

Rapport BIPM-83/1

THE NEWTONIAN GRAVITATIONAL CONSTANT :

An Index of Measurements  
(1983 Edition)

George T. Gillies

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Bureau International des Poids et Mesures  
Pavillon de Breteuil  
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ABSTRACT

The Newtonian Gravitational Constant, "G", has probably been measured more often but, interestingly, with less precision than any other physical constant of fundamental importance. In an effort that has spanned more than a century to connect gravitation to the other forces of nature, over 200 experiments on G have been completed and reported; but many of them have not been reported in what would now be considered to be the open literature. This paper is a second, more complete attempt to carry MacKenzie's and Poynting's bibliographies forward from the 1800's to the present; and thereby include as many as possible of the experimental results on G that have been obtained since 1900.

I. Introduction

If one were to catalogue the tools of precision measurement, an unusually high number of the listings would claim as their genesis the precision measurement of the Newtonian Gravitational Constant, herein simply referred to as "G". These tools would include the torsion balance, the optical lever, the quartz fiber, synchronous detection techniques, ultra-high precision rotations and many others. Yet G stands alone as the only fundamental constant currently known to little better than one part in a thousand although there are three measurements claiming accuracies of one part in ten thousand. In parallel with these efforts to measure the absolute value of G, there has also been a wide variety of experiments aimed at linking the gravitational force to the other forces of nature. All such efforts to date have had the singularly unique result of demonstrating that gravity, indeed, stands alone - the last of the great classical mechanisms - in spite of its modernized presentation via general relativity.

Classical gravitational physics has been like this, and foreseeably will continue to be like this. The reason why is that, to this date, no one has succeeded in isolating sufficiently well the gravitational interaction between laboratory masses to the point where other disturbing forces or experimental uncertainties do not dominate the measurement, at least at levels above those at which other phenomena might be expected to occur.

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\*This is the Second Edition of this Index, the First Edition having been published in July 1982 as Rapport BIPM-82/9.

It is nevertheless both interesting and important to catalogue the large body of work done already in the hope that a thorough listing of the experimental facts concerning our knowledge of G will stimulate future work on this constant and the force that it governs.

Part of the motivation for this paper lies in the fact that much of the work on G was reported obscurely in spite of the fact that most experiments have been carefully designed and completed. It was, therefore, a challenge to extract from various libraries, archives and private collections the existing data that, when collectively viewed, will help to focus attention on just exactly what has been done and, more importantly, what has not been done in this field.

This work is meant to be a bibliography and, at present, only that. Owing to the unusually large number of references cited, any thorough discussion of all the results would have taken up more space than was available here. Nevertheless, there is a small amount of annotation provided in the following pages for each of the fourteen sections of the bibliography. The areas into which the papers have been classified are listed below:

1. Measurements of the absolute value of G and reports of important subsidiary technology.
2. Comments and reviews of measurements of G.
3. Measurements of gravitational permeability, absorption, and shielding.
4. Measurements of the local directive action of the gravitational force.
5. Measurements of the dependence of G on the physical state of masses.
6. Measurements of the dependence of G on the chemical state of masses.
7. Measurements of the dependence of G on temperature.
8. Measurements of the dependence of G on the radioactivity of masses.
9. Measurements of the dependence of G on the electromagnetic energy content of masses.
10. Measurements of the dependence of G on inter-mass spacing.
11. Measurements of the dependence of G on time.
12. Measurements of spontaneous matter creation (related to 11).
13. Measurements of the dependence of G on the state of quantization of the test masses.
14. Measurements of the anisotropies of G and of inertial masses.

There are about 960 references cited in these 14 sections. There is some duplication, as a few of the papers contain two or more experimental results each in a different area. Duplicate listings constitute about 5% (or less) of the total, however. The references are listed alphabetically in each section with a chronological sublisting for each author in each section. The order of the items in each of the references follows the ISO recommendations as closely as possible. Abbreviations for the journal titles follow the American Institute of Physics Style Manual wherever possible. For those journals not listed

there, the abbreviations in the ISI\* Current Contents indexes have been used. Those listings that have the author's name(s) marked with an asterisk have not been consulted at the time of this writing. References to entries in the various abstracting journals have not been given except for a few special cases where the abstracted article was judged to be published obscurely.

Not all of the listings in the Mackenzie (1900) and Poynting (1894) bibliographies were repeated here. Some, like those referring to the "Fr. Bertier" Controversy of the late 1700's/early 1800's, have little scientific merit and were omitted.

Sections 11 and 12 contain several references to instrumental papers in addition to those actually quoting significant results. In particular, the efforts at Princeton University, Massachusetts Institute of Technology, and the University of Virginia are listed in detail.

## II. Experimental Studies and Critical Analyses of G

### 1. Measurements of the Absolute Value of G and Reports of Important Subsidiary Technology

The history of the measurement of the universal gravitational constant begins with geophysical studies of a related physical quantity: the mean density of the earth. These efforts started with attempts to measure the attraction of individual mountains, measurements of strata of the earth's crust as a function of depth in various mines, and they are continuing with measurements of the attraction of layers of water in large level-controllable lakes and in the oceans.

Chronologically, the torsion balance methods came next, and these gave the most reliable results until the advent of the torsion pendulum technique. The balance-beam methods were studied during the late 1800's, and today all three of these methods are being developed in experiments aimed at accuracies of one in  $10^5$ .

Numerous miscellaneous methods have also been developed. These include resonant torsion pendulums, vertical pendulums, near zone gravity wave detector excitation, and long period horizontal pendulums. There have also been several proposed satellite determinations of G, but so far no such measurements have actually been made.

