

# Michell's Radius Was Right, but Not for the Reason It Gave

— Setting the Newtonian escape velocity to  $c$  yields  $2GM/c^2$ , differing from the Schwarzschild radius by  $0.000 \times 10^0$  m — yet the same method applied to light bending gives **0.8758** arcseconds, exactly half of general relativity's **1.7516** — the agreement holds at one point only, and dimensional analysis alone does not even fix the factor **2** — [Paper 485]

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— *From thinking to syncing.* —

## Abstract

When the same expression appears, the two are taken to be saying the same thing. This paper shows that two derivations agreeing exactly at one point are off by a factor of **2** at the next—agreement is not evidence of a shared root. No new theorem or law is claimed. First, the Schwarzschild radius of the Sun is **2.954008** km (Section 2). Second, a Newtonian calculation setting the escape velocity to  $c$  returns exactly the same expression—a difference of  $0.000 \times 10^0$  m (Section 2). Third, dimensional analysis alone reaches only  $GM/c^2 = 1.477004$  km and does not fix the factor **2** (Section 2). Fourth, this is the core of the paper. The same Newtonian method applied to light bending gives **0.8758** arcseconds, exactly **2.000000000000** times smaller than general relativity's **1.7516** (Section 3). Fifth, that relativistic value agrees with the known **1.75** arcseconds—it is the Newtonian side that fails (Section 3). Sixth, the separator is whether the agreement holds at a point or across a family (Section 4). **Keywords:** Michell's dark star, Schwarzschild radius, black hole, deflection of light, general relativity.

Scope of this paper (scope note): No new theorem or law is claimed—Michell’s dark star, the Schwarzschild radius and the deflection of light are all standard. History is not the subject—what Michell or Laplace actually held is left to the historians. The calculations are reproduced in modern notation and the values compared. The horizon is not discussed—causal structure, the distinction between coordinate and true singularities, and interior solutions are not the subject; only one number, a radius. The deflection angle is not re-derived—the anatomy of the 4 belongs to Paper 134, whose result is borrowed here only as a test. No hierarchy of approximations—higher post-Newtonian terms are excluded; leading terms are compared with leading terms. Relation to earlier papers: Paper 300 set the criterion that numerical agreement alone does not establish a shared root—this paper gives a case where that criterion actually cuts. Paper 134 showed that the 4 in the bending angle is  $2 \times 2$  and that the second 2 is a property of  $v = c$ —that 2 is used here as the test separating the two derivations. Paper 169 showed that Sciama’s famous coincidence is an identity—there the agreement had a reason; here it has none. Paper 481 showed that without separators a refutation has no destination—this paper writes one of them. What is added is obtaining 2.954008 km by both routes, confirming a difference of  $0.000 \times 10^0$  m, showing that dimensional analysis reaches only 1.477004 km, setting the bending values 0.8758 and 1.7516 side by side, and placing the agreement and the disagreement in one table.

## 1. Notation and the Question

Setting: Around a sphere of mass  $M$ , compute two quantities. One is the radius at which the escape velocity reaches  $c$ ,

$$\frac{1}{2}mv^2 = \frac{GMm}{r}, \quad v = c \implies r = \frac{2GM}{c^2}$$

The other is the deflection of light passing at impact parameter  $b$ . Both can be written in Newtonian mechanics alone. Compute each in general relativity as well, and set the pairs side by side.

### Observation 1.1

When the same expression appears, the two are taken to be saying the same thing.  $2GM/c^2$  comes out of both—so the old theory was right, runs the picture.

### Observation 1.2

But an expression agreeing is not a theory agreeing. It may have agreed at one point—to check, look at the neighbouring point.

Question: How far does the agreement extend, and where does it break.

2. At the Radius, the Agreement Is Exact

Computation 2.1: Evaluate both routes at one solar mass.

| Route                                | Radius                       |
|--------------------------------------|------------------------------|
| Schwarzschild radius $2GM/c^2$       | <b>2.954008</b> km           |
| Newtonian escape velocity set to $c$ | <b>2.954008</b> km           |
| Difference                           | <b>0.000</b> $\times 10^0$ m |

Observation 2.2

The values are not merely close; the expressions are the same.A difference of  $0.000 \times 10^0$  m—not within rounding but identical symbolically.

Observation 2.3

The agreement includes the factor 2.Dimensional analysis alone gives  $GM/c^2 = 1.477004$  km—a factor of exactly 2.0000000000000000 out, since a dimensionless coefficient is not fixed by dimensions.

Observation 2.4

So this agreement is more than matching dimensions.It carries the information separating 1 from 2—fine-grained for a coincidence.

Observation 2.5

And it survives the two theories asserting different things.On one side a surface where light falls back, on the other a surface with no outward path—one radius carrying two meanings.

### 3. At the Bending, It Is Off by Exactly Two

Computation 3.1: Compute the deflection of light grazing the solar limb, by the same two routes.

| Route              | Deflection      | Arcseconds     |
|--------------------|-----------------|----------------|
| Newtonian          | 0.000004246 rad | 0.8758         |
| General relativity | 0.000008492 rad | 1.7516         |
| Ratio              | —               | 2.000000000000 |

Observation 3.2

The ratio is exactly 2.2.000000000000—not a near value but a different coefficient.

Observation 3.3

The relativistic side matches observation.1.7516 arcseconds against the known 1.75—the Newtonian side is the one that fails, and measurement is what decides which.

Observation 3.4

That 2 has a reason.As Paper 134 showed, the second 2 is a property not of gravity but of  $v = c$ —a particle of speed  $v$  deflects by  $1 + v^2/c^2$  times the Newtonian value, reaching 2 only at  $v/c = 1$ .

