

A Resistance Containing No Property of the Sample Is Actually Measurable

— the quantised Hall resistance is $h/e^2 = \mathbf{25812.807459}$ ohms divided by an integer, with no quantity of the sample in it at all — shifting ν to **1.0001** moves it by **2.581023** ohms, so being an integer is doing work —

[Paper 514]

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— *From thinking to syncing.* —

Abstract

A resistance is taken to be fixed by the properties of the sample. This paper shows that the quantised resistance contains no quantity of the sample—only h , e and an integer. No new theorem or law is claimed. First, $h/e^2 = \mathbf{25812.807459}$ ohms, matching the known value (Section 2). Second, its reciprocal returns $e^2/h = \mathbf{3.874045865} \times 10^{-5}$ S (Section 2). Third, the classical Hall resistance moves from $\mathbf{6.24} \times 10^{11}$ to $\mathbf{3.12} \times 10^{11}$ ohms with the carrier density, and with the field as well (Section 3). Fourth, this is the core of the paper. The quantised expression contains neither carrier density, nor field, nor thickness (Section 3). Fifth, shifting ν to **1.0001** moves the value by **2.581023** ohms—being an integer is doing work (Section 4). Sixth, the separator is whether the material fixes the value or an integer does (Section 4). **Keywords:** quantum Hall effect, von Klitzing constant, resistance standard, Planck constant, elementary charge.

Scope of this paper (scope note): No new theorem or law is claimed—the quantum Hall effect and the value $h/(\nu e^2)$ are both standard. No mechanism is derived—why it quantises, and how edge states and localisation enter, are not the subject; only the form of the value. The fractional effect is excluded— ν takes integer values only. Measurement is not discussed—real precision, temperature and sample quality are not the subject; only what appears in the expression. The index theorem is not derived—that the integer is a topological invariant belongs to Paper 70, and is borrowed here. Relation to earlier papers: Paper 70 showed that 4π and $32\pi^2$ are index-theorem normalisations—this is a member of that family that carries a measured value. Paper 483 showed that a radius cancels when two forces share an exponent—both are cases where a system’s properties disappear from a measurable quantity. Paper 300 showed that a shared root can be decided—the classical and quantised resistances are distinct roots. Paper 481 showed that without separators a refutation has no destination—this paper writes one of them. What is added is giving h/e^2 as 25812.807459 ohms, confirming the reciprocal, showing numerically that the classical side moves with the sample, showing that the quantised side contains none of it, and giving the 2.581023-ohm shift for a non-integer ν .

1. Notation and the Question

Setting: A thin sample carries a current in a perpendicular magnetic field, and the resistance is read from the transverse voltage. The classical expectation is

$$R_{\text{cl}} = \frac{B}{n q d}$$

containing the field B , the carrier density n , the charge q and the thickness d . At strong fields and low temperature the resistance instead rests at

$$R_{\text{qu}} = \frac{h}{\nu e^2}$$

with ν an integer. Below, what each expression contains is examined.

Observation 1.1

A resistance is taken to be fixed by the properties of the sample. Material, shape, impurities—the value changing with how it was made.

Observation 1.2

But the second expression holds no quantity of the sample. Only h , e and ν —so it should read the same wherever it is measured.

Question: Is there really nothing in it.

2. It Is Written from Constants Alone

Computation 2.1: Build a resistance from h and e .

Quantity	Value
h/e^2	25812.807459 ohms
e^2/h	$3.874045865 \times 10^{-5}$ S

Observation 2.2

It matches the known value. 25812.807459—agreeing with the frequently quoted 25812.807 ohms.

Observation 2.3

The reciprocal returns. 25812.807459 against 25812.807459—an independent check.

Observation 2.4

No significant figures are lost. A relative difference of 0.000×10^0 —since 2019 both h and e are defined values, so the ratio is exact.

Computation 2.5: Divide by integers.

ν	Resistance
1	25812.807459 ohms
2	12906.403730 ohms
3	8604.269153 ohms
4	6453.201865 ohms

Observation 2.6

Raising ν by one jumps by 12906.404 ohms. Not continuous—no value in between is taken.

3. The Classical Side Depends on the Sample

Computation 3.1: Vary the carrier density in the classical expression.

Carrier density	Classical Hall resistance
1×10^{15}	6.24×10^{11} ohms
2×10^{15}	3.12×10^{11} ohms
5×10^{15}	1.25×10^{11} ohms

Observation 3.2

It moves with the carrier density. Doubling it halves the resistance—how the sample was made fixes the value.

Observation 3.3

It moves with the field too. Doubling doubles it—a quantity applied from outside also enters.

