

## Could self-moving objects explain away 'dark matter'?

by Bend\_Weekly\_News\_Sources

A physicist has calculated that in four special places on Earth each year, for a thousandth of a second, objects might be able to move slightly with no push of any sort. The proposition stems from an unusual theory of motion that some researchers have devised to explain movements of stars and galaxies which, otherwise, seem to violate the laws of gravity. For instance, stars appear to orbit the centers of galaxies faster than they should.

The prevailing explanation for this is "dark matter": the idea that unseen blobs of an undetected substance pervade the universe. This would provide sources of gravitational pull which, added to the visible sources, account for the oddities.

The red square marks a spot in Greenland at 79°50' North latitude, 56° West longitude, where strange laws of motion could take hold next year, according to a study.

Some physicists consider dark matter a proven fact. But a minority disagrees, unsettled by the fact that dark matter has never been found, even though it would have to outweigh regular matter by five-fold.

A number of these skeptics have developed alternative theories that account for the mysterious motions through slight changes to the traditional laws of gravity and motion principles developed by Isaac Newton in the 1600s and elaborated by Albert Einstein in the last century. The revised theories are known as modified Newtonian dynamics, or MOND. A common version of MOND holds that one of the most venerable laws of motion, called Newton's Second Law, must be revised to give different results at extremely low accelerations. Traditionally, the law states simply that an object's acceleration is proportional to the force on it; in everyday language, the harder you push it, the faster it will move. But in the revised regime, at near-zero acceleration, objects would move according to a different law. The trick is how to define near-zero acceleration. Zero with respect to what? Everything moves with respect to something else. In a new paper, Alexander Iguanian of the theoretical Physics Research Institute in Melbourne, Australia, proposes that in our neighborhood of the universe, the effects of the revised law would become noticeable in places that are at near-zero acceleration with respect to the center of our galaxy. Because Earth spins, rotates and orbits in various ways, its motion overall would preclude tests of the idea. But Iguanian calculated that twice yearly, there are two points on the surface where all such motions cancel out, putting these spots momentarily at near-zero acceleration with respect to the galaxy center. The events would take place near the equinox dates, two days in the fall and spring when the day is the same length as the night. The locations would differ year by year. On Sept. 22 of next year, they would lie in northern Greenland and across the globe in Antarctica. According to Iguanian's theory, if this version of MOND is correct, an object at that location might briefly shift locations by one fifth of a trillionth of a meter, before returning to its original place a fraction of a second later. The event would be measurable by instruments known as gravitational wave detectors, he argued, which are built to

measuring an exotic phenomenon involving ripples in gravity. The experiment could be a "major step" in resolving the "MOND versus dark matter" dilemma. Ignatiev wrote. Other experiments that could resolve this are possible in principle, he noted, but most of these involve observations of places in space where the near-zero acceleration would be unmeasurable in practice. The new proposal describes for the first time a test that could take place on Earth, making it doable, he added. The study appears in the March 9 issue of the research journal Physical Review Letters. A copy is also posted online here.

Courtesy World Science

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