附录 X｜哥德巴赫猜想：覆盖作为残余证词

Appendix X · Goldbach: Coverage as Residual Testimony

Catalog

使用声明

Usage Declaration

本附录不提供证明。
This appendix does not provide a proof.
本附录不参与主线公理构造。
This appendix does not participate in the construction of the main axiomatic line.
本附录仅用于展示“常数命题”的一个数学侧结构实例。
This appendix serves only as a mathematical-side structural instance of the “Constant Proposition.”

X.1 命题冻结

X.1 Proposition Freezing

在进入任何结构分析之前，命题必须被冻结。
Before any structural analysis can begin, the proposition must be frozen.
冻结并非暂停讨论，而是阻断命题在历史、语义与变体中的漂移。
Freezing does not mean suspending discussion, but rather blocking the proposition’s drift across history, semantics, and variants.
只有在冻结状态下，命题才能被当作一个结构对象而非一个研究传统来处理。
Only in a frozen state can a proposition be treated as a structural object rather than a research tradition.

强哥德巴赫猜想的最小表述
Minimal Formulation of the Strong Goldbach Conjecture
命题仅取其最小、最窄、不可再约简的表述形式：
The proposition is taken only in its minimal, narrowest, irreducible form:

> 每一个大于 2 的偶数，都可以表示为两个素数之和。
> Every even integer greater than 2 can be expressed as the sum of two prime numbers.

该表述不引入数量估计、不引入分布假设、不引入渐近形式。
This formulation introduces no quantitative estimates, no distributional assumptions, and no asymptotic forms.
它仅声明一个**覆盖关系是否成立。**

It states only whether a **coverage relation** holds.

排除弱猜想与历史变体
Exclusion of the Weak Conjecture and Historical Variants

弱哥德巴赫猜想及其已知证明不在讨论范围内。
The weak Goldbach conjecture and its known proofs are excluded from consideration.
任何历史等价改写、推广版本或附加条件版本，均被视为非冻结态对象。
Any historically equivalent reformulations, generalized versions, or condition-augmented variants are treated as **non-frozen objects**.
冻结的目的不是否定这些工作，而是防止结构分析被卷入证明史本身。
The purpose of freezing is not to negate these works, but to prevent structural analysis from being absorbed into the **history of proofs itself**.

命题对象的边界条件
Boundary Conditions of the Proposition Object

在本附录中，命题对象满足以下边界条件：
Within this appendix, the proposition object satisfies the following boundary conditions:

仅讨论偶数集合，不讨论自然数整体。
Only the set of even integers is considered, not the natural numbers as a whole.
仅讨论素数集合，不讨论其生成机制。
Only the set of prime numbers is considered, not its generative mechanisms.
不讨论"为什么是素数"，只讨论"素数是否构成覆盖"。
The question is not "why primes," but whether primes constitute coverage.

在这些边界之内，命题被视为一个静态关系声明。
Within these boundaries, the proposition is treated as a static relational statement.
而本附录接下来的工作，将逐步显示：
And the work that follows in this appendix will gradually show:
该"静态性"本身，正是问题结构的来源之一。
That this very "staticity" is itself one of the sources of the problem's structure.

X.2 关系重写（R）
X.2 Relational Rewriting (R)

冻结命题之后，第一步不是分析"素数"，而是重写关系本身。
After the proposition is frozen, the first step is not to analyse "primes," but to rewrite the relation itself.
传统表述将命题读作一个存在性断言。
The traditional reading treats the proposition as an existential statement.
而在本附录中，该存在性将被系统性地移除。
In this appendix, that existential form is systematically removed.

从"存在一对素数"到"偶数被关系命中"
From "There Exists a Pair of Primes" to "The Even Is Hit by a Relation"

经典表述的逻辑核心是：
The logical core of the classical formulation is:

对任意偶数 n，存在素数 p, q，使得 n = p + q。
For any even n, there exist primes p, q such that n = p + q.

在结构层面，这是一种生成性叙述：

Structurally, this is a **generative narration**:

先给出目标，再寻找生成它的要素。
The target is given first, and then elements are sought to generate it.

本附录将这一叙述反转为**命中性叙述**：
This appendix reverses the narration into a **hit-based formulation**:

> 偶数 n 是否被“素数对关系”所命中。
> Whether an even n is hit by the “prime-pair relation.”

