Reverse Engineering Podkletnov's Experiments

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Abstract. Experiments reported by Podkletnov *et al*. suggest that gravity modification is within reach in our lifetimes. Solomon used process models to introduced the concept of non-inertia Ni fields and derived the massless gravitational acceleration formula $g=\tau c^2$ that is consistent with Hooft's finding that absence of matter no longer guarantees local flatness. Solomon had also shown that many photon experimental results could be modeled without the use of quantum theory. This would imply that neither a quantum nor a relativistic type theory would be indispensible to formulating a theory on gravity modification. This paper, therefore, explores the use of Ni fields and process models to reverse engineer Podkletnov's experiments from first principles to determine a possible theoretical or at least an engineering basis for the observed gravity shielding effects. This paper scrutinizes and documents Podkletnov's papers for detailed experimental clues and applies them to new process models. The paper shows that it is possible to infer gravity modifying effects using non-inertia Ni fields, without taking into consideration the quantum mechanical properties of the ceramic superconducting disc. That is without considering how or why these fields are produced. The modeling suggests that there are two similar but different phenomena present, the stationary disc and spinning disc effects. The observed weight loss with the stationary disc is due to the asymmetric magnetic field and the observed weight loss with the spinning disc is due to the electromagnetic Ni field. There are several keys to reproducing Podkletnov's experimental results, asymmetric fields, dual layer disc, and the presence of both electric and magnetic fields. Finally the paper shows that if the magnetic field was not superconducting, but a regular magnetic field, that the observed weight change should be reversed, and therefore, a non-superconducting disc would lend itself to simpler and easier experimental verification of gravity modifying effects.

Keywords: Podkletnov, Superconducting Disc, Gravity Shielding
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INTRODUCTION

From a theoretical perspective many researchers have proposed many different explanations as to why a superconducting disc should be gravity modifying. Li and Torr (1992) showed that superconductors may have gravity modifying effects. Modanese (1996) concluded a shielding effect of the reported magnitude cannot be explained either by classical General Relativity or by the usual perturbation theory of quantum gravity coupled to the Cooper-pair density. Buzea and Agop (2000) suggested a gravitational Meissner effect. Sukenık and Sima (2001) suggest that an electrostatic field could interfere with the Earth's gravitational field. De Aquino (2002) used inertia and gravitational mass to show that gravitational masses of the electrons of a superconducting material are strongly negative. Tajmar and de Matos (2006) explore the gravitomagnetic field in a rotating quantum material. Chiao (2007) considered the possibility that gravitational waves can be converted into electromagnetic waves, and vice versa. Wu (2008) using quantum gauge theory of gravity, proposed that the internal structure of the superconductor weakens the gravitational field passing though it thus causing shielding. Ummarino (2008) used gravitoelectric field to model shielding and came to the conclusion that it is a transient phenomenon.

Podkletnov's (Podkletnov and Nieminen, 1992; Podkletnov, 1997) papers suggest that any hypothesis on superconducting gravity shielding should eventually explain four observations, the stationary disc weight loss, spinning disc weight loss, weight loss increases along a radial distance and a possible weight increase. Therefore the primary objective of this paper is to review these spinning superconducting experiments, document the experimental parameters and establish some engineering guidelines for similar future experiments that could substantially increase the possibility of observing significant gravity modifying effects using Ni fields.

Solomon (2009) used process models to develop and introduced the concept of non-inertia Ni fields and derived the massless gravitational acceleration formula $g=\tau c^2$ that is consistent with Hooft's (2008) finding that absence of matter no longer guarantees local flatness. The Ni field is defined as a field of real or virtual velocity vectors where a spatial gradient in the velocities exists that is non-parallel to the velocity vectors, with the observed acceleration along this spatial gradient. Solomon (2010) had also shown that many photon experimental results, shielding, cloaking and nanowires, could be modeled without the use of quantum theory. This would imply that neither a quantum nor a relativistic type theory would be indispensible to formulating a theory on gravity modification. This paper, therefore, explores the use of Ni fields and process models to reverse engineer (Podkletnov and Nieminen, 1992; Podkletnov, 1997) spinning superconducting disc experiments from first principles, to determine a possible theoretical basis for the observed gravity shielding effects that would be consistent with Solomon's (2009) paper.

One can describe a form of locality, Origin Independent Locality, where the local physics of a phenomenon is independent of the origin of the phenomenon. For example the photo electric effect is independent of whether a photon originated from a light bulb or a star and is only dependent upon the local properties of the photon $h\nu$ and the material exhibiting the photo electric effect. Similarly, with $g=\tau c^2$ (Solomon, 2009) the acceleration of a body is independent of the originating mass source of the gravitational field and dependent only upon the local properties of spacetime. One can take this form of locality a step further and show for an electron moving at velocity u, the electric and magnetic field interaction at a distance r from the electron is given by $B = u \times E$. That is, the electromagnetic interaction at velocity u is independent of the originating electron field. Therefore, with Origin Independent Locality it would not be necessary to examine the properties of (Podkletnov and Nieminen, 1992; Podkletnov, 1997) the ceramic superconducting disc to determine gravity shielding effects. It would only be necessary to examine the local fields surrounding this ceramic superconducting disc. Therefore, this paper does not explore how or why electric and magnetic fields are produced by superconducting disc, but how the resulting fields can produce shielding effects.

