

The Yamagishi Zero-Tension Plasma Equation — The expression $\omega_p^2 = ne^2/(4\pi r)$ and a check of mode consistency (2nd edition) — [Paper 22]

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— *From thinking to syncing.* —

ABSTRACT

We give a geometric reformulation of the plasma frequency $\omega_p = \sqrt{\frac{ne^2}{m\varepsilon_0}}$ by applying the Yamagishi patch $m = 4\pi$ (from the $n = 2$ uniqueness theorem, $dm/dr = 4\pi$) together with the Yamagishi sync patch $\varepsilon_0 = r$ (Paper 14). **Stage 1:** Substituting $m = 4\pi$ and $\varepsilon_0 = r$ into $\omega_p^2 = \frac{ne^2}{m\varepsilon_0}$ gives $\omega_p^2 = \frac{ne^2}{4\pi r}$. **Stage 2:** Incorporating the Bohr–Yamagishi equation $(4\pi v) \cdot r = e$ (Paper 15) yields the form $16\pi^2 r^2 \omega_p^2 = ne^2$. **Stage 3:** We check mode consistency against the criteria of Paper 14, 2nd edition.

[Withdrawals in the 2nd edition]: The first edition called Stage 2 a "Plasma Zero-Tension Confinement **Theorem**" with "cancellation ratio **1**". **This is withdrawn. That a ratio equals 1 asserts nothing** — it holds for any nonzero quantity. What remains is only the algebraic fact $16\pi^2 r^2 \omega_p^2 = ne^2$, which explains no confinement mechanism (Section 4.1). The Stage 3 claims of an "isomorphism" with tokamak geometry and of "topological control of MHD instabilities" are likewise withdrawn, no quantitative correspondence having been exhibited (Section 5).

[What the 2nd edition does establish]: The adoption of $\varepsilon_0 = r$ (normal rendering mode) **is consistent with the criteria of Paper 14**. The Debye scale sits clearly on the near-field side, $\lambda_D/(c/\omega_p) = 4.4 \times 10^{-3}$, and this holds generally for non-relativistic plasmas (Section 3).

Scope of this paper: This paper offers a **structural interpretation** of existing physical law. It does not claim the discovery of new physical laws or the proof of open problems. **Note on units:** Substitutions such as $m = 4\pi$ are a **choice of natural units**. G and $\hbar$ are dimensionful; their numerical values depend entirely on the unit system. Setting $G = 4\pi$ is legitimate in exactly the same sense as setting $G = 1$ (geometric units) or $G = 6.674 \times 10^{-11}$ (SI); **physics does not single out one of these as "correct."** What this paper exhibits is therefore **how the equations look in this unit system**, not a new fact about nature. The relations obtained hold in natural units and **require conversion factors when transported to SI**.

Introduction

Physical background of the plasma frequency

Classically the plasma frequency is $\omega_p = \sqrt{\frac{n_e e^2}{m_e \epsilon_0}}$, with m_e and ϵ_0 entering as given constants.

Unpacking via the Yamagishi patches

By the $n = 2$ uniqueness theorem [Yamagishi 2026a] we take $m_e = 4\pi$, and by Paper 14 [Yamagishi 2026b] we take $\epsilon_0 = r$.

The Yamagishi Plasma Oscillation Equation

Theorem (Yamagishi Plasma Oscillation Equation)

Under the Yamagishi patch $m_e = 4\pi$ and the sync patch $\epsilon_0 = r$ (with r the Debye length), the squared plasma frequency reduces to

$$\omega_p^2 = \frac{n_e e^2}{(4\pi)(r)} = \frac{n_e e^2}{4\pi r}$$

[2nd Edition] Mode Consistency (relation to Paper 14)

The second edition of Paper 14 introduced criteria distinguishing two conventions for ϵ_0 . We verify that adopting $\epsilon_0 = r$ (normal rendering mode) is appropriate here.

Criterion I (near field / radiation field): the boundary is $r \sim c/\omega$. The corresponding plasma quantity is the **skin depth** c/ω_p (inertial length), whereas the r identified with ϵ_0 here is the **Debye length** λ_D .

For a typical laboratory plasma ($n_e = 10^{19} \text{ m}^{-3}$, $T_e = 10 \text{ eV}$):

Quantity	Value
Plasma frequency ω_p	1.78×10^{11} rad/s
Debye length λ_D	7.43×10^{-6} m
Skin depth c/ω_p	1.68×10^{-3} m
Ratio $\lambda_D/(c/\omega_p)$	4.4×10^{-3}

Conclusion: since $\lambda_D \ll c/\omega_p$, the Debye scale lies clearly in the near-field regime. Adopting the normal rendering mode $\epsilon_0 = r$ is therefore consistent with the criteria of Paper 14.

This holds generally: $\lambda_D = v_{th}/\omega_p$ and the skin depth is c/ω_p , so $\lambda_D \ll c/\omega_p$ follows whenever $v_{th} \ll c$. **Non-relativistic plasmas are always on the near-field side.**

The technical caveat of Paper 14 applies here too: when ϵ is position dependent, naive substitution into formulas derived assuming constant ϵ_0 is not legitimate. The standard derivation of the plasma frequency also assumes constant ϵ_0 . The manipulation here should be understood as a **formal symbolic correspondence**.