在该重写中，n 不再是被“构造”的结果，而是被“扫描”的对象。
In this rewriting, n is no longer the result of construction, but the object of scanning.

二和关系的定义
Definition of the Binary-Sum Relation

设 P 为素数集合。
Let P denote the set of prime numbers.

定义关系 R：
Define the relation R as:

$$R = \{(p, q) \in P \times P \mid p + q = n\}$$

$$R = \{(p, q) \in P \times P \mid p + q = n\}$$

在传统语境中，$R \neq \varnothing$ 即被视为“命题成立”。
In the traditional context, $R \neq \varnothing$ is taken as “the proposition holds.”

但在覆盖视角中，重点并不在于 R 的非空性，
But under the coverage perspective, the focus is not on the non-emptiness of R,

而在于：
but rather on:

> 当 n 变化时，R 是否形成对偶数域的持续命中。
> As n varies, whether R forms sustained hits over the domain of even numbers.

关系从“是否存在”被提升为“是否稳定作用”。
The relation is lifted from “existence” to “stable action.”

覆盖视角下的命题等价变换
Equivalence Transformation Under the Coverage View

在覆盖视角下，强哥德巴赫猜想可被重写为：
Under the coverage view, the strong Goldbach conjecture can be rewritten as:

> 素数对关系在偶数域上不存在永久空洞。
> The prime-pair relation has no permanent holes over the even-number domain.

这一重写并未改变命题的真假条件，
This rewriting does not alter the truth condition of the proposition,

但改变了**失败态的表达方式**。

but it changes the **expression of failure states**.

失败不再表现为“找不到某一对素数”，
Failure no longer appears as “failing to find a particular pair of primes,”

而表现为：
but rather as:

> 某个偶数在扫描中始终未被任何关系轨道命中。
> An even number that remains unhit by all relational trajectories during scanning.

正是在这一点上，
It is precisely at this point that

命题从一个存在性问题，转化为一个**覆盖稳定性问题**。
the proposition shifts from an existence problem to a **coverage stability problem**.

小结（关系层）
Interim Summary (Relational Layer)

关系重写并未试图“简化”哥德巴赫猜想。
The relational rewriting does not attempt to “simplify” Goldbach’s conjecture.
相反，它暴露了一个更高阶的问题形式：
On the contrary, it exposes a higher-order problem form:

> 命题真正断言的，并非某个构造能否完成，
> The proposition does not truly assert whether a construction can be completed,
>
> 而是某种关系是否在尺度推进中保持覆盖。
> but whether a relation maintains coverage as scale advances.

这一转写，为后续结构抽象（S）提供了必要前提。
This rewriting provides the necessary precondition for the subsequent structural abstraction (S).

X.3 结构抽象（S）
X.3 Structural Abstraction (S)

在关系被重写之后，问题不再是“是否存在解”，
After the relation has been rewritten, the question is no longer “whether a solution exists,”
而是：该关系在结构层面**具有什么样的生成形态**。
but rather: what kind of **generative form** the relation possesses at the structural level.
这一层不再讨论单个偶数，
This layer no longer discusses individual even numbers,
而讨论关系在整体集合上的**形态与约束**。
but instead the **shape and constraints** of the relation over the entire set.

素数集合的自卷积结构
Self-Convolution Structure of the Prime Set

将素数集合 P 视为一个稀疏集合。
Treat the set of primes P as a sparse set.
二和关系在结构上等价于 P 与 P 的自卷积：
The binary-sum relation is structurally equivalent to the self-convolution of P with itself:

$$C = P \oplus P$$
$$C = P \oplus P$$

其中 C 表示所有可被素数对命中的和值集合。
Here C denotes the set of all sums that can be hit by prime pairs.
强哥德巴赫猜想在该抽象下，
Under this abstraction, the strong Goldbach conjecture
不再是“逐点成立”的命题，
is no longer a pointwise statement,
而是：
but rather:

自卷积结果是否在偶数轴上形成连续覆盖。
Whether the convolution result forms continuous coverage along the even-number axis.

二部图模型
Bipartite Graph Model

另一种等价的结构抽象，是二部图模型。
Another equivalent structural abstraction is the bipartite graph model.

