

Universal Physics Journal

Question 14: Is centrifugal acceleration real?

Dear Mr. Skyler:

I have read with interest your descriptions of centripetal force and centripetal acceleration. I agree that centrifugal force is a real acceleration/Reaction force. I wonder if centrifugal acceleration is also real. On another site where the Coriolis force is explained, centrifugal acceleration is said to be possible since it is apparent to an observer who is riding on the earth's rotating surface. They say the object being observed is experiencing centrifugal acceleration and further that its cause is an apparent force predicted to be present by Newton's law 1. This force they refer to as the Coriolis force. No further explanation is offered as to the nature of this force nor its cause. Will you look into this and let me know if you think centrifugal acceleration is real or not?

F.W. (no city or country indicated)

Hello F.W.

Before delving into the particulars of the Coriolis effect and the possibility of "centrifugal acceleration", I want to make sure our readers share in our understanding that centrifugal force is always an outward-directed acceleration/Reaction force. As a reaction force, it is caused by the inward-directed (centripetal) acceleration/Action force, which in turn, is the cause of the activity of the test object's inward-directed (centripetal) acceleration. In short, this outward-directed reaction force is never the cause of any accelerational event. It just reactively goes along for the ride as it provides support and termination for the inward-directed, activity-causing centripetal acceleration/Action force. Thus an outward-directed reaction force can never be the cause of any such activity as outward-directed "centrifugal acceleration". (See Article VI: Gravitation = Acceleration?, Article XI: Reaction Forces, and Question 5 about reaction forces.)

So much of an absolute nature has been given up by the acceptance and adoption of Albert Einstein's Theory of Relativity that little is left to provide dependable support for thoughts of Physical events. It is as if Modern physicists have been left with little more to stand upon than a small chunk of Arctic ice that is floating in the direction of temperate waters. Any analysis of the Coriolis effect based upon the Modern Physics' interpretation of events is doomed by confusion right from the start.

Two serious problems come to mind. The first problem is that in the teachings of Modern Physics, every observation is viewed as correct while in Universal Physics it is recognized that it is a difficult job to get any observation right. In Modern Physics to explain the differences between disagreeing but equally "correct" observations, it has been decided to accept differing observations as being equally correct once adjustments were made to the Physical absolutes of time, distance and mass. Thus in the famous and much debated twin paradox, it is inadvertently predicted that if two space travelers leave Earth at the same time with their mutual destination being a distant star and one traveler travels at a rate approaching light speed while the second traveler travels at a much slower pace, then with "distance" being accepted as a relative concept, the "distance" to the star is predicted to be much reduced for the near light-speed traveler compared to the longer, more-normal distance for the low-speed traveler. The illogical

consequence of such a prediction is that the star will have to exist at two different distances from Earth at the same time. The high-speed traveler will get to turn around at the reduced relative distance to the near star position, while to keep things honest, the low speed traveler will have to pass by the star positioned at the near relative distance while continuing on to reach the same star positioned at the same time at a more normal relative distance.

One cannot have it both ways. If Albert Einstein is right and distance does shorten for a high-speed traveler as determined using the shortened length of Einstein's high-speed "measuring rod", then the distance to the target of the traditional twin paradox event has to be different for each speed of travel in effect. Thus if the Modern Physics interpretation of Einstein's Relativity theories is correct then the twin paradox target (the distant star) must exist at the same time at as many distances from Earth as there are space travelers with different speeds of approach. Clearly in assessing the merits of Modern Physics, it is an absolute requirement that logic be abandoned as an impediment to belief.

The second problem in analyzing the Coriolis effect from the Modern Physics' point of view is a consequence of the first problem. If every observer always sees the truth, then it is basically the same event when first a non-accelerating observer views an accelerating object as compared to when an accelerating observer views a non-accelerating object. This means that acceleration is thought of as a relative event between an object and an observer. Thus if the observer sees an object's motion as changing or accelerating, then according to the teachings of Modern Physics there is no need to question this observation. Instead we are expected to accept the perfection of this observation while applying our efforts exclusively to discovering or inventing, if need be, the acceleration/Action force that must be responsible for causing the object's observed acceleration.

Is acceleration an absolute event or is it a relative event? This is the question in need of an answer. I propose the following events to help us make this determination. As an impartial observer, you are seated on a rotatable stool positioned at the axis of a large, horizontal turntable that is housed within a featureless room. A number of small objects are at rest on the turntable. On the outside of each object, from your central perspective, there is a stop that is attached to the turntable. Built into each stop is a compression scale whose force display is plainly visible from the central position of your stool. Four evenly spaced lines are drawn quadrant fashion on the turntable's surface, with each line beginning at the rim and running straight in along a radius toward the central axis. As a final note, you have thought to bring along a pocket full of large-sized playing marbles.

