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The Most Favourable Hyperbolic Length on Double Surface

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Abstract: : *The most favourable hyperbolic length on the double surface was presented.*

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1. Introduction

On the double surface we have deal with the elliptic length n and the hyperbolic length h. They are related as follows [1]:

$$h(n) = n\left(2\sqrt{1+\frac{\pi^2}{n^2}}-1\right). \tag{1}$$

2. The Most Favourable Hyperbolic Length

The most favourable hyperbolic length on the double surface can be found when the function $h(n)$ has minimum. It happens at the elliptic length $n = \frac{\sqrt{3}}{3}\pi$ yielding the hyperbolic length $h = \sqrt{3}\pi$ (See appendix 1).

The length in question can be found easier with the help of quadratic function [1]:

$$3n^2 - 2nh + 4\pi^2 - h^2 = 0. \tag{2}$$

Having the next two solutions:

$$n_{1,2} = \frac{2h \mp \sqrt{4h^2 - 12(4\pi^2 - h^2)}}{6}. \tag{3}$$

Which are at the lowest hyperbolic length identical. It happens at the hyperbolic length $h = \sqrt{3}\pi$ yielding the elliptic length $n = \frac{\sqrt{3}}{3}\pi$ (See appendix 2).

3. Result

The minimum hyperbolic length is three times longer than the corresponding elliptic length:

$$\frac{h_{minimum}}{n(h_{minimim})} = \frac{\sqrt{3}\pi}{\frac{\sqrt{3}}{3}\pi} = 3. \tag{4}$$

4. Conclusion

If the ratio of hyperbolic to elliptic length expresses the dimensions of space, then the three spatial dimensions are the most favourable.

References

[1] Janez Špringer. " Measuring, Observing and Counting in Double Surface” International Journal of Advanced Research in Physical Science (IJARPS), Vol 11, issue 04, pp. 1-3., 2024.

Appendix 1

$$h = n\left(2\sqrt{1+\frac{\pi^2}{n^2}} - 1\right). \qquad (a)$$

Applying the derivation h^*

$$h^* = n^*.2\sqrt{1+\frac{\pi^2}{n^2}} - 1 + \mathrm{n}.\left(2\sqrt{1+\frac{\pi^2}{n^2}} - 1\right)^*. \qquad (b)$$

Giving

$$h^* = 2\sqrt{1+\frac{\pi^2}{n^2}} - 1 + \mathrm{n}\left(-\frac{2\pi^2}{\sqrt{1+\frac{\pi^2}{n^2}}}.\frac{1}{n^3}\right). \qquad (c)$$

The function h has minimum at $h^* = 0$

$$h^* = 2\sqrt{1+\frac{\pi^2}{n^2}} - 1 - \left(\frac{2\pi^2}{\sqrt{1+\frac{\pi^2}{n^2}}}.\frac{1}{n^2}\right) = 0. \qquad (d)$$

When

$$n = \frac{\pi}{\sqrt{3}}. \qquad (e)$$

Appendix 2

$$3n^2 - 2nh + 4\pi^2 - h^2 = 0. \qquad (f)$$

At the identical solutions of the above quadratic equation it holds

$$\frac{2h - \sqrt{4h^2 - 12(4\pi^2 - h^2)}}{6} = n = \frac{2h + \sqrt{4h^2 - 12(4\pi^2 - h^2)}}{6}. \qquad (g)$$

Then

$$4h^2 - 12(4\pi^2 - h^2) = 0. \qquad (h)$$

And

$$h = \sqrt{3}\pi. \qquad (i)$$

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