This paper uses numerical models to calculate the effects of fields and presents several iterations to reverse engineer Podkletnov's experimental results. Notwithstanding that the magnetic field is that of a superconducting material, two possible magnetic field shapes are modeled. One mimics a superconducting field and the other a regular magnetic field. Two distinct numerical models were built to explore the stationary disc observations, the magnetic model and spinning disc, the electromagnetic model. The reverse engineering assumes that all observations were made when the experiments had reached steady state as (Podkletnov, 1997) the reported weight measurements for various objects were taken in conditions which were maintained in a stable way for quite long periods (10 minutes or more). In this context the magnetic model proposes an approach to detecting the interaction between the gravitational field and the magnetic field. That a force is a force irrespective of it origin and the key is to determine how one could use magnetic force fields to modify gravity. One could construct similar models with electric fields but this is not the objective of this paper.

The simplest form of a force in a magnetic field is that on an object of mass m inside a solenoid with parallel field lines. For a numerical model, the magnetic field behavior can be modeled as a collection of very tiny parallel field lines. In the Ni field method the force along a magnetic field B line can be modeled by equation (1). Given that Ni fields works for gravitational, electromagnetic and mechanical interactions, (Solomon, 2009) this paper proposes a Broadened Principle of Equivalence. Since Principle of Equivalence states that gravitational acceleration and mechanical acceleration are equivalent, why not include acceleration due to magnetic and electrical fields. The Broadened Principle of Equivalence requires that all types of accelerations are equivalent and therefore the key to solving the gravity modification problem from the perspective of electric and magnetic fields, is to determine how and not why. Note that the accelerations are equivalent but not the fields.

$$\tau c^2 = \frac{dt}{dr} c^2 = \mathrm{B}^2/(2\mathrm{m}\,\mu_0) \tag{1}$$

PODKLETNOV'S 1992 PAPER

Figure 1 depicts a diagrammatic representation of Podkletnov's 1992 experiment (Podkletnov and Nieminen, 1992). The two types of magnets are used. The toroidal magnet at the bottom was used to levitate the superconducting disk. The two magnets on the sides were used to spin the superconducting disk. The paper suggest that the magnetic fields from these magnets did not contribute to the observed weight loss of the silicon dioxide sample, as a 0.05% weight loss was observed when the superconducting disc was stationary. And test measurements without the superconducting shielding disk, but with all operating solenoids connected to the power supply had no effect on the weight of the sample. There are two important observations. First, observed weight loss of the silicon dioxide sample was 0.05% when the superconducting disc was stationary. And, second, at certain spin speeds the weight loss stabilized at 0.3%. These two observations inform us that the superconducting disc had gravity modifying properties before it was spun.

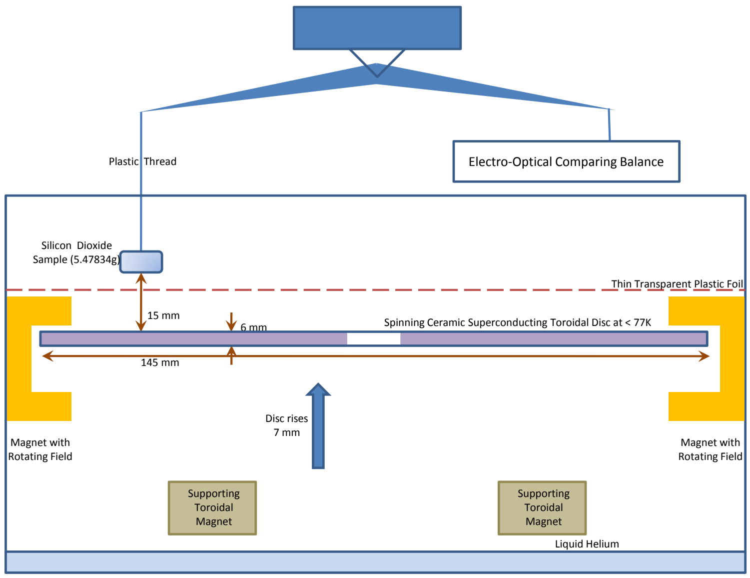


FIGURE 1. A diagrammatic representation of the essential features of Podkletnov's 1992 paper.

By the Broadened Principle of Equivalence, a superconducting disc could create gravity shielding if it creates a non-inertia Ni field that counteracts gravity's non-inertia field. There is a net change in time dilation along the vertical axis, parallel to gravity. Figure 2 suggest a possible (exaggerated) structure of the magnetic field over the superconducting disk. By equation (1) if a magnetic field was the primary source of a non-inertia field, requiring a net vertical change in time dilation, it immediately becomes clear that the symmetrical shape of the magnetic field about the horizontal plane would cause all acceleration effects to cancel. They cancel because for both the top and bottom side fields, the inner vertical change in time dilation, the spatial gradient, is equal and opposite to the outer change in time dilation. That each top and bottom non-inertia fields are net cancelling. Note it does not even matter that the determination of the direction of the change in time dilation is correct, they are net cancelling.

Therefore, a symmetrical magnetic field cannot produce any net gravity modifying effects. This symmetry canceling explains why this effect has not been previously observed in real experiments. Real experiments have always utilized symmetrical fields. The paper states that the spinning superconducting disc did rise 7 mm. It is also clear, that there is insufficient data in this 1992 paper to reconstruct the effects present but one is able to discern an important requirement, that of asymmetrical fields.