Observation 3.4

And with the thickness. It sits in the denominator—the shape fixes the value.

Observation 3.5

The quantised side contains none of these. $h/(ve^2)$ —no B , no n , no d .

Observation 3.6

So the two cannot both hold for the same measurement. One moves with the sample, the other does not—which applies is settled by the field and the temperature.

4. The Separator

The separator: does the material fix the value, or an integer.

Observation 4.1

The material, and it differs by sample. 6.24×10^{11} against 3.12×10^{11} —comparison requires bringing the same sample.

Observation 4.2

An integer, and every sample gives the same. 25812.807459—another laboratory with another material reads the same value.

Observation 4.3

Shifting ν moves the value. 2.581023 ohms at 1.0001—a measurable amount: being an integer is doing real work.

Observation 4.4

The two are distinct roots by the criterion of Paper 300. Both are “the Hall resistance”—one assembled from quantities of the sample, the other from constants and an integer: the inputs differ.

Observation 4.5

It is a member of Paper 70’s family carrying a measured value. There, 4π and $32\pi^2$ appeared as index-theorem normalisations—here, an integer is measurable as a resistance.

Observation 4.6

It has the shape of Paper 483. There, matching exponents made a radius cancel—here nothing cancels, because nothing entered. The manner of disappearance differs.

Observation 4.7

To be honest—why it quantises is not written. Edge states and localisation are not treated—what is shown is only the form: that the quantised expression contains no quantity of the sample. That the integer is a topological invariant belongs to Paper 70, and is borrowed here.

5. Roll Call and Closing

1. $h/e^2 = 25812.807459$ ohms (Computation 2.1): **matching the known value.**
2. **The reciprocal returns** (Observation 2.3): **an independent check.**
3. **No figures lost** (Observation 2.4): **exact, from defined values.**
4. **12906.403730 at $\nu = 2$** (Computation 2.5): **exactly half.**
5. **A jump of 12906.404 ohms** (Observation 2.6): **not continuous.**
6. **Halved by doubling the density** (Computation 3.1): **the sample fixes it.**
7. **No sample quantity on the quantised side** (Observation 3.5): **the core.**
8. **2.581023 ohms at $\nu = 1.0001$** (Observation 4.3): **integrality does work.**
9. **The separator is material or integer** (Observation 4.4): **distinct roots by Paper 300.**

10. The mechanism is not written (Observation 4.7): only the form was shown.

Closing: A resistance is taken to be fixed by the properties of the sample—material, shape and impurities changing the value. But $R = h/(\nu e^2)$ holds no quantity of the sample—only h , e and ν —so it should read the same wherever it is measured. It is written from constants alone— $h/e^2 = 25812.807459$ ohms and $e^2/h = 3.874045865 \times 10^{-5}$ S, agreeing with the frequently quoted 25812.807 ohms. The reciprocal returns, an independent check. The relative difference is 0.000×10^0 , since both h and e have been defined values since 2019, making the ratio exact. Dividing by integers gives 25812.807459, **12906.403730**, 8604.269153 and 6453.201865 ohms. Raising ν by one jumps by 12906.404 ohms, with no value taken in between. The classical side depends on the sample—it gives **6.24×10^{11}** , **3.12×10^{11}** and **1.25×10^{11}** ohms at carrier densities of 1, 2 and 5×10^{15} , halving as the density doubles. Doubling the field doubles it, so a quantity applied from outside also enters. The thickness sits in the denominator, so the shape fixes the value too. The quantised side contains none of these: $h/(\nu e^2)$ has no B , no n , no d . So the two cannot both hold for one measurement, and which applies is settled by the field and the temperature. One thing separates them—does the material fix the value, or an integer. The material, and it differs by sample, so comparison requires bringing the same sample. An integer, and every sample gives 25812.807459, in any laboratory and any material. Shifting ν to 1.0001 moves the value by **2.581023** ohms, a measurable amount, so integrality does real work. The two are distinct roots by the criterion of Paper 300: both are “the Hall resistance”, but one is assembled from quantities of the sample and the other from constants and an integer. It is a member of Paper 70’s family carrying a measured value: there 4π and $32\pi^2$ appeared as index-theorem normalisations, here an integer is measurable as a resistance. It has the shape of Paper 483, but there matching exponents made a radius cancel while here nothing cancels because nothing entered. To be honest—why it quantises is not written. Edge states and localisation are not treated, and what is shown is only the form: that the quantised expression contains no quantity of the sample. That the integer is a topological invariant belongs to Paper 70, and is borrowed here.

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