A simple proof of the absolute nature of space

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1 Abstract

A logical extension / extrapolation of Newton's bucket argument shows that space is absolute with respect to translational motion as well as rotational motion.

2 Newton's bucket experiment / argument

It is well known that Newton postulated the absolute character of space in order to develop his well known system of mechanics.

Newton demonstrated the absolute nature of space with respect to rotational motion by appealing to his famous bucket experiment or 'bucket argument" [1]. When rotated about a fixed axis perpendicular to the bottom of the pail, the water in the pail assumed a parabolic surface suggesting that forces were acting upon the water to make it continue in uniform rotation. However, simply rotating an observer around the axis fixed in a stationary bucket will not produce any forces on the water as the vast accumulated experience of humanity will demonstrate. Fecko (1994) and Hartman and Sabat (2009) are just three of the hundreds of authors who have written about this interesting subject.

However, it seems that the hypothesis of absolute space with respect to translational motion (as opposed to rotational motion) remained just that (i.e., a hypothesis) since no "prototype" inertial reference frame could be defined to provide a "boilerplate" for defining additional inertial reference frames. But the idea of space absolute with respect to translational motion (in addition to rotational motion) remained an essential element of his system despite the "circular reasoning" which his three laws entail [2].

However, since the advent of the Principia, the idea of absolute space (especially space which is absolute with respect to translational motion) has come under considerable criticism. The concept

1. The bucket argument / experiment is also known as the pail argument / experiment.
2. The circular reasoning revolves around the idea that it is impossible to state laws of motion without reference to a well- defined reference frame and that conversely, it is impossible to define (or choose) a suitable reference frame without first postulating that the three laws of motion are true in that frame.

of absoute space containing an aether in absolute translational rest with respect to absolute space was “hypothesized away” by Einstein in his initial publications on special relativity. However, just as Newton ignored the problems of translational motion, Einstein ignored the problems associated with rotational motion. The transformations he developed based on the appearance of a spherical light wave in two comoving frames (identical to those given earlier by Lorentz) compared two reference frames in uniform translational motion only.

3 A logical extrapolation of Newton's argument

Newton's bucket experiment proof of the absolute nature of space can be taken to its logical conclusion to show the absolute nature of space with respect to translational motion by considering pails (buckets) of ever increasing radius. With each subsequent increase of radius, we have the result that space is absolute with respect to rotational motion. But with each subsequent increase of radius, we also have that the motion of the water becomes more and more similar to translational motion. Finally, with a bucket of infinite radius, we have pure translational motion which is still subject to the influence of “absolute space”. Those claiming that this reasoning does not prove the absolute nature of space with respect to translational motion must explain at what bucket radius the transition from absolute to relative space occurs.

4 Conclusion

In conclusion, space is absolute with respect to both circular and translational motion.

References

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Hartman, Herbert I., and Charles Nissim - Sabat. 2009. “Reply to “The principle of relativity and inertial dragging” by Øyvind G. Grøn.” *American Journal of Physics* 77 (4): 373–380. https://doi.org/10.1119/1.2996479.