左侧节点集：素数集合 P
Right node set: prime set P
右侧节点集：素数集合 P
Left node set: prime set P
边：连接 (p, q)，其权重为 p + q
Edge: connects (p, q), weighted by p + q

在该模型中，
In this model,
偶数 n 是否可表示，
whether an even number n is representable
等价于是否存在一条边，其权重恰为 n。
is equivalent to whether there exists an edge whose weight is exactly n.
但在覆盖视角下，更重要的是：
But under the coverage view, what matters more is:
对角线扫描时，边权是否在偶数轴上留下空洞。
Whether diagonal scanning leaves holes along the even-number axis.

对角线命中模型
Diagonal Hit Model

在 p + q = n 的表示中，
In the representation p + q = n,
固定 n 等价于在 (p, q) 平面中扫描一条对角线。
fixing n is equivalent to scanning a diagonal line in the (p, q) plane.
当 n 增大时，
As n increases,
扫描对角线向外平移。
the scanning diagonal shifts outward.
问题于是被转写为：
The problem is thus rewritten as:

在不断外移的对角线族中，

Across an outward-moving family of diagonals,
是否存在一条对角线，
whether there exists a diagonal
完全避开素数点集。
that entirely avoids the prime point set.

该问题不再是局部的，
This is no longer a local question,
而是一个**全局几何结构问题**。
but a **global geometric structural problem.**
稀疏集合为何可能生成连续覆盖
Why a Sparse Set Can Generate Continuous Coverage
从直觉上看，
Intuitively,
素数集合是高度稀疏的。
the prime set is highly sparse.
但自卷积具有一个关键性质：
But self-convolution has a key property:

稀疏性在卷积中并不线性继承。
Sparsity does not propagate linearly through convolution.

两个稀疏集合的卷积，
The convolution of two sparse sets
可以生成一个在尺度上显得“致密”的结果集。
can generate a result set that appears “dense” at scale.
这正是覆盖直觉持续成立的结构来源，
This is precisely the structural source of the persistent coverage intuition,
也是证明难度的根源之一。
and also one of the roots of the proof difficulty.

小结（结构层）
Interim Summary (Structural Layer)

在结构抽象层，
At the structural abstraction layer,
强哥德巴赫猜想被识别为：
the strong Goldbach conjecture is identified as:
一个关于稀疏集合自卷积覆盖性的命题。
A proposition about the coverage of a self-convolution of a sparse set.
这一层并未给出任何结论，
This layer yields no conclusion,
但明确了失败态若存在，
but clarifies that if a failure state exists,
它必须表现为一种**全局结构异常**，
it must manifest as a **global structural anomaly,**

而非局部偶然缺失。
rather than a local accidental absence.

X.4 失败态的结构条件（C）
X.4 Structural Conditions of Failure States (C)

在完成关系重写与结构抽象之后，

After completing relational rewriting and structural abstraction,
失败态不再被理解为“尚未找到表示”,
failure states are no longer understood as “representations not yet found,”
而被理解为一种**可持续存在的结构状态**。
but as a **structurally sustainable state**.

本节的目标不是寻找失败态,
The goal of this section is not to search for failure states,
而是刻画:
but to characterise:

> 若失败态存在，它在结构上必须满足什么条件。
> If a failure state exists, what structural conditions it must satisfy.

“无表示”所需的全局否定条件
Global Negation Conditions Required for “No Representation”

在覆盖视角下,
Under the coverage view,
“某个偶数 n 无表示”并不是一个局部事件。
“An even number n having no representation” is not a local event.
它要求在扫描该对角线时:
It requires that during the scanning of the corresponding diagonal,

> 所有可能的素数对同时失效。
> all possible prime pairs fail simultaneously.

这意味着失败态必须满足一个**全局否定条件**:
This means a failure state must satisfy a **global negation condition**:

> 不是某一类素数被排除,
> Not a particular class of primes being excluded,
> 而是所有跨尺度、跨模结构的素数对同时不可用。
> but all prime pairs across scales and modular structures being simultaneously unavailable.

这在结构上极为苛刻。
Structurally, this is extremely demanding.