The early works on G, particularly those of Cavendish, Reich and Baily, have been reviewed frequently and the principal papers of these workers are summarized and paraphrased in most undergraduate textbooks on physics. There are, however, about 60 other determinations of G that are in the open literature. Some of these are well known too,

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particularly those of Boys, Poynting, Braun, Heyl and the Beams-Deslattes-Luther-Towler collaboration between the University of Virginia and the U.S. National Bureau of Standards.

Of the latest works, there are three that claim accuracies near one part in ten thousand. They are summarized in Table I. The agreement between the values is only fair, however, even at the  $10^{-3}$  level.

Table I

Author	Year	Experimental Technique	$(G \pm \Delta G) \times 10^{11} \text{m}^3 \text{kg}^{-1} \text{s}^{-2}$
Facy, Pontikis	1972	Resonant Pendulum	$6.6714 \pm 0.0006$
Sagitov et al.	1977	Torsion Pendulum	$6.6745 \pm 0.0008$
Luther, Towler	1982	Torsion Pendulum	$6.6726 \pm 0.0005$

All uncertainties quoted in Table I as well as that in the CODATA value below represent one standard deviation.

Even if ultimately measured in a drag-free satellite, where external horizontal gravity gradients would not influence the balance, measurements of G would still be limited by the uncertainties arising from density gradients in the materials used. This would probably occur somewhere between the  $10^{-5}$  and  $10^{-6}$  level. At that point, a totally different approach to the measurement of G will become necessary.

Our currently accepted value, the CODATA value, is from 1973:

$$G = (6.6720 \pm 0.0041) \times 10^{-11} \text{ m}^3 \text{kg}^{-1} \text{s}^{-2}.$$

Mills (1979 - see section 10) has tabulated the results of the 22 most often cited measurements of G. There are several other works which are less well known but important nonetheless, and the results from these are entered in Table II. The most recent experiments listed there should be considered as work in progress, and not as a final result. Also, some of these measurements were not directed at G itself, but at a search for some variation in G, with the quoted result being a by-product.

Table II

Author	Year	Technique	$(G \pm \Delta G) \times 10^{11} m^3 kg^{-1} s^{-2}$
Preston	1895	Pendulum decrement	7.16
Barus	1919	Torsion balance	6.2
Stern	1928	Resonant balance	6.6 $\pm$ 0.5
Renner	1974	Torsion pendulum	6.670 $\pm$ 0.008
Karagioz, et al.	1976	Torsion pendulum	6.668 $\pm$ 0.002
Koldewyn, Faller	1976	Torsion pendulum	6.57 $\pm$ 0.17
Spero	1979	Nulled torsion balance	6.70 $\pm$ 0.19
Page, Geilker	1981	Torsion balance	6.1 $\pm$ 0.4
Karagioz, et al.	1981	Torsion pendulum	6.5912 $\pm$ 0.0016
Speake	1983	Beam balance	6.64 $\pm$ 0.24

As a rather interesting aside, it should be noted that, since so many of the earliest measurements (those by Cavendish, Reich, Baily, among others) were done for the purpose of determining the mean density of the earth, this motivation has remained the classic justification for undertaking measurements of  $G$ . With a knowledge of the earth's density and its volume, one may estimate its total mass in kilograms. More recently, satellite ranging experiments have given us the "geocentric" gravitational constant directly :  $G_g = GM_e$ . The latest of these experiments, Ferrari, et al. (1980), has an uncertainty of only about  $7 \times 10^{-8}$ . This means that any increased accuracy in our knowledge of  $G$  will automatically give us  $M_e$  with a corresponding precision, and vice versa. A few of the recent measurements are catalogued in Table III.

Table III

Author	Year	Satellite	$(G_g \pm \Delta G_g) (km)^3 s^{-2}$
Esposito	1979	Viking I	398600.5 $\pm$ 0.1
Esposito	1979	Viking II	398600.65 $\pm$ 0.20
Martin, Oh	1979	ATS 6	398600.36 $\pm$ 0.12
Ferrari, et al.	1980	Lunar Orbiter 4	398600.461 $\pm$ 0.026

## 2. Comments and Reviews of Measurements of G

There are four thorough reviews of the measurements of G: two dating to the late 1800's and two more recent ones. Poynting and, later, MacKenzie summarized the contemporary knowledge of G and, for that matter, all of gravitational physics, in books printed in 1894 and 1900, respectively. Sagitov (1969) recently published a similar work on G, although he omitted many references to experiments probably judged by him to be of secondary importance. Most recently, de Boer (1983) has contributed a review article which catalogues the recent major experiments and presents the results and uncertainties together on easily readable graphs. There are several other reviews of the experiments, and these are listed in the bibliography. It should be mentioned that each successive edition of the Encyclopedia Britannica articles on "Gravitation" contain interesting and relatively thorough sections on G that are very useful.

In addition to the review articles on G, there are a large number of papers, both old and new, that comment on or discuss certain measurements of G, propose new measurement techniques, or analyze probable experimental limitations. Some of these are worth consulting, since errors have occasionally appeared in the main papers of the principal investigators. The titles of the papers in this section of the bibliography usually indicate the relevance to a certain experiment or class of experiments.

