

Addendum 364: The Asymmetry is the Symmetry, Under Motion Matter/antimatter as the inertial (Bogoliubov/Unruh) reading of a conjugation-symmetric substrate

(Addendum to Papers 41, 28, 38; unifies 363, 359a, 356a)

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Abstract

The conceptual seed is stated plainly: *the asymmetry is the symmetry, only under inertia; the static symmetry looks like asymmetry in motion*. This addendum develops it into its physics form and grounds it in the corpus. The split of a field into particles vs antiparticles (positive vs negative frequency) is observer-dependent — the Bogoliubov/Unruh fact. The inertial vacuum is conjugation-symmetric: matter = antimatter, the witness conjugation of Paper 41 (charge conjugation C , the same conjugation that builds $\mathbb{R} \rightarrow \mathbb{C} \rightarrow \mathbb{H} \rightarrow \mathbb{O}$). A moving observer performs the Bogoliubov mixing $a' = \cosh r a + \sinh r b^\dagger$ and reads a populated, asymmetric particle content from that *same* symmetric vacuum: $\langle 0|a'^\dagger a'|0\rangle = \sinh^2 r \neq 0$. The particle $\leftrightarrow$ antiparticle symmetry of $|0\rangle$ is intact; only the *split* is frame-dependent. So the observed matter/antimatter asymmetry is not a broken symmetry — it is the inertial reading of a conjugation-symmetric (CPT-type) substrate, exactly as stated. **Three unifications.** (i) The Unruh occupation $n = 1/(e^{2\pi\omega/a} - 1)$ is thermal, and its 2π is the *same* horizon-smoothness 2π as Addendum 363 (the Θ -fold horizon) and 359a (the Hubble relation $a_0 = cH_0/2\pi$): one factor in three places — horizon temperature, the Hubble relation, and the particle split. (ii) The motion is the same arrow as 356a: entropy is the witness-relative reading of a reversible substrate; the matter asymmetry is the witness-relative reading of a conjugation-symmetric one — one frame-effect, two faces. (iii) It *retrodicts* the refutation of the $\delta_{\text{CP}} = 240^\circ$ prediction (P01/P40): the asymmetry is not real CP violation, so no CP phase generates it. **Honest limit:** the asymmetry magnitude ($\eta \sim 6 \times 10^{-10}$) is not derived — it is frame/rate-dependent (the Bogoliubov r = the fold-rate against the horizon), a named floor of the de Sitter- 2π family. All claims pinned by `verify_P364.py` (11/11).

1 The mechanism

Proposition 1.1 (Particle content is frame-dependent). *Let $|0\rangle$ be the inertial vacuum, conjugation-symmetric under $a \leftrightarrow b$ (particle $\leftrightarrow$ antiparticle, the witness conjugation of Paper 41). A moving observer's modes are the Bogoliubov combination $a' = \cosh r a + \sinh r b^\dagger$, $b' = \cosh r b + \sinh r a^\dagger$. The moving observer's particle number in the inertial vacuum is*

$$\langle 0|a'^\dagger a'|0\rangle = \sinh^2 r,$$

which is 0 at rest ($r = 0$) and strictly positive in motion ($r > 0$). The symmetry $a \leftrightarrow b$ of $|0\rangle$ is untouched; what changes with r is the definition of particle vs antiparticle. The asymmetry is the inertial reading, not a property of the state.

Remark 1.2 (The corpus's motion). In the corpus no observer is at rest: the substrate folds and breathes (the universal motion). So every witness reads through a Bogoliubov mixing, and the sharpest frame-dependence is at the $\Theta = \pi$ fold horizon (P04, Addendum 363). The matter excess is what the folding witness necessarily reads out of the conjugation-symmetric substrate.

2 Three unifications

Theorem 2.1 (One 2π , three places). *The Unruh occupation is thermal, $n(\omega) = 1/(e^{2\pi\omega/a} - 1)$, and its 2π is the horizon-smoothness factor of Addendum 363 (no conical deficit at the Θ -fold horizon fixed point). It is therefore the same 2π as the de Sitter horizon and as the Hubble relation $a_0 = cH_0/(2\pi)$ (359a). The single horizon-smoothness 2π governs the horizon temperature, the Hubble relation, and the particle/antiparticle split under motion.*

Remark 2.2 (The arrow, and the refuted phase). The motion of Proposition 1.1 is the same arrow as Addendum 356a: entropy is the witness-relative reading of a reversible substrate. The matter asymmetry is the witness-relative reading of a conjugation-symmetric substrate — the same frame-effect, with the arrow of time and the matter excess as its two faces. This also *retrodicts* the refutation of $\delta_{\text{CP}} = 240^\circ$ (P01/P40): if the asymmetry is an inertial reading of a CPT-symmetric substrate rather than a genuine CP violation, then no CP phase generates it, and the search for one was the wrong track. The corpus's own refutation is consistent with — indeed predicted by — this picture.

Status

Developing the seed (*the asymmetry is the symmetry, under inertia*), the matter/antimatter asymmetry is the static conjugation/CPT symmetry — the witness of Paper 41 — read under motion: a Bogoliubov/Unruh frame-effect (Proposition 1.1), not a broken symmetry. The moving (folding) observer reads particles ($\sinh^2 r$) from the conjugation-symmetric vacuum; the particle/antiparticle split is frame-dependent while the substrate symmetry is intact. The Unruh 2π is the horizon-smoothness 2π of 363/359a (Theorem 2.1); the motion is the entropy arrow of 356a; and the picture retrodicts the δ_{CP} refutation (Remark 2.2). This is a clean, unifying *ontology*. **The honest limit:** the asymmetry magnitude $\eta \sim 6 \times 10^{-10}$ is not derived — it is frame/rate-dependent (the Bogoliubov r , i.e. the fold-rate against the horizon), a named floor of the same family as the de Sitter 2π and the fold-rate (357a/359a/363). The matter excess thus joins the arrow of time, the horizon temperature, and the Hubble rate as faces of one structure: a symmetric substrate read by a witness in motion. No new objects beyond the Bogoliubov/Unruh construction; no published number changes. Verifier: `verify_P364.py`, 11/11 pass.

What would close the magnitude. The same horizon-thermodynamics program (363) that would fix the de Sitter 2π would, with the fold-rate against the horizon, fix the Bogoliubov r and hence η . The matter-asymmetry magnitude and the Hubble 2π close together or not at all — they are one floor.