Observation 3.5

So agreement at the radius does not mean light could be treated as a particle at  $v = c$ .The same treatment reaches only half at the bending—the radius calculation sat where that error does not show.

#### Observation 3.6

Agreement and disagreement come from the same method in the same theory. Radius: difference  $0.000 \times 10^0$ . Bending: ratio 2.0000—one method gave two answers.

### 4. The Separator

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The separator: did the agreement hold at a point, or across a family.

#### Observation 4.1

At a point, and it is an agreement of values. 2.954008 km—it may fail at the neighbouring quantity, and it did.

#### Observation 4.2

Across a family, and it is an agreement of structure. It tracks as the parameters move—only then may the two be called the same statement.

#### Observation 4.3

These are distinct roots by the criterion of Paper 300. Both can claim “ $2GM/c^2$  came out”—but numerical agreement alone does not establish a shared root, which was that criterion.

#### Observation 4.4

This paper is a case where the criterion actually cuts. What cut it was the 2 in the bending—look only at the agreeing side and the roots seem shared without limit.

#### Observation 4.5

Paper 169's coincidence runs the other way. Sciama's had a reason and was an identity—this one has none and breaks next door. Whether the agreement has a reason is what separates them.

#### Observation 4.6

This is one of the separators of Paper 481. When “the old theory gives the same answer” turns out wrong—whether the value failed or the family failed sends the repair elsewhere.

#### Observation 4.7

To be honest—it is not shown that the agreement is a coincidence. Both derivations contain the same combination  $GM/c^2$ , which dimensions force—what is shown is that agreement to the factor 2 does not extend to the neighbouring quantity, not why it holds at the radius.

## 5. Roll Call and Closing

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1. **2.954008 km for the Sun** (Computation 2.1): **by both routes.**
2. **Difference  $0.000 \times 10^0$  m** (Observation 2.2): **identical symbolically.**
3. **Dimensions give 1.477004 km** (Observation 2.3): **the factor 2 unfixed.**
4. **One radius, two meanings** (Observation 2.5): **falling back, or no way out.**
5. **Bending 0.8758 against 1.7516** (Computation 3.1): **the core.**
6. **A ratio of exactly 2.000000000000** (Observation 3.2): **a different coefficient.**
7. **1.7516 matches the known value** (Observation 3.3): **the Newtonian side failed.**
8. **The 2 belongs to  $v = c$**  (Observation 3.4): **by Paper 134.**
9. **The separator is point or family** (Observation 4.3): **distinct roots by Paper 300.**
10. **Coincidence is not shown** (Observation 4.7): **only the failure to extend.**

**Closing:** When the same expression appears, the two are taken to be saying the same thing— $2GM/c^2$  comes out of both, so the old theory was right, runs the picture. But an expression agreeing is not a theory agreeing: it may have agreed at one point, and to check, one looks at the neighbouring point. At the radius, the agreement is exact—at one solar mass, both the Schwarzschild radius  $2GM/c^2$  and the Newtonian escape-velocity calculation return **2.954008**

km, differing by  $0.000 \times 10^0$  m. The values are not merely close; the expressions are identical symbolically. The agreement includes the factor 2, whereas dimensional analysis alone reaches only  $GM/c^2 = 1.477004$  km, a factor of exactly 2.0000000000000000 out, since a dimensionless coefficient is not fixed by dimensions. So this agreement is more than matching dimensions: it carries the information separating 1 from 2, which is fine-grained for a coincidence. And it survives the two theories asserting different things—on one side a surface where light falls back, on the other a surface with no outward path, one radius carrying two meanings. At the bending, it is off by exactly two—light grazing the solar limb deflects by **0.8758** arcseconds on the Newtonian route and **1.7516** in general relativity, a ratio of **2.0000000000000000**: not a near value but a different coefficient. The relativistic 1.7516 matches the known 1.75, so the Newtonian side is the one that fails, and measurement is what decides which. That 2 has a reason: as Paper 134 showed, the second 2 belongs not to gravity but to  $v = c$ , a particle of speed  $v$  deflecting by  $1 + v^2/c^2$  times the Newtonian value and reaching 2 only at  $v/c = 1$ . So agreement at the radius does not mean light could be treated as a particle at  $v = c$ ; the same treatment reaches only half at the bending, and the radius calculation sat where that error does not show. Agreement and disagreement come from the same method in the same theory—radius, difference  $0.000 \times 10^0$ ; bending, ratio 2.0000. One method gave two answers. One thing separates them—did the agreement hold at a point, or across a family. At a point, it is an agreement of values, which may fail at the neighbouring quantity, and it did. Across a family, it is an agreement of structure that tracks as the parameters move; only then may the two be called the same statement. They are distinct roots by the criterion of Paper 300: both can claim “ $2GM/c^2$  came out”, but numerical agreement alone does not establish a shared root. This paper is a case where that criterion actually cuts, and what cut it was the 2 in the bending; look only at the agreeing side and the roots seem shared without limit. Paper 169’s coincidence runs the other way—Sciama’s had a reason and was an identity, while this one has none and breaks next door. Whether the agreement has a reason is what separates them. This is one of the separators of Paper 481: when “the old theory gives the same answer” turns out wrong, whether the value failed or the family failed sends the repair elsewhere. To be honest—it is not shown that the agreement is a coincidence. Both derivations contain the same combination  $GM/c^2$ , which dimensions force. What is shown is that agreement to the factor 2 does not extend to the neighbouring quantity, not why it holds at the radius.

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