

009 - CEDA TRANSLATION CARD

aper: *On Average Properties of Inhomogeneous Fluids in GR I* (Buchert 2000)

Author: Thomas Buchert

Source: arXiv: gr-qc/9906015

On Average Properties of

T1. Native Objects → CEDA Primitives

Native variables (paper language)

- Local expansion scalar: θ
- Shear scalar: σ^2
- Spatial Ricci scalar: R
- Averaged quantities: $\langle \cdot \rangle_D$
- Domain scale factor: $a(t)$
- Backreaction term: Q

CEDA primitive mapping

Native Object	CEDA Classification	Notes
$g_{\mu\nu}$	Fundamental geometry	Standard GR
Dust stress–energy	Fundamental matter sector	Conserved locally
$a(t)$	Effective descriptive variable	Domain-defined, not a DOF
Q	Emergent bookkeeping term	Variance aggregate, not field
$\langle R \rangle_D$	Coarse-grained geometric descriptor	Slicing & domain dependent

No native object maps to a **new dynamical degree of freedom** under CEDA rules.

T2. Claimed Causal Structure (Translated)

Paper-native statement:

Averaging scalar Einstein equations yields additional terms (“backreaction”) that modify the effective expansion law of a spatial domain.

CEDA translation:

Effective expansion behavior differs from FRW **because averaging reshuffles variance terms into source-like contributions** in the averaged equations.

Important constraint:

No causal agency is assigned to:

- horizons
- entropy
- information
- nonlocal exchange

All effects originate from **statistical structure of local GR solutions under averaging**.

T3. Stress–Energy Accounting (CEDA View)

- No new stress–energy tensor introduced
- No modification to Einstein equations at the local level
- *QDQD* does **not** correspond to a conserved current or field
- *QDQD* enters only after:
 - choosing foliation
 - choosing domain
 - averaging scalars

CEDA classification:

Descriptive reorganization of existing geometric degrees of freedom
(not an injected source)

T4. Regime Translation

Native regime claims:

- Non-perturbative
- Dust-only
- Arbitrary compact domains
- Flow-orthogonal slicing

CEDA regime encoding:

- Valid only within **chosen coarse-graining scheme**
- No guarantee of:
 - scale invariance
 - global limit stability
 - regime persistence under domain refinement

CEDA flags this as **regime-relative descriptive dynamics**.

T5. Expansion / Acceleration Claim (Translated Carefully)

What the paper does claim:

- $aD(t)aD(t)$ may differ from FRW behavior
- Backreaction can generate effective curvature

What it does *not* claim:

- Generic accelerated expansion
- Inflationary behavior
- Late-time Λ -mimicry without assumptions

CEDA encoding:

Possible deviation from FRW expansion under averaging
No universal acceleration mechanism declared

AMBIGUITY BUDGET

This is the heart of Phase II.

A1. Domain Choice Ambiguity

- Domain DD is arbitrary but comoving
- Physical predictions vary with:
 - size
 - shape
 - location

CEDA status:

Structural ambiguity — must be branch-tracked.

A2. Foliation Dependence

- Flow-orthogonal slicing assumed
- Covariance claimed only *within this foliation class*

CEDA status:

Scheme dependence — alternative slicings not evaluated.

A3. Closure Ambiguity

- Averaged equations are underdetermined
- Closure requires:
 - assumptions relating $QDQD$ and $\langle R \rangle D \langle R \rangle D$
 - or special initial conditions

CEDA status:

Open functional freedom — risk of hidden tuning if not fixed.

A4. Functional Freedom of $QDQD$

- $QD(t)QD(t)$ not dynamically solved
- Can mimic multiple effective equations of state depending on assumptions

CEDA status:

Potential **functional redundancy** (C1 candidate).

A5. Global Interpretation Ambiguity

- No unique global cosmology derived
- “Universe-level” statements are suggestive, not derived

CEDA status:

Interpretive extrapolation beyond declared regime.

Translation Confidence Assessment

- Variable mapping: **High**
 - Conservation mapping: **High**
 - Causal interpretation: **High**
 - Global extrapolation clarity: **Low**
 - Closure discipline: **Explicitly incomplete**
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Status Checkpoint

- ✓ Translation Card complete
- ✓ Ambiguity Budget explicit
- ✗ No diagnostics applied yet
- ✗ No verdict language introduced

Next step by protocol is **Diagnostic Application**, starting with:

D2 — Coarse-Graining Stability

followed by

C1 — Functional Redundancy / Free-Function Test