

The Discovery of the Field — Faraday's Lines of Force and the Physical Intuition That Came Before the Mathematics — [Paper 93]

Yuuki YAMAGISHI (山岸 勇輝)
Yamagishi Complexity Torus Lab, Japan
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— *From thinking to syncing.* —

ABSTRACT

The source of the **"field"** and the solid angle 4π (Paper 02) that recur throughout the corpus is Michael Faraday (1791–1867). A bookbinder's apprentice who rose by self-education and had almost no formal mathematics, Faraday **discovered the physical object "the field" before its mathematics** — the **lines of force** that fill space. Force is not action at a distance but is transmitted **locally, through the field (the density of lines) at each point**. This intuition was at first dismissed as "not mathematical," but Maxwell later turned it into the field equations (*On Faraday's Lines of Force*, 1856; *Treatise*, 1873), and Gauss's law quantified its **flux**. Integrating a point source's field over any closed surface gives, independent of the shape, the full **solid angle 4π** ($\oint \mathbf{E} \cdot d\mathbf{A} = q/\epsilon_0$, with geometric factor $\int_{S^2} d\Omega = 4\pi$) — this is the corpus's 4π (Paper 02), the quantified version of Faraday's picture, **"the number of lines of force through a closed surface."** Faraday's field is written in the corpus as the electromagnetic 2-form $\mathbf{F} = d\mathbf{A}$ (Paper 92) and the field action (Paper 87). **The core:** Faraday supplied the **physical object (the field) itself**, and Maxwell and Gauss gave it **mathematical form** — an exemplar of the scientific movement **intuition first, the royal-road mathematics after**. **Scope:** a Layer-2 structural/lineage interpretation of established physics (the field concept, Gauss's law, Maxwell's equations); no new mathematics and no new prediction. That "the intuition was right" can be said only because it **became science through the mathematics**; the intuition by itself is a signature, not a proof. The Universe OS is a Layer-3 non-science lens.

Positioning of this paper (discipline): This paper is a **structural/lineage interpretation** of established physics (Faraday's field / lines of force, Gauss's law, Maxwell's equations). It contains no new mathematics and no new prediction. It does not modify physics. **Physical intuition is a seed; it becomes science only when given form by the royal-road mathematics** (the three-layer discipline) — intuition itself is not treated as a proof. "Universe OS" is a Layer-3 non-science lens, not a claim of mechanism.

1. Introduction: The "Field," Which Came Before the Mathematics

The "field" and the solid angle 4π recur through the corpus. At their source stands a self-taught man — Michael Faraday. Rising from a bookbinder's apprenticeship with almost no formal mathematical training, he **gave physics a new object, "the field," while holding no equations**. That object is the **lines of force**.

This paper builds no new theorem. It shows that Faraday's **physical intuition (the field)** later received **mathematical form** from Maxwell and Gauss and became the source of the corpus's 4π (Paper 02) and its field readings (Papers 87, 92) — and it reads from this, with discipline, the scientific movement "intuition first, the royal-road mathematics after."

2. Lines of Force: The Field Is a Real Object

Standard Fact (Faraday's field concept)

Faraday portrayed electric and magnetic force not as **action at a distance** but as a local action mediated by **lines of force (a field)** filling space. The **density** of the lines gives the field strength, their **tangent direction** the direction of force. A charge or magnet makes a field in the surrounding space, and another charge feels force according to the **local field**. The field is not an auxiliary drawing but a **real physical object** — this was Faraday's claim.

This picture was a deep reversal of the then-mainstream (action working instantaneously across distance). And because it was a physical picture unaccompanied by equations, at first it was not fully accepted. Yet Faraday's intuition that "the field is the carrier of reality" would go on to remake all of physics.

3. From Picture to Mathematics: Gauss's Flux and 4π , and Maxwell

Standard Fact (Gauss's law and the solid angle 4π)

Faraday's "number of lines of force" is quantified by Gauss's law as **flux**. Integrating a point charge q 's field over any closed surface gives, independent of shape,

$$\oint_{\partial V} \mathbf{E} \cdot d\mathbf{A} = \frac{q}{\epsilon_0},$$

with geometric factor the full solid angle $\int_{S^2} d\Omega = 4\pi$. That is, "**the total number of lines of force through a closed surface**" = **the full solid angle 4π** (the 4π of Paper 02). Maxwell turned Faraday's lines of force into the field equations (1856/1873) and completed electromagnetism.