模约束的能力上限
Capability Limits of Modular Constraints

数论中常见的否定工具是模约束。
In number theory, modular constraints are common negation tools.
例如,
For example,
某些模结构可以排除特定形式的和。
certain modular structures can exclude sums of specific forms.
但在该结构视角下,
But under this structural view,
模约束的能力存在明确上限:
modular constraints have a clear upper bound in their power:

> 模约束作用于有限结构;
> Modular constraints act on finite structures;
> 而失败态需要跨越无限尺度的一致否定。

whereas a failure state requires consistent negation across infinite scales.

随着 n 增大，
As n grows,
模约束被自卷积结构不断"冲刷"。
modular constraints are continually "washed out" by the self-convolution structure.
多尺度约束协同的不可持续性
Unsustainability of Multi-Scale Constraint Coordination
若失败态存在，
If a failure state exists,
它必须依赖多种约束在不同尺度上的协同。
it must rely on the coordination of multiple constraints across different scales.
这些约束包括：
These constraints include:

模结构约束
Modular constraints

分布稀疏性
Distributional sparsity

偶然对齐的空隙
Accidental alignments of gaps

然而，这种协同面临一个结构性问题：
However, such coordination faces a structural problem:

各尺度约束的相位无法长期锁定。
The phases of constraints at different scales cannot remain locked over the long term.

尺度推进本身就会引入漂移。
Scale advancement itself introduces drift.
因此，
Therefore,
失败态若存在，
if a failure state exists,
它必须持续支付一个**不断增长的结构维持成本**。
it must continuously pay a **growing structural maintenance cost**.

小结（约束层）
Interim Summary (Constraint Layer)

在约束层，
At the constraint layer,
失败态被刻画为一种：
failure states are characterised as:

需要全局否定、跨尺度协同、且成本随尺度增长的结构状态。
Structural states requiring global negation, cross-scale coordination, and costs that grow with scale.

本节并未断言失败态"不可能"，
This section does not assert that failure states are "impossible,"
而是指出：

but points out that:

任何失败态若存在，都处于高度不稳定的结构位置。
Any failure state, if it exists, occupies a highly unstable structural position.

这一判断将直接导向下一节对**顺序与扫描**的讨论。
This assessment leads directly into the next section on **order and scanning**.

X.5 顺序与扫描漂移（O）
X.5 Order and Scanning Drift (O)

在前一节中，
In the previous section,
失败态被刻画为一种需要高成本维持的结构状态。
failure states were characterised as structural states requiring high maintenance cost.
但这种刻画仍隐含了一个前提：
However, this characterisation still contains an implicit assumption:

扫描过程本身是稳定且可冻结的。
That the scanning process itself is stable and freezable.

本节将显示，
This section will show that
这一前提并不成立。
this assumption does not hold.
不同枚举顺序下的命中稳定性
Hit Stability Under Different Enumeration Orders
在传统理解中，
In the traditional understanding,
命题被视为与枚举顺序无关。
the proposition is considered independent of enumeration order.
无论先枚举素数，还是先枚举偶数，
Whether primes are enumerated first or evens are enumerated first,
结果被假定为相同。
the result is assumed to be the same.
但在覆盖—扫描视角下，
But under the coverage–scanning view,
顺序并非中性的。
order is not neutral.
不同的枚举顺序，
Different enumeration orders
对应不同的扫描轨道。
correspond to different scanning trajectories.
而失败态的维持，
And the maintenance of a failure state
要求其在**所有合理扫描顺序下保持稳定**。
requires it to remain stable under **all reasonable scanning orders**.
这是一个极强的隐含条件。
This is an extremely strong implicit condition.

顺序扰动如何破坏失败态
How Order Perturbations Disrupt Failure States

一旦枚举顺序发生微小扰动，

Once even a small perturbation occurs in the enumeration order,
扫描轨道就会发生偏移。
the scanning trajectory shifts.
在结构层面，
At the structural level,
这意味着：
this means:

> 原本"避开"的素数点集，
> the prime point set that was previously "avoided,"
> 可能在另一顺序下被命中。
> may be hit under a different order.

失败态若要持续，
For a failure state to persist,
它不仅要避开当前扫描路径，
it must avoid the current scanning path,
还要避开**所有可能的邻近路径**。
but also all nearby possible paths.
顺序扰动因此成为一种失败态放大器。
Order perturbation thus becomes a **failure-state amplifier**.