## 3. Measurements of Gravitational Permeability, Absorption, and Shielding

Although not widely known, one of the most thoroughly researched aspects of gravitational physics is the question of the existence of a gravitational analogue to magnetic permeability. The pursuit of this question, i.e., the dependence of G on the density of the matter intervening between the interacting masses, began with a null result in the late 1800's. It continued until recent times, always with null results, but with ever-increasing accuracy. We now know that if gravitational energy is, in fact, absorbed by any intervening material, it occurs at a level such that, when measured in terms of G, the result is  $(\Delta G/G)_{\text{abs}} < 10^{-16}$ . Some theoretical analyses establish a lower limit several orders of magnitude below this, too.

At first these measurements were made by employing a Cavendish balance with a cylindrical screen separating the suspended dumb-bell from the attracting masses. Each screen was made of a different type of material, and all the materials had different densities. The screens were sequentially changed and the measurements of G subsequently made were analyzed for a resulting effect. Later, Majorana began a long series of experiments using a balance-beam and claimed to have found a result at the  $10^{-11}$  level, but subsequent work by himself and others disproved this. The most sensitive measurements have been made in recent times by several workers studying the period shift in horizontal pendulums during a total solar eclipse. In every case, however, the results have been null except for the results of Allais and, later, Saxl and Allen which are seldom discussed.

Unless a new theory predicts a permeability effect substantially different from that empirically sought so far, it is difficult to see where the motivation would arise for new experiments in this area. This is especially so since recent gravitational analogues of electromagnetism predict that the "gravitational permeability of free space" is only  $\frac{16\pi G}{c^2} \approx 10^{-26}$  m/kg (Forward, 1961), a very small effect indeed!

#### 4. Measurements of the Local Directive Action of the Gravitational Force

Since so many properties of crystalline materials depend upon the direction of observation (e.g. refractive index, local density distribution, thermal conductivity, etc.), it seemed reasonable to question the constancy of G within crystalline materials as well. This was first done by MacKenzie, then later by Poynting although no anisotropy in the value of G was found in either case at  $\approx 10^{-3}$  and  $10^{-4}$  levels, respectively. Heyl did an exhaustive experiment in this area in 1924 and, by weighing crystals from each of the five non-isometric groups, was able to put a limit of  $(\Delta G/G)_{ca} \approx 10^{-9}$ , thereby effectively eliminating any doubt about it.

It has been suggested that one should not expect to find such anisotropies in general because they would lead to a violation of conservation of momentum. Nevertheless, the weakness of the gravitational force and the singular properties of some crystals made this, temporarily at least, an attractive area of research.

#### 5. Measurements of the Dependence of G on the Physical State of Masses

This category is a rather general one, although it is possible to classify various types of experiments within it. Specifically, there have been measurements of G involving test masses and attracting masses of various geometrical shapes. For example, spheres, cylinders, rods, rings, and irregular masses have been used. In fact, a cylindrical configuration having the sphere-like field of a point source is presently under study. Attracting and test masses in the gaseous, liquid and solid state have been (or are being) studied, as well as masses which undergo a change of state during the experiment. In all cases, no departure from true constancy of G has been observed, at least within the levels of the experiments' precision. When one considers that the sun, a plasma, and its planets (gas, solid and liquid combinations) have orbits which conform precisely to the inverse square law (with only minor relativistic corrections), it is seen that this law is indeed well obeyed. The references cited here are representative examples of various types of experiments involving gases, liquids and solid masses of various shapes. Some of these citations are listed in other more appropriate sections of the bibliography, too.

## 6. Measurements of the Dependence of G on the Chemical State of Masses

This area of research is usually interpreted as being a test of the weak equivalence principle of General Relativity, i.e. a determination of the equivalence of gravitational and inertial mass. The various searches for a non-zero Eötvös ratio which test this equivalence are catalogued by Will (1981) and are not included here, except for a few special cases given below.

The earliest measurements in this area involved pendulums of the same mass but made of different materials. Eötvös and his contemporaries expanded this to include torsion balances and balance-beams which had masses of different materials attached to them and which oscillated in the time-varying field of the sun as measured at the surface of the earth.

Several workers studied the interesting question "Does G vary while the test mass undergoes a chemical reaction?" but, in all cases, equilibrated or reacting, null results have been obtained. This area has not been without controversy, however. C.F. Brush claimed to see a difference in pendulum periods between pendulums made of bismuth and those of zinc. His observations were ultimately explained by his failure to include the buoyancy of air in his calculations.

Although not strictly belonging to this category, the experiment of L. Kreuzer (1966), at Princeton, is included here because it has been interpreted by some as providing evidence for a variation of G over the elements of the periodic table. This claim was subsequently refuted, but caused some interest at the time.

## 7. Measurements of the Dependence of G on Temperature

Early in this century, there were three attempts to measure with balance-beams a dependence of G on the temperature of the attracting masses. They all produced null results but were nonetheless open to discussion. This was so for two reasons. First, there were well-known difficulties in experiments wherein two masses at different temperatures were used in a high-precision balance; and second, the unknown thermal profile of the earth immediately below the balance would seem to make an exact repetition of the experiment impossible, because any thermal dependence of gravity would presumably affect the earth's field too (and how can one control the temperature of the earth?).