PODKLETNOV'S 1997 PAPER

There are more details in Podkletnov's 1997 paper (see Figure 3) and note several points with respect to the previous discussion of his 1992 paper. First, lateral forces are present. To quote the paper, "Because of considerable disc vibration at 3000-3300 rpm, the disc had to be rapidly braked in order to avoid unbalanced rotation . . .". Second, the disc size was increased from a diameter of 145 mm to 275 mm. This would imply that the centripetal g-forces have increased to a maximum of 98 g's. Third, the weight loss ranged between 0.3% and 0.5% (2007 email from Podkletnov) without disc spin but with an internal current in the ceramic. This would suggest that the internal current and the resulting magnetic field would have been a factor in the gravity shielding effect. And that somehow spin may amplify this shielding effect.

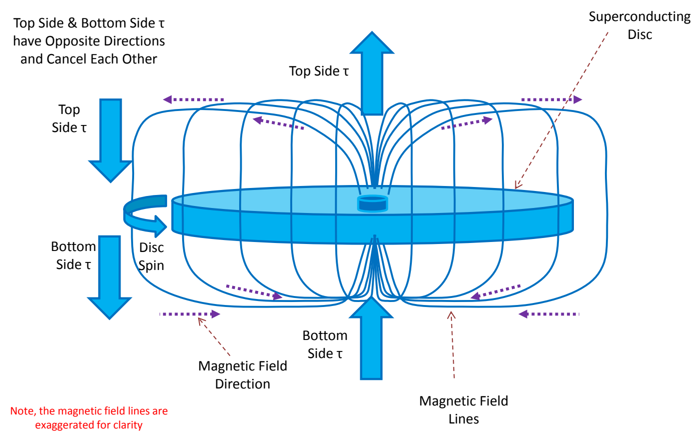


FIGURE 2. A possible (exaggerated) magnetic field structure over the superconducting toroidal disk.

Fourth, that when spinning, the weight loss is greater at the outer edge of the spinning toroidal disk, than at the inner edge. This would imply that this weight loss effect is some function of the radial distance from the center. From the perspective of a Ni field the tangential velocity due to spin could not create the necessary vertical Ni field as the spin velocity would not change along the vertical axis. However, the tangential velocity is changing along the radial axis of the disk, in the plane of the disk, and therefore the centripetal forces. Therefore, the spin tangential velocity Ni field is present in the plane of the disc but not orthogonal to it. A tangential velocity, however, would be a factor in the orthogonal Ni field if it changed (increased or decreased) along a vertical axis. If this were the phenomenon then it could match the experimental observations.

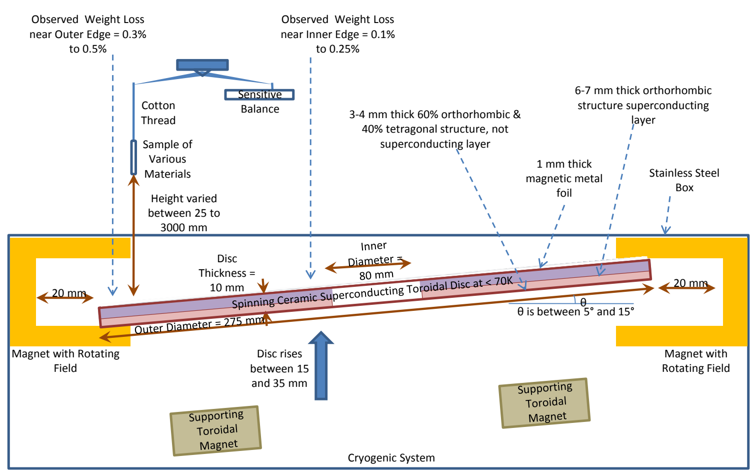


FIGURE 3. A diagrammatic representation of the essential features of Podkletnov's 1997 paper.

And fifth, that something of the form of gravity shielding was in effect. One infers that weight loss was observed independently of the angle of the tilt of the spinning superconducting disk, or even the height of the sample above the disk. If this weight loss was a function of the orthogonal surface of the disk, there would be specific angles of tilt when weight loss would not be observed. This was not the case. Therefore, the weight loss was only aligned with the gravitational field and directly above the surface of the disc shielding the gravitational field. No weight loss was observed below the cryostat. See Figure 4. Thus the disc must have genuine shielding properties that align with the gravitational field. The rebuttal (Unnikrishnan, 1996) that gravity shielding cannot be valid, is flawed in that it does not take into account that gravity is a vector field such that the horizontal vector components cancel leaving only the vertical vector component which cause downward accelerations.

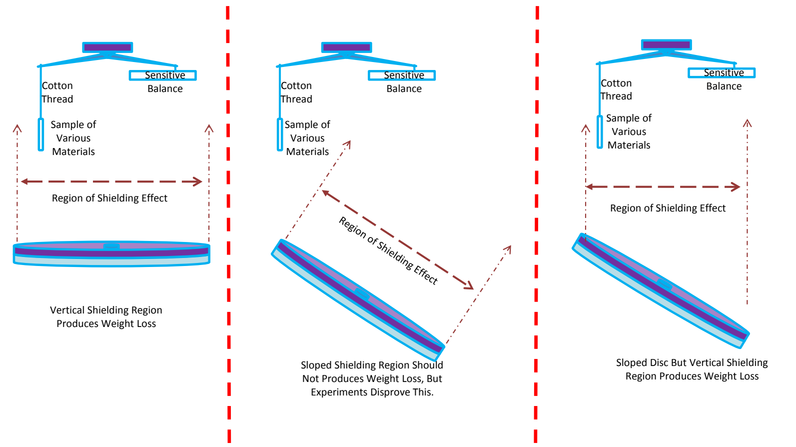


FIGURE 4. A diagrammatic representation showing that weight loss is aligned with the gravitational field.