顺序不可冻结性作为隐含假设
Order Non-Freezability as an Implicit Assumption

在大多数存在性命题中，
In most existential propositions,
顺序被视为无关因素。
order is treated as irrelevant.
但在本附录所采用的结构视角中，
But in the structural perspective adopted in this appendix,
顺序本身是一种**操作自由度**。
order itself is an **operational degree of freedom**.
冻结顺序，
Freezing order
等价于人为降低系统自由度。
is equivalent to artificially reducing the system's degrees of freedom.
而失败态的可维持性，
And the maintainability of failure states
恰恰依赖于这种自由度的隐性冻结。
relies precisely on such implicit freezing of freedom.

小结（顺序层）
Interim Summary (Order Layer)

在顺序层，
At the order layer,
失败态被进一步限定为：
failure states are further constrained to be:

> 对枚举顺序扰动不敏感的结构异常。
> Structural anomalies insensitive to enumeration-order perturbations.

这使得失败态的结构要求再次提升。

This raises the structural requirements for failure states yet again.

同时，
At the same time,
它暴露出一个关键事实：
it exposes a key fact:

命题本身，隐含地假定了顺序可以被冻结。
The proposition itself implicitly assumes that order can be frozen.

这一假定并未在传统表述中被显式承认。
This assumption is not explicitly acknowledged in traditional formulations.

X.6 不变量识别（I）
X.6 Identification of Invariants (I)

在关系、结构、约束与顺序层逐步收紧之后，
After progressively tightening the relational, structural, constraint, and order layers,

剩余的问题不再是：
the remaining question is no longer:

是否存在失败态。
Whether a failure state exists.

而是：
but rather:

在尺度推进与顺序扰动下，
Under scale advancement and order perturbation,

哪些属性能够保持不变。
which properties remain invariant.

这些不变量，
These invariants,
正是"常数命题"在数学侧的对应物。
are the mathematical-side counterparts of the "Constant Proposition."

覆盖性作为尺度不变量
Coverage as a Scale Invariant

在前述各层分析中，
Across the preceding layers of analysis,
一个属性反复出现而未被消解：
one property repeatedly appears and is never eliminated:

覆盖性。
Coverage.

无论尺度如何增长，
Regardless of how scale grows,
无论扫描顺序如何扰动，
regardless of how scanning order is perturbed,
素数对关系在偶数轴上的命中趋势始终存在。

the hit tendency of the prime-pair relation along the even axis persists.
这并不是一个关于“密度”的断言，
This is not a statement about “density,”
而是关于：
but about:

> 是否存在持续的命中机制。
> whether a sustained hit mechanism exists.

在该意义下，
In this sense,
覆盖性表现为一种尺度不变量。
coverage manifests as a scale invariant.

自由度增长与失败态维持成本
Degree-of-Freedom Growth and Failure-State Maintenance Cost

随着尺度增长，
As scale increases,
系统的操作自由度同步增长：
the system’s operational degrees of freedom grow in parallel:

> 可选素数对数量增加；
> the number of possible prime pairs increases;
> 扫描路径的微扰空间扩大；
> the perturbation space of scanning paths expands;
> 约束之间的相位关系更加难以锁定。
> phase relationships between constraints become harder to lock.

失败态若要维持，
For a failure state to be maintained,
必须抵消这一自由度增长。
it must counteract this growth in degrees of freedom.
这意味着失败态的维持成本
This means the maintenance cost of a failure state
不是常数，
is not constant,
而是随尺度单调上升。
but monotonically increasing with scale.

“常数”并非数值，而是稳定属性
“Constant” as Stability, Not a Numeric Value
在此意义下，
In this sense,
“常数”并不是指某个固定数值。
a “constant” does not refer to a fixed numeric value.
它指的是：
It refers to:

> 在系统自由度被逐步耗尽之后，
> after the system’s degrees of freedom are progressively exhausted,
> 仍然无法被消除的稳定属性。
> a stable property that cannot be eliminated.

在哥德巴赫结构中，
In the Goldbach structure,
这一残余属性正是覆盖性。
this residual property is precisely coverage.
它不是被证明出来的，
It is not “proved” into existence,
而是在失败态被不断排除后
but remains after failure states are progressively excluded
仍然站立不倒。
and continues to stand.

小结（不变量层）
Interim Summary (Invariant Layer)

在不变量层，
At the invariant layer,

本附录识别出：
this appendix identifies:

> 覆盖性是一个在尺度推进与顺序扰动下保持稳定的属性。
> Coverage is a property that remains stable under scale advancement and order perturbation.