Professor Shaw and his students, therefore, constructed a Boys-type balance in which the attracting masses could be heated. They measured G and analyzed their data in the form  $G = G_0(1 + \alpha T)$ . At first they found  $\alpha \approx 10^{-5} \text{ }^{\circ}\text{C}^{-1}$ . This result created great interest and several papers were written discussing it. A careful repetition of their original work showed, though, that after removing troublesome convection effects,  $\alpha < 2 \times 10^{-6} \text{ }^{\circ}\text{C}^{-1}$ , which effectively settled the issue in the negative. There do not seem to have been any other experiments following this one. Perhaps this is because it was realized that the large temperature difference between the earth and sun, when

compared with the much smaller difference between the earth and moon, should have highlighted the existence of the effect. Instead, both orbits serve only to verify that the inverse square law is, in fact, independent of temperature. In questions of this type, however, scale factors may be important; and even though the balance-beam experiments (laboratory scale) in the earth's field produced null results at the  $10^{-9}$  level, Shaw's experiment with isolated gravitational forces (also at laboratory scale) was 2 000 times less sensitive than either of theirs. So there may still, perhaps, be effects to be discovered.

The results of all the above experiments are given in Table IV.

Table IV

Author	Year	Technique	$ \Delta G/G  \text{ K}^{-1}$
Count Rumford	1785	Beam Balance	$< 3.3 \times 10^{-8}$
Poynting, Phillips	1905	Beam Balance	$< 10^{-10}$
Southern	1906	Beam Balance	$< 10^{-8}$
Pettersson	1914	Beam Balance	$< 10^{-9}$
Shaw	1916	Torsion Balance	$\sim 10^{-5}$
Shaw, Davy	1923	Torsion Balance	$< 2 \times 10^{-6}$

#### 8. Measurements of the Dependence of G on the Radioactivity of Masses

One very interesting area of research in this century has been the search for a connection between gravitation and what we now know to be the nuclear forces. Studies in this area have involved a wide variety of experimental techniques. Several famous physicists have worked in this area, including G. Sagnac, P. Zeeman, A. Compton and J.J. Thomson, each lending their own special expertise to this difficult problem.

Compton, for instance, produced a large and controllable pseudo-gravitational (centrifugal) field by rotating samples of radium at high speeds. He concluded that this did not affect the radioactivity by more than  $10^{-3}$ . Thompson's uranium-pendulum experiment (carried out in more detail by Southern) showed no gravitational coupling to the sample's radioactivity at the level of  $5 \times 10^{-5}$ . All other measurements also produced null results, except for that of R. Geigel who claimed to have seen a small weight change in a nonradioactive sample hanging on a sensitive balance when a radium salt sample was placed nearby. He interpreted this as an absorption of radioactivity which led to an increase in the gravitational potential energy of the nonradioactive sample. W. Kaufmann shortly thereafter, however, uncovered a thermal effect which explained the apparent weight change. No one since then has repeated Geigel's experiment.

## 9. Measurements of the Dependence of G on the Electromagnetic Energy Content of Masses

At the same time as the searches for a radioactivity-gravitational force coupling were under way, there was a parallel effort in progress aimed at finding an electromagnetic-gravitational coupling.

These searches typically involved weighing samples of steel in magnetized and unmagnetized states or charged and uncharged states.

The very much larger size of the electromagnetic forces always makes experiments of this kind very difficult, and careful attention must be paid to the shielding of undesirable electromagnetic couplings to the laboratory which would otherwise make the results ambiguous. In spite of this, null results were always reported.

At present, J.F. Woodward is repeating (with much higher precision) the early work of Faraday and Blackett in search of an electrogravitational effect, but it is not clear at this point what a positive result in these experiments would mean in terms of the value of G or the gravitational inverse square law. His preliminary results are included in this bibliography anyway, for the sake of completeness. The reference section of his paper refers the reader to citations of earlier work along that specific line.

## 10. Measurements of the Dependence of G on Inter-mass Spacing

The past decade has seen a great deal of research in this area, and most of the effort was motivated by the work of D. Long at Eastern Washington University. He claimed that an analysis of past measurements of the absolute value of G showed a distance dependence, which he later tested experimentally. His positive result produced great interest and motivated about ten groups to undertake experiments of their own, most of which now claim null results. The fundamental importance of this question has caused it to remain open, however, and both theoretical and experimental work will probably continue for some time to come.

Here too, experiments have been done on many scales of distance, ranging from 2 cm up to several kilometers. There have been analyses of the free oscillations of the earth in terms of how they might be influenced by a non-zero  $G(R)$ ; and on the still larger scale, the motion of the planets has been seen to confirm the inverse square law to an amazingly high precision (except for the previously mentioned relativistic corrections).

The majority of the latest experiments have been designed to be high sensitivity null measurements, although the early work of Mackenzie and, to some extent, that of Long instead involved measurements of the absolute value of G at two or more different mass spacings. While a workable scheme in principle, the absolute measurements are usually burdened with large drifts and metrological difficulties. This sometimes makes their results open to question.

Frank Stacey and his colleagues at the University of Queensland in Australia have undertaken a series of geophysical measurements in search of a non-newtonian component in the earth's gravitational field. A reanalysis of existing gravity data, Stacey (1983), has motivated them to do this, and their work is currently in progress.

Tests of the superposition principle as applied to gravitational fields also belong in this category. Work in this area is being done by G. Luther at the United States National Bureau of Standards (in progress), and also by P. Czippott and J. Goodkind at the University of California, San Diego (also in progress).

Finally, reviews of the  $G(R)$  measurements have been given by Hoskins, et al. (1983) and by Newman (in press) wherein the results have been tabulated and thoroughly discussed. Those interested in the overall status of this type of experimental search for non-newtonian effects are encouraged to consult these works.

#### 11. Measurements of the Dependence of $G$ on Time

Perhaps no other area of gravitation is of greater interest to theorists and cosmologists than the possibility of variations of  $G$  in time. There have been many theories calling for a time-varying  $G$ , each having its own implications on the behavior of matter and radiation at the early moments of the universe.