This is an important observation. It informs us that gravity modification can take two forms. First is gravity modulation, the ability to attenuate (shield) or amplify (intensify) the field strength. This is reported in both (Podkletnov and Nieminen, 1992; Podkletnov, 1997) papers. The second is the field vectoring, or a directed force field, the use of fields to change the direction of force.

The sixth and most important point is that the ceramic disc consisted of two layers. The top layer was superconducting, while the bottom layer was not. The lesson from the Podkletnov's 1992 paper is that the magnetic field has to be asymmetrical. The dual layer structure of the ceramic disc suggests a real possibility of this asymmetrical field structure. Figure 5 shows two of many possible magnetic field structures, top-side and bottom-side.

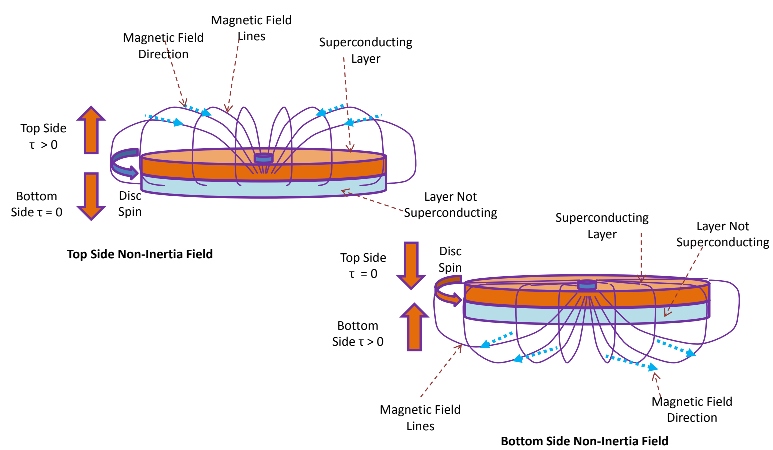


FIGURE 5. Two possible variations in the magnetic field structure of the superconducting disc.

MAGNETIC MODEL AND THE SINGLE FIELD EFFECT

The fact that a weight loss of 0.05% (Podkletnov and Nieminen, 1992) was observed with a stationary ceramic disk, suggest that a weak Ni field was present due to a magnetic field produced by an internal current. By the Broadened Principal of Equivalence, equation (1) suggests that some asymmetrical combination of the magnetic field strength and direction could cause a weak gravity-like Ni field. Figure 2 suggests that the horizontal component of the magnetic field produces a Ni field that cancels radially with respect to the center of the disk. There are essentially no net forces along the radial plane due to asymmetrical magnetic field effects. So, for the estimation of this weak gravity-like field strength one can ignore all horizontal components of this magnetic field.

An aside, the direction of magnetic field lines are currently determined by convention. By equation (1) the direction of the force would necessarily be the same as the direction of the magnetic field lines. Therefore, it should be possible to experimentally determine true direction of magnetic field lines by aligning them with gravitational fields.

Unlike a solenoid, the magnetic field in a superconductor is caused by vortexes (Hyperphysics). Using vortexes one can infer some of the properties of the magnetic field around this superconducting toroidal disk from Podkletnov's experimental data. Again, assuming that the force observed is some function of the magnetic field one infers that the magnetic field strength is greater on the outer edge (disc radius is r_o) than it is in the inner edge (disc radius is r_i). Therefore, there are more vortices on the outer edge than in the inner edge. Given that the average size of a vortex in a Type II superconductor is about 300 nm, for a superconducting penetration depth w_s, the number of outer n_{vo} and inner n_{vi} vortexes is given by,

$$n_{vo} = 2\pi r_0 w_s/(300 \times 10^{-9})^2 \quad (2)$$

$$n_{vi} = 2\pi r_i w_s/(300 \times 10^{-9})^2 \quad (3)$$

Given that r_o = 0.1375m, r_i = 0.04m and w_s = 100nm, the number of vortexes evaluate to $n_{vo} = 9.60\times10^5$, and $n_{vi} = 2.79\times10^5$. The radial change in field strength necessarily implies that the vortexes are aligned along the radial axis of the disk. If they were aligned along the circumference they would not be stable as effective North or South poles would not be present. Further, a changing number of vortexes along a radial direction would imply an asymmetrical magnetic field. Suggesting that a portion of the superconducting field enters or exits the upper and lower flat surfaces of the superconducting disc. The ratio of the number of vortexes, 9.60÷2.79, is 3.44. The stationary disc weight loss varied between 0.05% to 0.07% (Podkletnov, 1997). However, it is not clear at which radial, inner, outer or middle positions Podkletnov observed this 0.05% to 0.07% weight loss. Given that a superconducting magnetic field is essentially horizontal in the middle of the disc, would suggest that the weight loss was observed either on the outer or inner edges of the disc. The experimental layout would suggest that these measurements were observed on the outer edges of the superconducting disc.