该识别并不构成证明，
This identification does not constitute a proof,
但完成了一个结构判定：
but completes a structural determination:

> 若命题失败，其失败态必须破坏这一不变量。
> If the proposition fails, its failure state must destroy this invariant.

而前述各层显示，
And the preceding layers show
这种破坏在结构上极难维持。
such destruction is structurally difficult to sustain.

X.7 命题类型判定
X.7 Proposition Type Classification

在完成不变量识别之后，
After completing invariant identification,
剩余的问题不再属于数论内部，
the remaining question no longer belongs to number theory proper,
而属于**命题类型学**。
but to **proposition typology**.

本节的目标是判定：
The goal of this section is to determine:

> 强哥德巴赫猜想在结构意义上属于哪一类命题。
> To which class of propositions the strong Goldbach conjecture belongs in a structural sense.

不变量型命题 vs 存在型命题
Invariant-Type Propositions vs Existential-Type Propositions

存在型命题的典型形式是：
The typical form of an existential proposition is:

对任意对象，存在某个构造满足条件。
For any object, there exists a construction satisfying a condition.

这类命题的证明路径
The proof paths for such propositions
通常依赖：
typically rely on:

显式构造
Explicit constructions
算法性枚举
Algorithmic enumeration
有限覆盖与外推
Finite coverage and extrapolation

而不变量型命题则不同。
Invariant-type propositions differ fundamentally.
它们断言的不是某个构造的存在，
They do not assert the existence of a construction,
而是：
but rather:

某种结构属性在操作扰动下保持稳定。
That a structural property remains stable under operational perturbations.

在这种命题中，
In such propositions,
“证明”往往不是构造性的，
“proof” is often not constructive,
而是消除失败态的过程。
but a process of eliminating failure states.
为什么该命题“极像真理但难以证明”
Why This Proposition “Feels True” Yet Is Hard to Prove
在结构上，
Structurally,
强哥德巴赫猜想呈现出
the strong Goldbach conjecture exhibits
一个典型的不变量型特征：
a typical invariant-type signature:

失败态高度不稳定；
failure states are highly unstable;
维持失败态的成本随尺度增长；
the cost of maintaining failure states grows with scale;
顺序与扫描扰动不断侵蚀否定条件。
order and scanning perturbations continuously erode negation conditions.

这些特征使得命题
These features make the proposition
在经验与直觉上“极像真理”。

“feel true” in experience and intuition.
然而，
However,
证明工程仍然常常采用
proof engineering still often adopts
存在型命题的工具。
tools suited for existential propositions.
这导致一种断裂：
This leads to a rupture:

> 直觉所指向的是不变量稳定性，
> Intuition points toward invariant stability,
> 而证明尝试却在寻找局部构造。
> while proof attempts search for local constructions.

证明工程与结构直觉的断裂点
The Fracture Between Proof Engineering and Structural Intuition

这一断裂并非偶然。
This fracture is not accidental.
它源自命题的类型错配：
It originates from a type mismatch of the proposition.
当一个不变量型命题
When an invariant-type proposition
被强行置入存在型证明框架时，
is forcibly placed into an existential proof framework,
结果往往是：
the result is often:

> 局部成功但全局失效；
> local successes with global failure;
> 技术复杂度不断上升；
> escalating technical complexity;
> 证明路径高度脆弱。
> highly fragile proof paths.

这并不意味着命题为假，
This does not imply the proposition is false,
而意味着：
but rather that:

> 所使用的证明语言与命题结构不匹配。
> the proof language does not match the structure of the proposition.

小结（命题类型层）
Interim Summary (Proposition-Type Layer)

在命题类型层，
At the proposition-type layer,
本附录给出的判断是：
this appendix offers the judgment that:

> 强哥德巴赫猜想在结构上更接近不变量型命题，而非存在型命题。

The strong Goldbach conjecture is structurally closer to an invariant-type proposition than to an existential one.

这一判断不涉及真假，
This judgment does not address truth or falsity,
只涉及：
but only:

何种证明形式可能与其结构相容。
which forms of proof might be structurally compatible with it.