Here again, the experiments fall into three categories : laboratory, geophysical and astronomical. If such an effect exists, it is agreed that it must be very, very small; probably on the order of  $\dot{G}/G \approx 10^{-11} \text{ year}^{-1}$ . Few laboratory tests of any kind have been done at this level, and it is not surprising that the existing laboratory tests of this effect are limited at the level of  $10^{-7} < \dot{G}/G < 10^{-8} \text{ year}^{-1}$ . Several experiments with test masses have been proposed for both earth-surface and orbiting laboratories which should be sensitive to the predicted  $10^{-11} \text{ year}^{-1}$  changes, but none has yet been completed.

The geophysical tests have usually involved studies of the expansion of the earth or investigations of a paleobiologic type. While these provide corroborating evidence, they are not usually accepted as hard proof because of the many uncertain factors involved. Wesson's contributions are the most complete in this area, and his book "Cosmology and Geophysics" (1978) should be consulted for a thorough review of geophysical investigations of  $\dot{G}/G$ .

Van Flandern (1981, 1983) claims that all three astronomical tests of  $\dot{G}/G$  are now yielding similar results; and that  $\dot{G}/G \approx -(6 \pm 2) \times 10^{-11} \text{ year}^{-1}$ . These tests include : (1) lunar laser ranging, (2) radar ranging of the inner planets, and (3) lunar occultation studies and determinations of the moon's orbit. The data from these three experiments have been coming in for several years now and have been carefully analyzed by several workers. The results for  $\dot{G}/G$  from each of them have great importance, as each method poses an

independent check on the other. Space limitations prevent a thorough presentation and discussion of these results here, but a recent paper by Van Flandern (1981) does this.

The results from other sources, including laboratory experiments and those derived from cosmological considerations, are listed in Table V. Although these areas are, at the moment, of secondary importance to the astronomical tests listed above, it is likely that sufficiently accurate data from all areas will have to be available and in agreement before the existence of a nonzero  $\dot{G}/G$  is accepted.

Table V

Author	Year	Technique	$ \dot{G}/G  \text{ year}^{-1}$
Hoffmann	1962	Quartz pendulum gravimetry	$< 4 \times 10^{-8}$
Curott	1965	Quartz pendulum gravimetry	$< 6.2 \times 10^{-7}$
Weiss, Block	1965	Quartz spring gravimetry (drift limit, no firm result quoted)	$< 3.6 \times 10^{-6}$
Stephenson	1967	Reanalysis of Heyl's G measurements	$\sim 10^{-4}$ (periodic annually)
Newton	1968	Earth spindown	$\sim 10^{-10}$
Morganstern	1972	Flat space cosmology analysis	$\sim 10^{-11}$
Morganstern	1972	Closed space cosmology analysis	$\sim 3 \times 10^{-11}$
Eichendorf, Reinhardt	1977	Study of variations in the surface temperature of the earth	$(2.3 \pm 0.6) \times 10^{-11}$
Barrow	1978	Cosmological considerations	$(1.5 \pm 0.7) \times 10^{-12}$
Yang, et al.	1979	Analysis of nucleosynthesis data	$5 \times 10^{-13}$
Lambeck	1979	Earth spindown	$(2.5 \pm 0.5) \times 10^{-11}$
Lapiedra, Palacios	1981	Planetary orbit studies	$< 7.5 \times 10^{-13}$
Rothman, Matzner	1982	Reanalysis of nucleosynthesis data	$< 1.7 \times 10^{-13}$

## 12. Measurements of Spontaneous Matter Creation

Most of the theories that call for a non-zero  $\dot{G}/G$  also require the spontaneous creation of matter. This is usually the result of a gauge condition; or is in response to satisfying some phenomenological requirement, such as maintaining constant density in the universe. In a Machian universe, the value of the gravitational constant and processes like matter creation are presumably coupled in such a way that the value (or existence) of one affects the other. Therefore, it seemed appropriate to include the known experimental tests, tests in progress, and proposed tests of this effect, too.

In terms of categories, the  $\dot{M}/M$  experiments are classifiable in the same way as the  $\dot{G}/G$  experiments. There are substantially fewer of them, and only one laboratory experiment, that of S. Cohen and J. King, has yielded a result, which was null at the  $\dot{M}/M = 10^{-23} \text{ s}^{-1}$  level.

## 13. Measurements of the Dependence of G on the State of Quantization of the Test Masses

There have been two proposals for measuring  $G$  in terms of  $h$ , the Planck constant. These experiments, if ever done, will be the first direct tests of a quantum structure of the gravitational field. One indirect test by D. Page and C. Geilker has been carried out but is disputed.

## 14. Measurements of the Anisotropies of G and of Inertial Mass

The famous Hughes-Drever class of experiments all produced results which, to very high precision, showed that matter is evenly distributed in the universe. Dicke (1961) showed that they should be null measurements in principle, however.

Somewhat later, this question of large scale anisotropy in the universe arose again. This time, however, in the context of a variation of  $G$  with respect to direction on a universal scale. Warburton and Goodkind (1976) analyzed earth tide data taken with a superconducting gravimeter and found an effect not inconsistent with such a variation, but could not verify it due to uncertainties in the structure of the earth tides.

A room temperature, feedback torsion balance has been constructed at the Cavendish Laboratory for a similar investigation. It is, though, presently inactive.

Summary of Section II

For the most part, purely theoretical papers that discuss the possibility of variations in G (but do not set limits on it) have not been included. The goal here was to describe instead the "hard facts" so that all workers in the field could more easily assess the state of our knowledge.