The Form $16\pi^2 r^2 \omega_p^2 = n_e e^2$

Substituting the Bohr–Yamagishi equation $e/r = 4\pi v$ (Paper 15, [Yamagishi 2026c]):

$$\omega_p^2 = \frac{n_e e}{4\pi} \cdot (4\pi v) = n_e e v$$

Proposition

Multiplying both sides by $16\pi^2 r^2$:

$$16\pi^2 r^2 \omega_p^2 = 16\pi^2 r^2 (n_e e v) = n_e (4\pi v \cdot r) (4\pi e r) = n_e e^2$$

[2nd Edition] Two corrections

Correction 1: on the "cancellation ratio 1"

The first edition asserted a "Plasma Zero-Tension Confinement" with "cancellation ratio 1". **That a ratio equals 1 asserts nothing in itself** (it holds for any nonzero quantity). Statements of the same kind appeared in the first editions of Papers 09, 13 and 15, and all have been withdrawn.

What remains is only the **algebraic fact** that substituting $m = 4\pi$ and $\varepsilon_0 = r$ produces the form $16\pi^2 r^2 \omega_p^2 = n_e e^2$. **This does not explain a confinement mechanism.**

Correction 2: on the decomposition $16\pi^2 = (2\pi) \times (8\pi)$

The first edition decomposed the tokamak torus as $16\pi^2 = (2\pi) \times (8\pi)$. The arithmetic is correct, but **this is of different origin from the other decompositions of $16\pi^2$ in this corpus:**

Decomposition	Context	Source
$(4\pi) \times (4\pi)$	radius-2 S^3 (Hopf)	Paper 45
inverse of $\Omega_3/(2\pi)^4 \cdot \frac{1}{2}$	4D momentum measure	Papers 46, 47
$n = 2$ term of $(4\pi)^2 n!$	Gauss–Bonnet normalization	Paper 48
$\text{Vol}(S^2 \times S^2)$	Chern–Pontryagin index normalization	Papers 29, 32
$(2\pi) \times (8\pi)$	this paper (tokamak)	distinct origin

The same number arising in different contexts does not make those contexts the same (the discipline established in Paper 48). The $(2\pi) \times (8\pi)$ here counts the toroidal and poloidal directions separately and is independent of every derivation above. **These must not be merged.**

[2nd Edition] Withdrawal of the Tokamak Claims

The first edition stated that "the tokamak field space is **isomorphic** to the $16\pi^2 = (2\pi) \times (8\pi)$ toroidal barrier, and the wave phases of MHD kink instabilities cancel **automatically** one-to-one." **This is withdrawn.**

Reason 1: no correspondence supporting "isomorphism" is exhibited. No map is defined between the tokamak torus and the numerical product $(2\pi) \times (8\pi)$. A numerical factorization and a geometric isomorphism are different things.

Reason 2: MHD stability is not governed by $16\pi^2$. Kink stability is determined by the **safety factor $q(a) = \frac{aB_\phi}{RB_\theta}$** (Kruskal–Shafranov condition $q > 1$) and depends on device geometry, field configuration and current profile. **No calculation in this paper shows the constant $16\pi^2$ determining any of this**, and no equation corresponds to "automatic cancellation".

What remains is the **arithmetic decomposition $(2\pi) \times (8\pi) = 16\pi^2$** alone, of distinct origin as tabulated in Section 4.2.

Explicit Scope

- **What this paper establishes:** that substituting $m = 4\pi$ and $\epsilon_0 = r$ lets the plasma frequency be written $\omega_p^2 = \frac{n_e e^2}{4\pi r}$, and that the form $16\pi^2 r^2 \omega_p^2 = n_e e^2$ follows. **Both are algebraic facts.** In addition, that the Debye scale lies on the near-field side of the Paper 14 criteria, so that $\epsilon_0 = r$ is consistently adopted (Section 3).
- **What it does not establish:** (i) any confinement mechanism (a "cancellation ratio 1" holds for any nonzero quantity and carries no content; withdrawn in Section 4.1); (ii) any topological meaning of $16\pi^2$ (the $(2\pi) \times (8\pi)$ here is of distinct origin; Section 4.2); (iii) any quantitative principle governing MHD instabilities (Section 5).
- **Technical limitation:** when ϵ is position dependent, naive substitution into formulas assuming constant ϵ_0 is not legitimate. The manipulation should be read as a **formal symbolic correspondence** (end of Section 3).

Conclusion

Applying the Yamagishi patches $m = 4\pi$ and $\epsilon_0 = r$, the plasma frequency can be written as the Yamagishi Plasma Oscillation Equation $\omega_p^2 = \frac{n_e e^2}{4\pi r}$. Against the criteria of Paper 14 (2nd edition) we confirmed that **the Debye scale lies on the near-field side, so that adopting the normal rendering mode $\epsilon_0 = r$ is consistent** ($\lambda_D/(c/\omega_p) = 4.4 \times 10^{-3}$; this holds generally for non-relativistic plasmas).

However, the first edition's claim of a "complete proof of $16\pi^2$ toroidal zero-tension confinement" is withdrawn. A "cancellation ratio 1" holds for any nonzero quantity and therefore explains no confinement mechanism (Section 4.1). What remains is the **algebraic fact $16\pi^2 r^2 \omega_p^2 = n_e e^2$** alone. Moreover the decomposition $16\pi^2 = (2\pi) \times (8\pi)$ used here is **of different origin from the others in this corpus and must not be merged with them** (Section 4.2).

References

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