Therefore, this order of magnitude analysis of the radial vortex arrangement suggests that the direction of the magnetic field is upward at the outer edge, and downward at the inner edge. The bottom-side field structure shown in Figure 5 is the most appropriate magnetic field structure. Since the magnetic field is a function of the number of vortexes, equations (2) and (3), one infers that magnetic field strength B_r on the surface of the superconducting disc at a radial distance r from the center of the disk must take the form,

$$B_r = rB_z \quad (4)$$

where B_z is some reference magnetic field, at a unit distance. Equation (4) is an approximation as the field B_r does not linearly reach zero as the radius goes to zero. But in the absence of any other information in the 1997 paper about these magnetic and electric fields this is as good a simplifying engineering assumption as any for the numerical modeling. Therefore, using equation (1) the accelerations a_o and a_i at any point in the edge magnetic field can be written for the outer edge r_o and inner edge r_i as,

$$a_o = \tau c^2 = \frac{dt}{dr} c^2 = (B_z r_0)^2/(2m\mu_0) \quad (5)$$

$$a_i = \tau c^2 = \frac{dt}{dr} c^2 = (B_z r_i)^2/(2m\mu_0) \quad (6)$$

The mass of the disc m is 0.95 kg (2007 email from Podkletnov). From equations (5) and (6) it is clear that $a_o > a_i$. Therefore, the orientation of the asymmetrical magnetic field is upward on the outer edge and downward on the inner edge. The field should be equivalent to bottom sided as the magnetic field should be flat over the top superconducting side of this toroidal disk.

To estimate the value of this magnetic field, one does know that the sum effects of the vertical weak gravity-like Ni field across the disc should be equivalent to 0.05% to 0.07% of g. Using a middle figure of 0.06% (gives an error of ±20%) the weight loss is due to the net of the upward outer edge field minus the downward inner edge field should take the *i, j* functional form,

$$i\left\{\left(B_z r_o\right)^2 / \left(2m\mu_0\right)\right\} = j\left\{0.006g\right\} \tag{7}$$

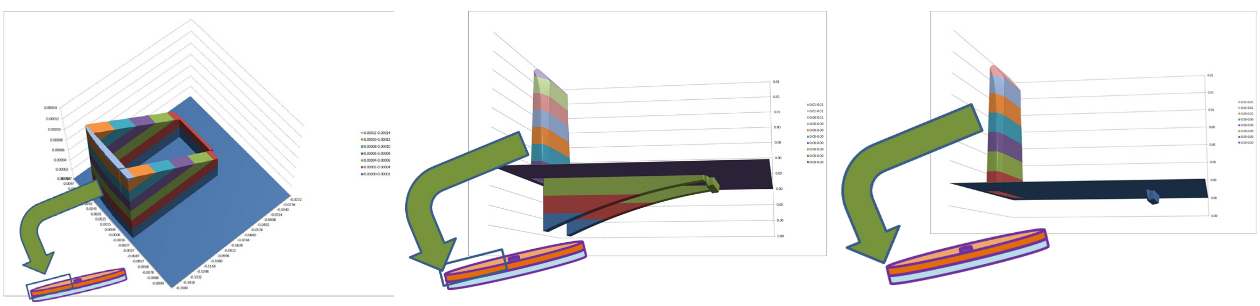
The *i, j* functional forms are the cross-sectional areas of the field such that the Outer Field Area (A_o) x Upward Field Strength = Outer Field Area (A_o) x Observed Weight Change.

$$A_o\left(B_z r_o\right)^2 / \left(2m\mu_0\right) = A_o 0.006g \tag{8}$$

Equation (8) provides a reference field B_z of 27.3 Gauss with the outer and inner edge fields of 3.7 and 1.1 Gauss, respectively.

Do note that the numerical model shows that the upward magnetic field effect is sensitive to the shape of the field and the field strength in the field region outside the superconductor. Several scenarios were evaluated, for the magnetic field shape shown in Figure 6(a). To get a net upward acceleration of 0.06% of g, a reference field B_z of 8.7 Gauss was required, with the resulting outer and inner edge fields of 1.2 and 0.3 Gauss, respectively which is about a third that of equation (8). It should be noted that the numerical model implements a series of concentric ring of magnetic fields, and the circumferential length of each concentric ring was used instead of the area under the field because width of each ring was constant.

A magnetic field should be present within the non-superconducting layer, and possibly the environment below it. With the superconducting layer the magnetic field is flat and flows linearly over the superconductor in air, while it may not be as flat below the superconducting layer as the bottom layer is non-superconducting and not air, thus suggesting a bottom-side magnetic field structure. The numerical model assumed that the magnetic field on the lower side of the disc had the same shape as the magnetic field on the upper side of the disk, because both fields flowed along the flat surface of the superconducting layer, and should therefore be similar. As a precaution the outer and inner magnetic fields were not allowed to extend more than 0.0048m and 0.0018m from the outer and inner radius, respectively, and not beyond 0.0006m from the top and bottom surface of the superconducting material. This ensured that the modeling describes a superconducting magnetic field that could not interact with the surrounding equipment.



(a) **(b)** **(c)**

FIGURE 6. (a) Magnetic field strength around a cross section of the stationary toroidal disk; (b) Accelerations around cross section of stationary toroidal disk with a sloped magnetic field; (c) Accelerations around cross section of stationary toroidal disk with a horizontal magnetic field.

Figure 6(a) shows the numerical magnetic model's estimated field strength *B* around the left cross section of the toroidal disk. It shows that the magnetic field is essentially a thin layer outside the superconducting disk. Figure 6(b) shows the accelerations produced using equations (5) and (6) across the vertical portion of the field. It is quite clear that there is a substantial upward magnetic field on the outside of the disk, and a very small downward magnetic field on the inside of the disk. Note that for the numerical model the direction of the magnetic field was inclined slightly because the vortex structure per equations (2) and (3) would suggest an asymmetric field shape. The top side was inclined downwards as one progress towards the center of the disc, and bottom side was inclined upward. The net effect of the two inclines is a small weight increase which is exaggerated in Figure 6(b) for clarity. Figure 6(c) shows the accelerations if the magnetic field was horizontal and not inclined, and that the middle area would have any gravity modifying effects. This analysis would suggest that Podkletnov's stationary disc weight loss measurements were taken at the outer edge of the disc. One infers that asymmetrical fields are by their nature gravity modifying as a net Ni field is present. However, figuring out how to engineer, and control their shapes with precision will take a lot more innovative thinking.

