

# 009 - CEDA TRANSLATION CARD

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

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Source: arXiv: gr-qc/9906015

On Average Properties of

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## T1. Native Objects → CEDA Primitives

### Native variables (paper language)

- Local expansion scalar:  $\theta\theta$
- Shear scalar:  $\sigma_2\sigma_2$
- Spatial Ricci scalar:  $RR$
- Averaged quantities:  $\langle \cdot \rangle D \langle \cdot \rangle D$
- Domain scale factor:  $aD(t)aD(t)$
- Backreaction term:  $QDQD$

### CEDA primitive mapping

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

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

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## 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**.

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## **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)

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## **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**.

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## 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  $\Lambda$ -mimicry without assumptions

### CEDA encoding:

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

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## 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.

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## A2. Foliation Dependence

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

**CEDA status:**

Scheme dependence — alternative slicings not evaluated.

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## 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.

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## 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).

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## A5. Global Interpretation Ambiguity

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

**CEDA status:**

Interpretive extrapolation beyond declared regime.

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## 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