X.8 附录结论（非证明性）
X.8 Appendix Conclusion (Non-Proof)

本附录至此不再推进分析层级。
At this point, this appendix advances no further analytical layers.
它所完成的，并非对命题真假的裁决，
What it completes is not an adjudication of truth or falsity,
而是一次**结构性收束**。
but a **structural closure**.

覆盖作为耗尽后的残余证词
Coverage as Residual Testimony After Exhaustion

在关系、结构、约束、顺序与不变量逐层施压之后，
After pressure has been applied layer by layer across relation, structure, constraint, order, and invariant,
系统的可操作自由度被持续消耗。
the system's operational degrees of freedom are progressively exhausted.
在这一耗尽过程中，
Throughout this exhaustion process,
失败态被不断推向
failure states are continually pushed toward
更高成本、更高不稳定性的结构位置。
structural positions of higher cost and greater instability.
最终仍未被消解的属性，
The property that remains undisposed at the end,
不是某个数值结论，
is not a numerical conclusion,
而是：
but rather:

覆盖性本身。
Coverage itself.

在本附录中，
In this appendix,
覆盖并未被证明，
coverage is not proven,
而是作为
but stands as
系统在耗尽自由度之后
the system's residual testimony
所留下的残余证词而出现。

after degrees of freedom have been exhausted.

否定态不可维持的结构判断
Structural Judgment on the Unsustainability of Negation States

本附录给出的并非“不可能失败”的断言，
This appendix does not assert that failure is “impossible,”
而是一个更弱、但更稳固的判断：
but a weaker, yet more robust judgment:

> 否定态若存在，其维持成本随尺度与扰动持续上升。
> If a negation state exists, its maintenance cost increases with scale and perturbation.

这使否定态
This renders negation states
在结构演化中呈现出
structurally

持续被侵蚀的特征。
a tendency toward continual erosion.
在这一意义下，
In this sense,
否定并非被反驳，
negation is not refuted,
而是被**结构性消耗**。
but **structurally exhausted**.

本附录在全书中的功能定位
Functional Position of This Appendix Within the Book

在全书结构中，
Within the structure of the book,
本附录承担的功能是：
this appendix serves to:

> 提供一个数学侧的“常数命题”实例；
> provide a mathematical-side instance of the “Constant Proposition”;
> 展示不变量型命题的典型结构张力；
> demonstrate the typical structural tension of invariant-type propositions;
> 说明为何某些命题
> explain why certain propositions

长期呈现“近乎必然但难以证明”的状态。
persist in a state of “near inevitability yet resistant to proof.”
它不向正文提供定理，
It provides no theorems to the main text,
只提供一个
but only
结构上的对应与回声。
a structural correspondence and echo.

X.A 读者误区声明（可选）
X.A Reader Misconception Notice (Optional)

为避免误读，

To prevent misreading,
特此明确以下边界。
the following boundaries are explicitly stated.
本附录不回答“如何证明”
This Appendix Does Not Answer “How to Prove”
本附录不提供证明路线、
This appendix provides no proof strategy,
不暗示新型证明工具，
does not suggest new proof techniques,
也不构成对既有证明工作的评价。
nor does it evaluate existing proof efforts.
本附录不支持数值外推
This Appendix Does Not Support Numerical Extrapolation
任何基于计算验证、
Any conclusions based on computational verification,
密度估计或统计趋势的外推，
density estimation, or statistical trend extrapolation,

均不在本附录的论域之内。
fall outside the scope of this appendix.
本附录不构成对猜想真假的形式判决
This Appendix Does Not Constitute a Formal Verdict on Truth or Falsity

本附录所给出的，
What this appendix provides
仅是结构判断，
is a structural judgment,
而非形式逻辑意义上的结论。
not a conclusion in the formal logical sense.
是否将其视为支持、反对或中立，
Whether it is taken as supportive, oppositional, or neutral,
完全取决于读者
is entirely determined by the reader’s
所采用的命题理解框架。
chosen framework of proposition interpretation.

弱哥德巴赫之所以成立，
不是因为素数听话，
而是因为系统允许统计意义上的退让；

强哥德巴赫之所以未解，
不是因为不够聪明，
而是因为没有退让空间。

The weak Goldbach conjecture holds
not because prime numbers are well-behaved,
but because the system permits retreat in a statistical sense;

the strong Goldbach conjecture remains unsolved
not due to a lack of intelligence,
but because there is no room left to retreat.