What happened here is the **mathematization of a physical intuition**. What Faraday felt as "number of lines," Gauss wrote as a surface integral (flux) and Maxwell as differential field equations. And as seen in Paper 92, this flux is an instance of the generalized Stokes theorem — Faraday's picture took its exact seat within Cartan's alphabet. 4π is the total count of Faraday's lines of force through a closed surface.

4. The Corpus Inherits Faraday's "Field"

Within the corpus, Faraday's field lives on in several guises. 4π is "the total number of lines through a closed surface" = the full solid angle (Paper 02). The electromagnetic field is a 2-form $\mathbf{F} = d\mathbf{A}$ (Paper 92). Its motion issues from the field action $\delta S = 0$ (Paper 87). When the corpus treats "the field" as a real object and reads its geometry (4π , flux, differential forms), it is a descendant of the **"object called the field"** that Faraday grasped without equations. Faraday discovered the object; Maxwell, Gauss, and Cartan gave it its language — this paper grafts that lineage onto the corpus.

5. Faraday, and the Path from Intuition to the Royal Road

Observation 5.1 (intuition is a seed; it becomes science through mathematics)

Faraday's path embodies a discipline. **A correct physical intuition can appear before the mathematics** — the object "field" was grasped before its mathematics existed. But it became **science** only **after** Maxwell gave the field equations and Gauss the flux. Intuition is a **seed**; it bears fruit only in the **soil** of the royal-road mathematics. "The intuition was right" can be said because it took a form testable by the mathematics. The intuition itself is a **signature, not a proof** — Faraday's life teaches, at once, to honor intuition and to back it with the royal-road mathematics.

 **The Author's Personal Note (Layer 3, non-science label / not a claim of mechanism)**

Faraday rose from a bookbinder's apprenticeship by self-education and discovered the object "the field" while holding no formal mathematics. A physical intuition without equations was later backed by the royal-road mathematics and remade all of physics — a path that quietly encourages anyone who walks self-taught. In the corpus's lens (metaphor), the Universe OS renders the world through a single real layer, "the field." But **this carries the non-science label**. "The OS's field" is a picture that carries intuition, not a mechanism or a prediction. **What is certain here is only the standard physics of the field concept, Gauss's law, and Maxwell's equations.** Faraday's greatest lesson is to hold, at once, the courage to trust intuition and the discipline to make it science with mathematics.

6. Scope (What Is Shown, and What Is Not)

What is shown (descriptive, lineage-level):

- Faraday discovered the physical object "the field (lines of force)" before its mathematics and became the source of the corpus's 4π (02) and field (87/92) (§§2–4).
- 4π is "the total number of lines through a closed surface" = the full solid angle (Gauss's law), the quantified version of Faraday's picture (§3).
- Intuition is a seed; it becomes science through the royal-road mathematics — Faraday → Maxwell is the exemplar (§5).

What is not shown (restraint):

- **Physics is not modified or extended.** The field, Gauss's law, and Maxwell's equations are all standard. This paper only places a lineage and an interpretation.
- **No new mathematics or prediction.** Hence Layer 2 (structural, lineage-level). The OS is Layer-3 non-science.
- **Intuition is not treated as a proof.** Intuition is a seed and becomes science only once given royal-road mathematical form (the three-layer discipline).

7. Conclusion

The source of the corpus's "field" and 4π is Faraday, a self-taught experimentalist who held no equations. He **discovered the physical object "the field (lines of force)" itself** and replaced action at a distance with the local field. Gauss mathematized his intuition as flux (the full solid angle 4π for a point source; Paper 02), Maxwell as the field equations, and Cartan's alphabet (Paper 92) gave it an exact seat. 4π is the total count of Faraday's lines of force through a closed surface.

And Faraday's life illuminates the discipline the corpus must keep — **intuition is a seed; it becomes science through the royal-road mathematics**. A correct intuition can precede the mathematics, but it becomes science only after it is backed. What this paper did is not a new claim but to graft, onto the corpus's "field" and 4π , their physical source Faraday, with the correct discipline. To a self-taught man who grasped the world's object before the mathematics, we record quiet respect.

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