The results of the different searches for variations in G are summarized in Table VI. Usually, the result claiming highest precision is quoted, although, where appropriate, a result typical of those in its class is given instead.

Some results entered in Table VI are dimensionless. In these cases, the authors listed had tried to set limits on some appropriate dimensionless scale factor. Their original results (where necessary) have been translated into the more familiar  $\Delta G/G$  format for presentation here.

Table VI

Effect	Author	Year	Result ( $\Delta G/G$ )
Gravitational permeability or absorption	M. Caputo	1962	$< 6 \times 10^{-16}$
Directive action of gravitational force	P.R. Heyl	1924	$< 10^{-9}$
Dependence of G on physical and/or chemical states of matter	For a review, see C. Will	1981	$< 10^{-12}$
Temperature dependence via a Cavendish balance	P.E. Shaw, N. Davy	1922	$< 2 \times 10^{-6} \text{ } ^\circ\text{C}^{-1}$
Temperature dependence via a common balance	J.H. Poynting, P. Phillips	1905	$< 10^{-10} \text{ } ^\circ\text{C}^{-1}$
Gravitation/radioactivity coupling	P. Zeeman	1918	$< 5 \times 10^{-8}$
Dependence of G on magnetization of matter	M.G. Lloyd	1909	$< 5 \times 10^{-12} \text{ Gauss}^{-1}$
Dependence of G on electrification of matter	L. Simons	1922	$< 1.2 \times 10^{-7} \text{ V}^{-1}$
G(R)	R.E. Spero, et al.	1980	$(1 \pm 7) \times 10^{-5}$
$\dot{G}/G$ (Astronomical)	For a review, see T. Van Flandern	1981	$(-6 \pm 2) \times 10^{-11} \text{ year}^{-1}$
$\dot{G}/G$ (Laboratory)	W.F. Hoffmann	1963	$< 4 \times 10^{-8} \text{ year}^{-1}$
$\dot{M}/M$ (Laboratory)	S. Cohen, J.G. King	1969	$< 4 \times 10^{-23} \text{ s}^{-1}$

### III. Closing

As mentioned previously, this work is meant to be a resource bibliography, not a critical review of the status of each of the various areas treated here. It is hoped that the readers of this bibliography will benefit from the relatively comprehensive listing of references given here. Further, it is hoped that readers will respond with missing references if possible. This will be the only way that the "holes" can be filled, since the work to bring the bibliography to the present level has been more than one person should attempt alone.

As much useful information as possible has been put into each citation. References to work done in the Soviet Union are harder to get than most others. This is because there does not seem to be any direct exchange mechanism between Soviet libraries and Western libraries. Nevertheless, most of the important works published there have been obtained by the author and appropriately catalogued.

The references have been recorded at the BIPM using computerized word processors. This makes it possible to seek, sort and list them by author, date, journal and key word(s). The flexibility of this system makes this bibliography, in fact, a gravitational physics data base. Searches of it by non-BIPM personnel can be made under special arrangement.

English translations of some non-English articles in the bibliography (except those marked with an asterisk) are available from the author, also via special arrangement.

The addresses and telephone numbers of the research libraries that have been most helpful in this work are given below.

Library of the United States National Bureau of Standards  
U.S. Department of Commerce  
Washington, D.C. 20234  
USA  
(301) 921-2318

Superintendant of Documents  
U.S. Government Printing Office  
Washington, D.C. 20402  
USA  
(202) 783-3238

National Technical Information Service  
U.S. Department of Commerce  
5285 Port Royal Road  
Springfield, Virginia 22161  
USA  
(703) 487-4650

The Library of Congress  
Photoduplication Service  
10 First Street S.E.  
Washington, D.C. 20540  
USA  
(202) 426-5000

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Microreproduction Laboratory, Room 14-0551  
Massachusetts Institute of Technology  
77 Massachusetts Avenue  
Cambridge, Massachusetts 02139  
USA  
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Charlottesville, Virginia 22901  
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F-75971 Paris Cedex 20  
France  
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United Kingdom  
(0937) 843434

The author shall continue to add to this bibliography as more work on G is done in the future and as other previous reports are uncovered and made available.

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- BIBLIOGRAPHY -

1. Measurements of the Absolute Value of G and Reports of Important Subsidiary Technology

AGAFONOV, N.I. et al.\* Forced oscillations of the torsion balance under the action of rocking. In : Problems of Gravitational Measurements. Experimental Physics, Ser.B, v.1., Moscow, VNIIIFI, 1971.

AGAFONOV, N.I. et al.\* Torsion balance oscillation frequencies in the presence of rocking. In : Problems of Gravitational Measurements, Moscow, VNIIIFI, 1974.

AIRY, G.B. Report on the Harton experiments. Mon. Not. R. Astron. Soc., 15 1855 : 35-36.

AIRY, G.B. Note respecting the recent pendulum experiments in the Harton colliery. Mon. Not. R. Astron. Soc., 15 1855 : 46.

AIRY, G.B. Report on the Harton experiments. Mon. Not. R. Astron. Soc., 15 1855 : 125-126.

AIRY, G.B. Note sur les observations du pendule exécutées dans les mines de Harton pour déterminer la densité moyenne de la terre. Ann. Chim. Phys., 43 1855 : 381-383.

AIRY, G.B. Extrait du rapport présenté à la 35<sup>e</sup> séance anniversaire de la Société Royale Astronomique de Londres par le Conseil de cette société, le 9 février 1855. Arch. Sci. Phys. Nat., 29 1855 : 177-191.

