres [10]. Integrations follow DIRBE response-weighted quoted-flux conventions [11], not monochromatic or visible magnitudes. Proxima itself is excluded from this background because the local system is rendered separately.

Historical means do not predict future variability. Of 1,963 objects receiving expanded terms, Price labels 893 survey nonvariables, 54 variables, 11 candidate variables and leaves 1,005 unclassified. Unclassified does not mean constant. Smith, Price and Cosmoglobe share DIRBE observations; agreement is a processing crosscheck, not independent-data validation. Binary/photocentre motion, changed extinction and a complete photometric uncertainty budget remain unsolved.

3. Cleanup, projection and provenance

Local reconstruction at old source positions

Before colour mapping, subtract the old-source model and a conditional model of untreated neighbours from each Earth band. Within one-degree discs around accepted old source positions, solve a graph-harmonic extension: each interior pixel equals the mean of its immediate valid HEALPix neighbours; surrounding valid pixels remain fixed. Overlapping patches are solved together. This estimates a locally smooth background, not hidden measured structure.

Use the estimate fully inside 0.7 degrees, taper smoothly to zero at one degree, then add back the same neighbour model and unchanged target sources. The Sun creates no old-position hole. Outside the patches, linear maps remain unchanged. Supported positive neighbour amplitudes come from joint nonnegative fits with planar backgrounds inside two degrees, excluding removed-star cores of radius 0.55 degrees. Neighbours centred inside these cores, unsupported fits and ambiguous blends get no preservation model or catalogue-flux fallback.

Reconstructed backgrounds are display estimates. They may suppress unresolved real structure as well as artifacts. Untreated bands can retain old-position emission (for example, Antares or Aldebaran), producing colour lobes that are not validated physical colours. Missing target-band flux is never invented. The quantitative subtraction baseline remains separately identifiable.

False colour and sampling

Bilinear HEALPix sampling feeds the inherited band stretches and display processing, with Earth-frozen scales. For stretched bands T: $B=T_{1.25}$, $G=T_{2.2}$, $R=0.68T_{4.9}+0.20T_{3.5}+0.12T_{12}$. The lossless equatorial master is the approved Native08 image. Its Galactic derivative uses one bilinear resampling through the standard ICRS/Galactic rotation. This interpolates display RGB, not physical radiance; it is not a flux-conserving scientific reprojection. No new source fit, global blur or increased physical resolution is introduced.

4096 x 2048 CAR	EQUATORIAL / MSAD	GALACTIC / PROXIMA3D
Centre and seam	RA 0 at centre; RA 180 seam	l=0 at centre; l=180 seam
Direction	North up; RA increases left	Galactic north up; l increases left
Pixel centres (x, y)	$RA=[180-360(x+0.5)/4096] \bmod 360$; $Dec=90-180(y+0.5)/2048$	$l=[180-360(x+0.5)/4096] \bmod 360$; $b=90-180(y+0.5)/2048$

The Galactic texture matches the supplied Proxima3D sampling convention: flipY=false. Do not bake the page's additional 2.3-degree adjustment or sky orientation quaternion into the bitmap. Those viewer transforms remain the page's responsibility. Both editions carry the same epoch and model; neither bakes in spacecraft aberration, Doppler shift or frontend gain.

Binary provenance: black modified, white unchanged

The equatorial mask marks source-correction support, local reconstruction support and actual lossless RGB changes from the Earth baseline: 1,997,347 pixels (23.810%). Changes hidden by clipping remain marked. The Galactic mask conservatively marks every output pixel with any nonzero bilinear contribution from a marked equatorial pixel; Earth-versus-model RGB changes are also checked. It marks 2,314,934 pixels (27.596%). Both masks remain exactly black/white, not thresholded grey masks.

Different fractions reflect projection and conservative sampling, not extra corrected sources. White means no declared modification contributes and matched lossless Earth/model RGB values are identical. Lossy WebP-only differences are excluded. The equatorial reconstruction-only mask isolates cleanup (17.196% of pixels). CAR fractions are not equal-area sky fractions; none indicates coverage, confidence or accuracy.

4. Validation, use and scientific value

Numerical and visual checks

Independent source-model checks reconstruct kernels, integrated fluxes and inverse-square scaling; audit accepted records; verify native preservation, correction identities, kernel coverage and FITS integrity; and confirm the 31 retained terms exactly. The largest independently reconstructed map difference is 1.34×10^{-8} MJy/sr. This verifies implementation of the declared model, not the physical truth of every subtraction.

Independent cleanup checks verify spherical patch masks, taper weights, the graph equation and boundary range, neighbour-response sums, source add-back and unchanged invalid/outside-patch samples. All lossless RGB changes are marked; target positions and flux coefficients stay unchanged. Old-source atlases were visually inspected for remnants and boundaries. No independent refit or physical validation of neighbour-preservation photometry is claimed.

The Galactic edition is checked against the supplied shader convention, coordinate landmarks and an independent coordinate transform. Reprojection alignment, binary-mask contributor coverage, seam handling and unchanged approved equatorial input hashes are recorded. The same resampling applied to Earth and model displays checks that all actual lossless differences are marked. Numerical consistency does not recover lost angular detail or remove astrophysical uncertainty.

Interpretation and deployment

Use the equatorial WebP in the post-arrival MSAD infrared slot at J2028.5270; retain the Earth texture before arrival. Use the Galactic WebP with the Proxima3D Galactic background sampler. Keep each provenance PNG in its matching coordinate frame. Quantitative missing samples remain invalid: common five-band native coverage is approximately 99.8089% of equal-area sky. Display black does not establish measured zero emission, and PNG/WebP pixels are unsuitable for flux measurement.

The result reproducibly connects observer position, stellar distance, band-integrated flux and instrumental response. Source inclusion is band dependent and BSC limited. Untreated stars, unresolved emission, dust and diffuse structure remain Earth-derived; a two-dimensional map lacks the distances, extinction and time histories needed for a complete relocated sky. Cleaner appearance and a new coordinate projection do not increase physical completeness.

Suggested caption: DIRBE/Cosmoglobe infrared visualization with selected stellar sources reconstructed for a Proxima observer at J2028.5270, Earth-derived diffuse context and marked local background estimates at old source positions.

Reproducibility and primary references

The frozen Native08 archive contains native maps, the unchanged quantitative subtraction FITS baseline, beams, catalogues, source geometry and fluxes, local reconstruction patches, code, audits and hashes. The coordinate-edition package adds the Galactic assets, reprojection code and checks. Rebuilding starts from frozen astrophysical inputs; it does not repeat Cosmoglobe mapmaking, orbital inference or upstream spectrum derivation. This four-page publication is self-contained and replaces earlier methodology PDFs.

[1] Watts et al., Cosmoglobe DR2 I (2024) | [2] Smith et al., DIRBE catalogue (2004) | [3] Price et al., stellar light curves (2010; 2011 erratum retained) | [4] Hoffleit & Warren, Bright Star Catalogue V/50 | [5] van Leeuwen, Hipparcos new reduction (2007) | [6] Akeson et al., Alpha Centauri binary astrometry (2021) | [7] Castelli & Kurucz, CK04 atmosphere grids | [8] Kervella et al., Alpha Centauri angular diameters (2017) | [9] Coddington et al., TSIS-1 HSRS v2 (2023) | [10] Rieke et al., infrared calibration (2008) | [11] NASA/GSFC LAMBDA, DIRBE response and flux convention