

## *Summary and Abstract*

There are two fundamental problems of gravitation:

- The first is that the widely accepted and dominating theory of how gravitation operates, that set forth in Einstein's "General Theory of Relativity", is wrong and suffers from not being supported by any demonstrated mechanism.

That erroneous theory is that the cause of gravitation is the curving of space by the gravitational mass of physical bodies.

- The second is that the method of implementation of the original physical law of gravitation, that of Newton's Law of Gravitation, misinterprets that law and applies that misinterpretation in all gravitational determinations.

That error of implementation is the assumption that gravitation can be treated as acting as if all of the gravitational mass of gravitating bodies were concentrated at the center of mass of each body.

[It is fortunate for astrophysics and for understanding of solar system behavior and navigation that that error, while locally significant is negligible at the level of the solar system and beyond.]

This book, "Resolving the Problems of Gravitation", addresses and corrects both of those problems.

In order to do so it is first necessary to determine the form and nature, as they pertain to gravitation, of the source of all gravitation, the gravitating mass of particles of matter. And, to address that requires going back to the beginning, the origin of the universe, the origin of its particles of mass. Those issues are the subject of this book's Section 1, "The Origin of Matter", Section 2, "The Form of Matter", and Section 3, "The Behavior of Matter".

Then, the following three sections treat the fundamental problems of gravitation as follows.

*Section 4 - Connecting Newton's  $G$  With the Rest of Physics –  
Modern Newtonian Gravitation Resolving the Problem of "Big  $G$ 's" Value*

As a simplified, idealized understanding of the behavior of a physical system the General Relativity model has been highly successful in its gravitational role. However, it fails to address the problem of sufficiently precise measurement of *Big  $G$* , the Newtonian Gravitation Constant, and has failed to obtain connection of *Big  $G$*  to the rest of physics. Because *Big  $G$*  arises naturally from Newton's treatment of gravitation, this paper elaborates the Modern Newtonian Model of Gravitation and through it resolves the problems of *Big  $G$*  at which General Relativity has failed. Specifically: the causes of the problems in measuring *Big  $G$*  are resolved, *Big  $G$*  is connected to the rest of physics, and a sufficiently precise value of *Big  $G$*  is obtained by calculation from other fundamental physical constants.

*Section 5 – The Experimental Data Validation of Modern Newtonian Gravitation  
Over General Relativity Gravitation*

Section #4, *Connecting Newton's  $G$  With the Rest of Physics – Modern Newtonian Gravitation Resolving the Problem of "Big  $G$ 's" Value*, derives the value of the gravitation constant *Big  $G$* ,  $G$  of Newton's Law of Gravitation, directly from other physics fundamental constants but left it to a subsequent experimental validation of the derived *Big  $G$* . The present Section 5 now performs that validation by examining various past experiments intended to measure *Big  $G$* , in each case determining the acceleration,  $a_g$ , as found per Einstein's General Theory of Relativity versus per Modern Newtonian Gravitation for that case. The ratio of those two times the reported measured *Big  $G$*  value yields a result identical to the *Big  $G$*  determined from the derived formulation for *Big  $G$* , within the error range of the reported measured *Big  $G$*  value. That thus validates the correctness of the derived formulation for *Big  $G$* .

*Section 6 -The Mechanics of Gravitation – What It Is; How It Operates*

Having contended that the theory of gravitation set forth in Einstein's "General Theory of Relativity" is wrong and unacceptable because there is no supporting mechanism by which its contended "curving of space" can occur or be caused, it is incumbent upon the present author to provide an alternative theory.

That is the function of this Section 6.

From a start of only the limitation on the speed of light, the necessity of conservation, and the impossibility of an infinity in material reality, this section presents a comprehensive development of the mechanics, the operation of gravitation

Experience shows that everything has a cause and that those causes are themselves the results of precedent causes, and *ad infinitum*. Defining and comprehending the causality or mechanism operating to produce any observed behavior is essential to understanding or explaining the behavior.

The behavior of gravitation is well known, described by Newton's Law of Gravitation. But what gravitational mass is, how gravitational behavior comes about, what in material reality produces the effects of gravitation, is little understood. The extant hypotheses include Einstein's General Relativity's curving of space, efforts to develop "quantum gravitation", and attempts to detect "gravitons". None of those addresses the cause, the mechanism of gravitation.

The remaining two sections consist of applications of control of gravitation and the relevant design engineering.

Just as the sail-driven ships of past centuries experienced fuel-free travel by means of controlling the energy of the wind, the technology of gravitation will enable fuel-free travel through space by controlled manipulation of the energy of the gravitational field that permeates all of space.

In order to understand gravitation, a product of matter, it is first necessary to determine the form and nature of matter, *i.e.* of the source of all gravitation, the gravitating mass of particles of matter. And, to address that requires going back to the beginning, the origin of the universe, the origin of all particles of mass.