The magnetic model by itself proposes an explanation for the stationary disc gravity shielding phenomenon but the numerical magnetic model shows that spinning this magnetic field does not affect the weight loss. The modeling suggests that there are two similar but different phenomena present, the stationary disc asymmetric magnetic field effect and spinning disc electromagnetic effect. For ease of communication this asymmetrical magnetic field's effect on gravity is termed the Single Field Effect and is defined as the net non-cancelling of the Ni field resulting from an asymmetrical field shape. If this Single Field Effect is a correct property of Nature then one should be able to observe it with electric fields.

THE ELECTROMAGNETIC MODEL

In the electromagnetic model the magnetic field is overlaid with an electric field, and tested to see if the stationary disc Ni field would be present with this electric and magnetic field interaction. Podkletnov (1997) hints of the presence of strong electrical fields. This is confirmed by Modanese (1999) who suggested of possibility of large surface currents and subsequent experiments (Podkletnov and Modanese, 2003) that involve very strong electrical fields. For the numerical model the electric field *E* was modeled using equation (9) that for a given voltage *V* across parallel plates the electric field *E* falls off inversely with distance *d*. The electric field was modeled in this manner using tiny increments of parallel plates.

$$E = V/d \tag{9}$$

The electric field originates on the surface of the toroidal disk, and dissipates inversely with the shortest distance *d* from the surface. Note, first, technically, the divisor in equation (9) should be *2d* but since the gap between the toroidal disc and the surrounding casings is small *d* would be a more appropriate divisor, as tiny parallel plates are a better approximation. Second, given that the electric field originates from the outer surface of the dual layered disk, any purely electrical field effects should cancel, because the top-side and bottom-side electrical fields are symmetrical with respect to the dual layered disc. This electromagnetic numerical model assumes that the Ni field produced by the electric and magnetic field interaction would by the Broadened Principle of Equivalence affect the gravitational field passing through the superconducting disc, and that any interaction between the superconducting disc and the enclosed environment would at best have a trivial effect on the gravitational field.

Two versions of the magnetic field were evaluated. First, using a version of equation (10), the inverse model to mimic natural magnetic field B_d that dissipate inversely with height *d* from the surface of the superconducting disc given a magnetic field B_r at that point on surface,

$$B_d = B_r/d \tag{10}$$

Second, the constant model, to mimic a superconducting magnetic field, where the magnetic field strength remains a constant for a short height from the surface of the superconducting layer.

$$B_d = B_r \qquad \text{for all } d \text{ within the field} \tag{11}$$

Note that B_r changes with the radial position from the center of the disc per equation (4). The effective velocity *v* for this electromagnetic Ni field at a height *d* from the surface was calculated using equation (12) per Solomon 2009 electron model as follows,

$$v = (q/m)Br \tag{12}$$

Or

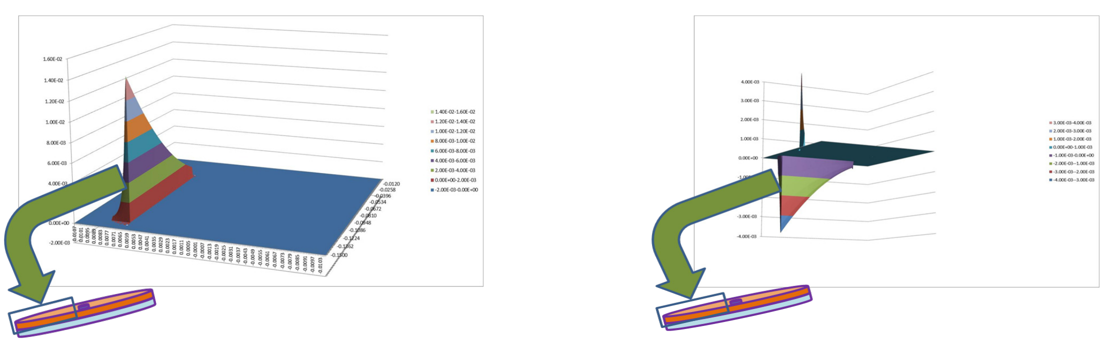
$$v = (2\varepsilon_0/m)BEd \tag{13}$$

At the start of the experiments Podkletnov (1997) had used a high frequency current to the main solenoids to initiate an internal current in the ceramics. This suggests that an electric field was present in addition to the superconducting magnetic field. Solomon (2009) electron model was used in these numerical models to model the presence of both the electric and magnetic fields. Note that the distance *d* is the height from the surface to a point in the electric field, and this distance will be orthogonal to the velocity and along the electric field line per the electron model. Further, there is an electric and magnetic field overlap on the top surface and sides of this dual layered toroidal disk. There isn't any interaction between the electric and magnetic fields on the bottom side, as the magnetic field is presumed to be within the non-superconducting layer, while the electric field is on the external surface of this non-superconducting layer. With both models, constant and inverse magnetic fields, when the disc is not spinning, no significant vertical non-inertial fields are present through electromagnetic interactions. Therefore, the stationary disc gravity shielding is not electromagnetic in origin. It is a Single Field Effect, and purely an asymmetric magnetic field effect.