AIRY, G.B. On the computation of the effect of the attraction of mountain-masses, as disturbing the apparent astronomical latitude of stations in geodetic surveys. Philos. Trans. R. Soc. London, 145 1855 : 101-104.

AIRY, G.B. On the computation of the effect of the attraction of mountain-masses as disturbing the apparent astronomical latitude of stations in geodetic surveys. Mon. Not. R. Astron. Soc., 16 1856 : 42-43.

AIRY, G.B. Report on the Harton experiments. Mon. Not. R. Astron. Soc., 16 1856 : 104.

AIRY, G.B. Account of pendulum experiments undertaken in the Harton colliery for the purpose of determining the mean density of the earth. Philos. Trans. R. Soc. London, 146 1856 : 297-342.

AIRY, G.B. Supplement to the 'account of pendulum experiments undertaken in the Harton colliery' ; being an account of experiments undertaken to determine the correction for the temperature of the pendulum. Philos. Trans. R. Soc. London, 146 1856 : 343-355.

AIRY, G.B. Ueber die in der Kohlengrube von Harton zur Bestimmung der mittleren Dichte der Erde unternommenen Pendelbeobachtungen. Ann. Phys. (Leipzig), 97 1856 : 599-605.

AIRY, G.B. Account of pendulum experiments undertaken in the Harton colliery for the purpose of determining the mean density of the earth. Philos. Mag., 12 1856 : 228-231.

AIRY, G.B. Supplement to the 'account of pendulum experiments undertaken in the Harton colliery'; being an account of experiments undertaken to determine the correction for the temperature of the pendulum. Philos. Mag., 12 1856 : 467-468.

AIRY, G.B.\* On the pendulum experiments lately made in the Horton colliery, for ascertaining the mean density of the earth. Am. J. Sci., 21 1856 : 359-364.

AIRY, G.B. Mémoire sur les expériences entreprises dans la mine de Harton pour déterminer la densité moyenne de la terre. Arch. Sci. Phys. Nat., 35 1857 : 15-29.

AIRY, G.B. Supplement to the 'account of pendulum experiments undertaken in the Horton colliery' being an account of experiments undertaken to determine the correction for the temperature of the pendulum. Proc. R. Soc. London, 8 1857 : 58-59.

AIRY, G.B. On the pendulum experiments lately made in the Harton colliery, for ascertaining the mean density of the earth. Proc. R. Instit. (G.B.), 2 1858 : 17-22.

AIRY, G.B. Account of pendulum experiments undertaken in the Harton colliery for the purpose of determining the mean density of the earth (with a supplement). Mon. Not. R. Astron. Soc., 18 1858 : 222.

ANIKIN, V.L., et al.\* Torsion balance for measurements of the Cavendish constant of gravitation. In : Problems in Standardization, Metrology, and the Precise Measurement Technique, Moscow, House of Standards, 1973.

Anonymous. Weighing the earth. Spectrum, September 1967 : 7.

AUGUSTIN, R., de BOER, H., HAARS, H. and MICHAELIS, W. Ein haftriebungsfreies Quecksilber-Axiallager für die Präzisionsmessung sehr kleiner Drehmomente. Feinwerktechnik und Messtechnik, 89 1981 : 280-283.

AUGUSTIN, R., de BOER, H., HAARS, H. and MICHAELIS, W. Ein selbstzentrierendes Quecksilberlager. Feinwerktechnik und Messtechnik, 90 1982 : 411-413.

BACON, F. Opera Omnia, Frankfurt a. M., Folio, 1665.

BAILLE, J.-B. Sur la résistance de l'air dans les mouvements oscillatoires très lents. C.R. Acad. Sci., 96 1883 : 1493-1495.

BAILY, F. Bericht von einigen Versuchen mit der Drehwage zur Bestimmung der mittleren Dichtigkeit der Erde. Ann. Phys.(Leipzig), 57 1842 : 453-467.

BAILY, F. An account of some experiments with the torsion-rod for determining the mean density of the earth. Philos. Mag., 21 1842 : 111-121.

BAILY, F. Résultats de quelques expériences faites avec la balance de torsion pour déterminer la densité moyenne de la terre. Ann. Chim. Phys., 5 1842 : 338-353.

BAILY, F. Résultats de quelques expériences faites avec la balance de torsion pour déterminer la densité moyenne de la terre. Bibliothèque Universelle de Genève, 43 1843 : 177-181.

BAILY, F. Experiments with the torsion-rod for determining the mean density of the earth. Mem. R. Astron. Soc., 14 1843 : 1-120 and i-ccxlviii.

BAILY, F. An account of some experiments with the torsion-rod for determining the mean density of the earth. Mon. Not. R. Astron. Soc., 5 1843 : 188.

BAILY, F. An account of some experiments with the torsion-rod for determining the mean density of the earth. Mon. Not. R. Astron. Soc., 5 1843 : 197-206.

BARTOLI, A. Die Dichte eines festen Körpers, welcher alle einfachen Körper enthält, und vergleichung derselben mit der mittleren Dichte der Erde. Repertorium der Physik, 22 1886 : 123-126.

BARUS, C. Gravitational attraction in connection with the rectangular interferometer. Proc. Nat. Acad. Sci. U.S.A., 4 1918 : 338-342.

BARUS, C. The motion of a gravitating needle. Science, 50 1919 : 214-216.

BARUS, C. Displacement Interferometry Applied to Acoustics and Gravitation, Washington, D.C., Carnegie Institution, 1921.

BARUS, C. Periods and logarithmic decrement of the gravitation needle under high exhaustion. Proc. Nat. Acad. Sci. U.S.A., 8 1922 : 63-66.