Your job, as observer, is to see if there is any difference between observing an event where the objects are being forced to accelerate while the observer remains in a non-accelerated state as compared to observing an event where the observer is accelerating while the objects remains in a non-accelerated state. If the teachings of Modern Physics are correct and any observation of acceleration is purely a relative one, then as these events unfold, you will be left with no clues to aid in your determinations. If so then any determination as to whether the event's acceleration lies with the observer or instead with the objects will be purely a guess. If the teachings of Modern Physics are wrong then obvious clues as to where the acceleration lies will be fully present and easily detectable by you, the impartial observer.

First Event

You perceive a humming sound so you know the first event is occurring. The first thing you observe is that all the objects sitting on the turntable are rotating about your person at an even rate of rotation that is directed to your left. You do not sense any rotation of your body so you want to assume that only the objects are experiencing the centripetal acceleration associated with their following a circular path about your common axis. Is there a test you can perform to tell if the rotation present belongs exclusively to the turntable and not to your person seated on the axial stool? You take out a marble and place it on an exposed surface of the stool top. It remains at rest indicating to you that the stool is not actually rotating. This means that you are not experiencing acceleration. Next you place the marble on the inside rim of the turntable at the inner end of one of the four radial quadrant lines. Holding the marble on the line's inner end requires your hand and the marble contained within to adopt the rotational motion of the table's inner rim. Upon the marble's release, you notice that it immediately begins to rotate about its own horizontal axis as it rolls outward before departing the turntable's surface. It does not follow the straight quadrant line but instead veers away to the right of the line on its way to the table's rim. Luckily the marble misses hitting any of the table's objects. You accept this marble test as indicating first that your stool is not experiencing actual acceleration while the turntable is experiencing actual acceleration due to its leftward-directed rate of rotation about the table's vertical axis. Upon its release, the initially non-rolling marble loses the inward-directed acceleration/Action force from your hand required to be present in order for the marble to continue following its curved path around the axis. Now the marble begins rolling at a faster and faster pace while veering to the right of the radial quadrant line since the leftward-directed forces from the rotating turntable are insufficient to force the marble to the faster and faster leftward pace required in order for the marble to follow the radial quadrant line all the way out to the rim. Thus the path of the marble indicates the presence and direction of the turntable's leftward rotation meaning that inward-directed acceleration is occurring to the components of the turntable and its supported objects. Further, you understand and accept that an inward-directed (centripetal) acceleration/Action force is required to be present and acting as the cause of inward-directed (centripetal) acceleration for each of the turntable's objects. You look to the scale positioned beyond each object for proof of the presence of an inward-directed acceleration/Action force. Sure enough, each scale is displaying the magnitude of inward-directed acceleration/Action force present as the cause of that object's inward-directed acceleration. You also recognize, according to Newton's LAW III and the Universal Physics Rule 7, Part b, that each object is reactively bearing outward against the scale with its own equal and opposite acceleration/Reaction force. You memorize each force reading and note that the more-massive objects require higher acceleration/Action forces from the turntable's stop than do less-massive objects. Here you conclude, supported by the evidence provided by the scales and the rolling marble, that it is the turntable along with its objects that are experiencing centripetal acceleration resulting from the turntable's actual rotation to your left.

Second Event

The humming sound changes and you sense that something about the rotation of your stool has changed. Interestingly enough, now the rotation of the turntable appears to have ceased. You consider that either the turntable has stopped its rotation all together or your stool is now rotating

at the same rate and in the same direction as the turntable. Which is it? You know that if the turntable's rotation has continued unchanged from the first event, then the same centripetal acceleration/Action forces displayed by the scales will continue to be present. Sure enough, each force display remains unchanged from its value displayed in the first event. You also know that if the turntable's actual rotation is now reversed to an identical rate but in the opposite direction and your stool is brought up to the same rate and direction which is now to the right, then no change will occur to the scale's force readings. To resolve this direction-of-rotation concern, you take another marble from your pocket and place it first on the exposed portion of the stool. Upon its release, the marble immediately begins rolling about its own horizontal axis and subsequently rolls off the stool while veering to the right. You are quick enough to catch it so that it can be used to test for changes in the actual rotation of the turntable. After placing it on the table's inside rim next to the radial quadrant line and allowing its release, you observe the marble again display the same increase in its rolling motion as it again follows an outward path that veers to the right of the straight quadrant line. From this information you conclude that your stool is now rotating at the same rate and leftward-direction as the turntable. You also notice that you have to lean forward a bit on the stool in order to easily maintain your balance. Plus your sense of balance is now a bit off as you are feeling dizzy. You take this information as clues indicating that even though you visually can not detect the presence of any acceleration, this visual observation is misleading. Now you recall that if the Modern Physics version of events is right, your visual observation should be always true. But already you are thinking that this position must be incorrect for here you realize that the application of logic to experimental facts yields a superior understanding.

