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New theory proposed to explain Pioneer probe gravitational anomaly

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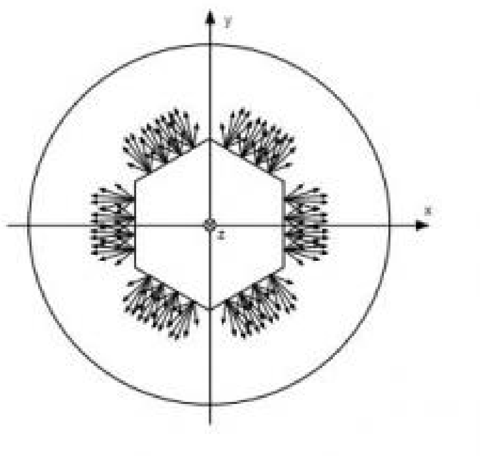

Schematics of the configuration of Lambertian sources used to model the lateral walls of the main equipment compartment. Image credit: arXiv:1103.5222v1 [physics.space-ph] http://arxiv.org/abs/1103.5222

(PhysOrg.com) -- Portuguese physicists might have finally solved the decades old mystery of why the Pioneer probes, launched in the early 70's, haven't been decelerating from the Sun's gravitational pull at the rate expected; it seems it might be something as mundane as adding in the tiny forces that occur when minute traces of heat from the plutonium on board the probes bounce off their receiving dishes, creating a counterforce, which in turn, causes the craft to slow; if ever so slightly.

The Pioneer anomaly, as it's come to be known, has had physicists scratching their heads ever since an astronomer by the name of John Anderson, working for NASA's Jet Propulsion Laboratory, back in 1980, noticed a discrepancy between the slowdown rate projections for the craft and the rates they were actually experiencing, which led to the basic question, how could both probes be slowing down faster than the laws of physics projected? Possible explanations ranged from unknown mechanical issues with both craft, to dark matter pushing back, to possible flaws in the physics theories themselves.

But now, Frederico Francisco of the Instituto de Plasmas e Fusao Nuclear, Lisbon Portugal and colleagues, as they describe in their paper published in *arXiv*, seem to have solved the problem using a simple old technology. Suspecting that heat was involved, they started with follow-up work by Anderson in 2002 and Slava Turyshev in 2006, also from NASA's Jet Propulsion Laboratories, who both showed that heat released from the plutonium onboard the spacecraft could very well explain a slowdown. Unfortunately, both concluded that such heat emissions could not possibly account for the amount of slowdown seen. But this was because neither man thought to consider the impact of heat hitting the backside of the satellite dish (antennae) and then bouncing back. Francisco and his team used a computer modeling technique called Phong shading to show how the flow of heat as it was emitted from the main equipment compartment could emanate outwards, eventually bouncing off the back of the dish, resulting in just enough counterforce to explain the gravitational discrepancy.

Case closed, as far as Francisco et al are concerned, but of course this being science, others will have to replicate the results before any sort of consensus can be found.

More information: Modelling the reflective thermal contribution to the acceleration of the Pioneer spacecraft, arXiv:1103.5222v1 [physics.space-ph] arxiv.org/abs/1103.5222

Abstract
We present an improved method to compute the radiative momentum transfer in the Pioneer 10 & 11 spacecraft that takes into account both diffusive and specular reflection. The method allows for more reliable results regarding the thermal acceleration of the deep-space probes, confirming previous findings. A parametric analysis is performed in order to set an upper and lower-bound for the thermal acceleration and its evolution with time.