The numerical models assumed that the magnetic field had a shape of height of 0.0017 m, both above and below the superconducting disk; 0.0078 m and 0.0048 m wide on the outer and inner edges of the toroidal disk. The surface electric field strength was 10,000,000 V/m and the surface magnetic field strength varying between 3.54T (inner edge) and 14.52T (outer edge). This provided an equivalent weight loss of 0.043% (outer edge) to 0.004% (inner edge) of g in the constant field model. That there is weight loss and it is in the range of the experimental observations. This concurs with Podkletnov's observation that the weight loss is greater on the out edge than it is at the inner edge. Spin used was 5,000 rpm. The model shows that gravity shielding is monotonic with the rate of spin of the disc. The effect is reduced when spin is reduced and increased when spin is increased.

To make the constant field and inverse model comparable, the average magnetic field strength of the inverse model was set (by trial and error iteration) to the constant model's 9.19T. Note, that in this normal magnetic field model the field strength was allowed to exceed that of the critical field strength, about 23T, of Type II superconductors. The model field strength ranged between 0.26T and 330T. The surprise was that the inverse magnetic field model gives a net acceleration that is opposite to that of the constant model. The model acceleration is downward ranging between -0.022% (outer edge) to -0.002% (inner edge) of g. This would be consistent with Podkletnov (1992) observed weight changes of between -2.5% to +5.4%. It is very likely that the shape of the magnetic field similar to the inverse model contributed to weight gain of up to 5.4% and a field shape similar to the constant model contributed to the weight loss of up to -2.5%, as mixed state, normal and superconducting, magnetic fields are known to exists. This suggests that at least in the 1992 experiment Podkletnov's magnetic field shape was not stable.

The resulting Ni fields of the constant and inverse models are shown in Figures 7(a) and 7(b). One can see that the constant field model has a ridge of positive accelerations on the top surface of the disk, the back of the diagram, while the inverse field model has a trough at this same location. The spike in Figure 7(b) is due to modeling error at the boundary where the fields do and do not exist. The electromagnetic model's accelerations are on the top surface, unlike the magnetic model where the non-inertia field is on the side, with the maximum accelerations on the outer side of the top cross section of the toroidal disk.



(a) (b)

FIGURE 7. (a) Electromagnetic acceleration with the constant magnetic field model; (b) Electromagnetic field accelerations with the inverse magnetic field model.

Do note that again, the field effects are sensitive to the shape of the fields. Further, that there isn't any electromagnetic field interaction below the superconducting layer as the field size requires that the magnetic field is present within the lower layer, but the electric field is outside the lower layer of this dual layered disk. This is correct for the bottom-sided magnetic field structure as long as the magnetic field is encased inside the lower layer. The electromagnetic models show that for the specific gravity shielding effect observed by Podkletnov, the magnetic field strength needs to be independent of the distance from the surface of the superconductor, or at least close to that type of field structure. That is a compressed magnetic field like that found around superconducting surfaces facilitates this specific, gravity shielding effect. While a gravity amplifying effect is caused by a decreasing field strength like that found around regular wires or solenoids. This should not be surprising as the acceleration is in the direction of the greater effective velocities. Or to state it differently, using equation (13) given all other factors constant, to get an upward acceleration, the effective velocity v_{top} at the top of the field must be greater than the effective velocity v_{bottom} at the bottom of the field.

$$v_{top} > v_{bottom} \tag{14}$$

This occurs when their respective top and bottom parameters, are as follows,

$$B_{top} E_{top} d_{top} > B_{bottom} E_{bottom} d_{bottom} \tag{15}$$

That is, per the Ni field properties, the spatial gradient of the net field effects determine the direction of the field vectoring. This result suggests that future experiments require an evaluation of the spatial gradient to control the observed weight change.

It should be noted that Podkletnov (1997) believed that the frequency of the oscillating magnetic field was important to the shielding effect. The Ni field method used would suggest that frequency would not be a consideration as the change in the direction of the magnetic field would reverse the direction of the velocity vectors but not the spatial gradient as the entire field would change direction simultaneously. The oscillating magnitude of the field could alter the spatial gradient as the absolute value oscillates between zero and a maximum. This would however show up as an oscillating gravity shielding behavior, but since the experiments were not designed to observe oscillating weight change, it would have gone unobserved. Podkletnov also observed that braking the disc speed would cause the effect to increase, in effect suggesting some form of resonance. The Ni field method would suggest gravity shielding has a monotonic behavior and that it increases as the specific parameters increase. Therefore, the braking effect could be informative of some other undiscovered electromagnetic behavior within the superconducting disc.

A side note. Rounds (1997) reported observing weight change as the superconductor temperature transitions across T_c suggesting that gravity shielding effect may be present. Rounds had suggested that this could be due to changes in the gravitational constant *G*. Ni fields eliminates the possibility that observed weight changes are due to changes in the gravitational constant *G* because *G* is not present in the Ni field calculations.