Third Event

Again the humming sound changes. Now the turntable appears to be rotating to the right at about half the speed of its leftward-directed rotation in the first and second events. Remembering in the second event where rotation is present at equal rates for both you and the turntable, you now wonder what changes to the truth of your understanding have to take place in order for you to see the turntable appear to now rotate at half-rate in the opposite or rightward direction. You consider four possibilities. 1) Your actual rate of rotation of the stool to the left has doubled making it appear to you that the turntable's rate is now half its rate in the first and second events while being opposite in direction. 2) The turntable's actual rate of rotation to the left in the first and second events has been reduced by half, again making it appear to you that the table's rate of rotation is now half its former rate and opposite or to the right in direction. 3) Your actual rate of rotation to the left in the second event has ceased to exist or stopped while the turntable's equal, actual rotation to the left has now become an actual rotation to the right at half-rate compared to the turntable's rate of actual rotation to the left in the first and second events. 4) Changes to your stool's actual rate and direction of rotation along with changes to the turntable's actual rate and direction of rotation have both occurred.

Which is it? Are there enough clues to help you decide? You know that the inward-directed forces present to cause inward-directed acceleration for the turntable's objects will change in magnitude if any actual change occurs to the turntable's actual rate of rotation. You check the scales and observe that indeed each scale is now registering only 1/4 its former value which means to you that the turntable is now rotating at half its former rate. But what about its direction of

rotation? Is it rotating at half-rate to the left or to the right? You employ the rolling marble test which by its leftward veer away from the radial quadrant line indicates to you that the turntable's direction of rotation is now to the right. Does this result now predict that your stool's rotation has now ceased? This has to be the case as predicted by possibility 3). You note that the dizzy feeling of the second event has gone away. A quick marble test on your stool gives the answer. The stool is no longer rotating.

Fourth Event

After the final change in the humming sound, you observe that the turntable now appears to have increased its rate of rotation to where the objects on the table are rotating at the same high rate about your person as in the first and second events. Only now the direction of rotation appears opposite or rightward. You check the scales to discover that no inward-directed (centripetal) acceleration/Action force is being impressed against any of the objects. This observable fact along with the return of the dizzy feeling makes you think that all rotation of the turntable has ceased. For this event to appear as it does, your stool must be rotating at full speed in the leftward direction. A rolling marble check of both the turntable and the stool verifies your conclusion. Upon release, the marble sits at rest on the non-rotating turntable but veers rightward off the stool indicating that only the stool is rotating and further that this rotation is leftward directed.

Conclusion

You realize now that if you were limited to the use of visual clues, while being deprived of your marble tests, your recognition of the truth in each of the four events would be haphazard at best. You also recognize from the first and fourth events that there exist important and easily detectable differences between an event where a non-accelerating observer is viewing the accelerating objects of the first event as compared to where an accelerating observer is viewing the non-accelerating objects of the fourth event. From this realization comes the inescapable conclusion that acceleration is always an absolute event, not a relative event as is falsely predicted to be the case by the teachings of Modern Physics.

Understand that your conclusion is not a new one. Long ago, Isaac Newton, in his rotating bucket of water experiment known as Newton's Bucket, proved that acceleration is an absolute event. Unfortunately we have had centuries since Newton's time for lesser minds to muddy the water that Newton left nearly crystal clear. I think this happens often with the concepts and understandings of Physics. Often it is the best, most logical, minds that enabled the advancement of Physics. But there exists endless time after each such advancement for less-logical minds to mess things up.

How does this realization affect our understanding of a Coriolis event? A typical Coriolis event is a lot like our second event where the observer and the frame of reference (the turntable) are both experiencing actual, absolute rotation in the same direction and at the same rate. Next an object travels a straight-line path above the rotating frame such as a rocket or long-distance artillery round. Using visual clues only, the observer watches the rocket or artillery round appear to "veer" off to the side away from the frame's actual direction of rotation. From this visual clue, the observer determines that the rocket's path is curved to the right when in fact it is the frame of

reference rotating to the left that is responsible for this incorrect observation. Finally, our confused Coriolis observer, not admitting to any knowledge of his own rate and direction of rotation, makes the determination that some outward-directed "centrifugal force" must be present to account for the rocket's observed "centrifugal acceleration". In fact we now know that the non-impartial observer's denial of acceleration is solely responsible for the misleading Coriolis clues. This confused observer has invented a "centrifugal acceleration" where acceleration of the object is absent and further invented a "centrifugal" acceleration/Action force to "account" for this nonexistent "centrifugal acceleration". In the permissive realm of Modern Physics, these erroneous observations and erroneous conclusions remain honored and unchallenged over the decades.

The bottom line F.W. is that "centrifugal acceleration" is a misnomer. No such acceleration exists anywhere in the Universe. The only acceleration that exists in circular events, where an object is rotating about or orbiting an axis at a uniform rate, is inward-directed or centripetal acceleration. Likewise for the imagined "centrifugal acceleration-causing action force" popularly known as the "Coriolis force". Again no such action force exists. These inventions are the outcome of faulty observations as influenced by Coriolis confusion.

Thanks for asking,

Best Regards,

Ethan Skyler
March 28, 2004

Copyright © 2004 - 2009 by Ethan Skyler. All rights reserved.

The author grants each visitor to The Universal Physics Journal the right to make one copy of Question 14 for his or her own personal archive as long as the author's copyright notice is permanently affixed to the archive copy.