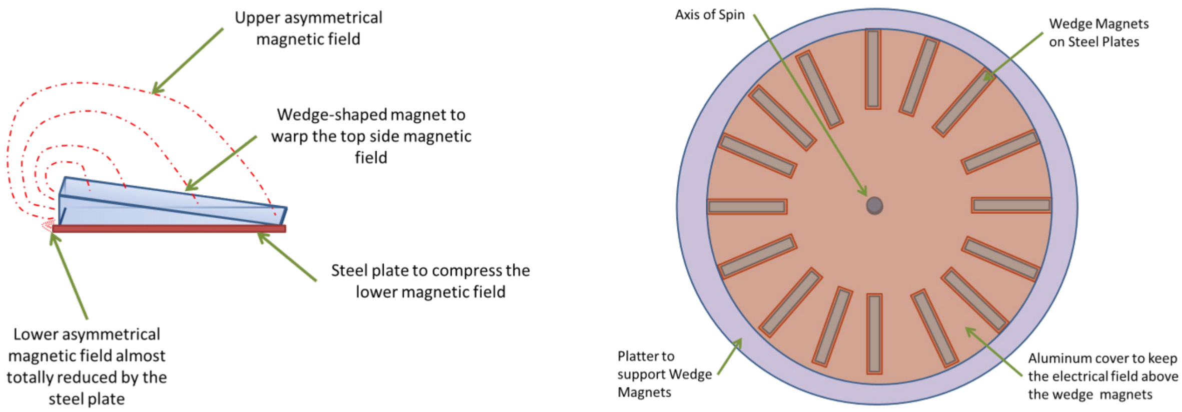
NON-SUPERCONDUCTING EXPERIMENT

This paper presented an alternative method for deconstructing Podkletnov's experiments. That it is possible to deconstruct these experiments without taking into consideration the quantum mechanical or relativistic properties of the ceramic material, thus opening up these experiments to non-superconducting materials. Figure 8 proposes an outline of a non-superconducting experimental set up to test some of the inferences derived in this paper.

Figure 8(a) illustrates a wedge shaped magnet to produce an asymmetrical field that mimics the inverse field used in the electromagnetic model. The steel plate effectively compresses the lower side magnetic field making it horizontal. A platter is constructed consisting of the wedge magnets arranged in a ring, Figure 8(b), and wrapped, top and bottom, with a non-magnetic material such as an aluminum sheet to keep the electrical field outside the ring of wedge magnets. This platter is then spun without the cryogenics, as if it were a superconducting disc. If one were to observe weight change this would confirm that the superconducting ceramic materials are not a prerequisite for gravity modification, and would open up this technology to simpler, cheaper materials.

CONCLUSIONS

In conclusion one can identify several conditions that need to be met for any future experiments involving spinning superconductor disc. First, an electrical field with surface field strength on the order of 10^7 N/C. Second, a magnetic field on the order of 15T. Third, the rate of spin changes the magnitude of shielding effect. Fourth, that shielding is monotonic with respect to these parameters. Fifth, the asymmetrical shape of the magnetic field is critical to observing weight change, and therefore these experiments require a method of mapping the field lines. Sixth, a dual-layered disc structure is critical to ensure two different electric and magnetic interactions per top-side and bottom-side of the disc. And seventh, that one should be able to observe weight increase. By analyzing the field effects and not their origin, the author has taken an approach that suggests that superconducting materials are no longer a prerequisite to gravity modifying experiments, thus opening up the experimental designs to non-superconducting materials.



(a) **(b)**

FIGURE 8. (a) Wedge shaped magnetic with steel plate to produce an asymmetrical magnetic field; (b) Ring of wedge magnets that would mimic an inverse magnetic field structure.

NOMENCLATURE

A_i	=	acceleration at the inner edge (m/s^2)
A_o	=	acceleration at the outer edge (m/s^2)
A_d	=	cross sectional area of the magnetic field on the inner and outer edges (m^2)
A_i	=	cross sectional area of the magnetic field on the inner edge (m^2)
A_o	=	cross sectional area of the magnetic field on the outer edge (m^2)
B	=	magnetic field (T)
B_d	=	magnetic field at a height d (T)
B_r	=	magnetic field at a radial distance r (T)
B_{bottom}	=	magnetic field at the bottom of the Ni field (T)
B_{top}	=	magnetic field at the top of the Ni field (T)
B_z	=	reference magnetic field (T)
c^2	=	a constant whose numerical value is the value of the square of the velocity of light (m^2/s^3)
d	=	distance along an electric field line (m)
d_{bottom}	=	height at the bottom of the Ni field (T)
d_{top}	=	height at the top of the Ni field (T)
E	=	electric field (N/C)
E_{bottom}	=	electric field at the bottom of the Ni field (T)
E_{top}	=	electric field at the top of the Ni field (T)
ε_0	=	electric permittivity (F/m)
g	=	gravitational acceleration (m/s^2)
G	=	gravitational constant (m^3 kg^{-1} s^{-2})
m	=	mass of object in the magnetic field (kg)
n_{vi}	=	number of vortexes at the inner edge of the superconducting disc (unitless)
n_{vo}	=	number of vortexes at the outer edge of the superconducting disc (unitless)
q	=	particle charge (C)
r	=	radial distance from the center of the superconducting disc (m)
r_i	=	inner disc radius (m)
r_o	=	outer disc radius (m)
T_c	=	critical temperature of superconductors (K)
τ	=	dt/dr = change in time dilation / change in distance (s/m)
u	=	velocity (m/s)
μ_0	=	magnetic permeability (T m/A)
v	=	velocity of particle (m/s^2)
v_{bottom}	=	velocity at the bottom of the Ni field (m/s)

v_{top}	=	velocity at the top of the Ni field (m/s)
V	=	voltage across tiny parallel plates (V)
w_s	=	superconducting penetration depth (nm)

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