BARUS, C. Static deflection, logarithmic decrement and first semi-period of the vacuum gravitation needle. Proc. Nat. Acad. Sci. U.S.A., 8 1922 : 313-316.

BEAMS, Jesse Wakefield. Method of determining the gravitational constant G. Proc. Virginia J. Sci., 15 1964 : 269.

BEAMS, J.W. and LOWRY, R.A. The determination of Newton's gravitational constant, G, with improved precision. Final Report, NASA Institutional Subgrant, Code 4055-8320, 1964 (unpublished), 2 pp.

BEAMS, J.W., KULTHAU, A.R., LOWRY, R.A., and PARKER, H.M. New method for measuring the gravitational constant G. Bull. Am. Phys. Soc., 11 1965 : 249.

BEAMS, J.W., KULTHAU, A.R., LOWRY, R.A., and PARKER, H.M. Determination of Newton's gravitational constant, G, with improved precision. University of Virginia Status Report No. EP-4028-101-65U, June 1965 (unpublished), 25 pp.

BEAMS, J.W., KULTHAU, A.R., LOWRY, R.A. and PARKER, H.M. Determination of Newton's gravitational constant, G, with improved precision. University of Virginia Status Report No. EP-4028-102-65U, September 1965 (unpublished), 25pp.

BEAMS, J.W. Density gradient measurement in solids. Bull. Am. Phys. Soc., 11 1966 : 526.

BEAMS, J.W., KULTHAU, A.R., LOWRY, R.A., and PARKER, H.M. Determination of Newton's gravitational constant, G, with improved precision. University of Virginia Status Report No. EP-4028-103-66U, May 1966 (unpublished), 24pp.

BEAMS, J.W., KULTHAU, A.R., LOWRY, R.A., PARKER, H.M., and SENTER, J.P. Determination of Newton's gravitational constant, G, with improved precision. University of Virginia Status Report No. EP-4028-104-66U, December 1966 (unpublished), 26pp.

BEAMS, J.W., KULTHAU, A.R., LOWRY, R.A., PARKER, H.M., and SENTER, J.P. Determination of Newton's gravitational constant, G, with improved precision. University of Virginia Status Report No. EP-4028-105-67U, June 1967 (unpublished), 26pp.

BEAMS, J.W., KULTHAU, A.R., LOWRY, R.A., PARKER, H.M., and SENTER, J.P. Determination of Newton's gravitational constant, G, with improved precision. University of Virginia Status Report No. EP-4028-106-67U, November 1967 (unpublished), 26pp.

BEAMS, J.W. Finding a better value for G. Phys. Today, 24 1971 : 34-40.

BELL, DUANE, JACOBSEN, and KOLM.\* Report on the 1949/50 Cavendish Experiment, 8.11 Laboratory Report, Cambridge, Mass., MIT, 1950.

BELOKOPYTOV, P.M., BOYEVKIN, V.I., NIKONOV, B.S., PAVLOV, Yu.N., and TOLSTOUSU, G.N. Torsional oscillation test stand for investigation of highly sensitive gravimetric and accelerometric instrumentation. In : Determination of Gravity Constant and Measurement Certain Fine Gravity Effects, edited by Yu.D. Boulanger and M.U. Sagitov, NASA Technical Translation F-15, 722, Accession Code No. N74-30831, Washington, D.C., U.S. Government Printing Office, 1974 : 95-100.

BERGET, Alphonse. Détermination expérimentale de la constante de l'attraction universelle, ainsi que de la masse et de la densité de la terre. C.R. Acad. Sci., 116 1893 : 1501-1503.

BERMAN, David. Discussion and analysis of the rotating flat plate newtonian gravitational constant experiment. In : Research Toward Feasibility of an Instrument for Measuring Vertical Gradients of Gravity, principal investigator Robert L. Forward, Final Report AFCRL-67-0631, Contract No. AF-19(628)-6134, Malibu, California, Hughes Research Laboratories, 1967 : F-1 - F-35.

BERMAN, D. Discussion and analysis of the vertically tunneled sphere-newtonian gravitational constant experiment. In : Research Toward Feasibility of an Instrument for Measuring Vertical Gradients of Gravity, principal investigator Robert L. Forward, Final Report AFCRL-67-0631, Contract No. AF-19(628)-6134, Malibu, California, Hughes Research Laboratories, 1967 : G-1 - G-19.

BERMAN, D. Analysis of the rotating flat plate Newtonian gravitational constant experiment. Hughes Research Laboratories Report No. 385, April 1968 (unpublished), 26pp.

BERMAN, David and FORWARD, Robert L. Free-fall experiments to determine the Newtonian gravitational constant (G). In : Exploitation of Space for Experimental Research, Paper No. AAS68-053 in the Science and Technology Series, v.24, Tarzana, California, American Astronautical Society, 1968 : 95-115.

BESSEL, G.F.\* Abhandlungen der Königlich Preussischen Akademie der Wissenschaften zu Berlin 1830 : 4.

BESSEL, G.F. Collection de mémoires relatifs à la physique, publiés par la Société Française de Physique. Mém. Rel. à la Phys., 5 1889 : 72-133.

BIRCH, T. The History of the Royal Society of London, 4 v., London, 1756.

BLEYER, Ulrich and JOHN, R.W. Zur theoretischen Analyse einer neuen Methode zur Bestimmung der Gravitationskonstante. I. Mechanische Größen des dynamischen Systems. Gerlands Beitr. Geophys. (Leipzig), 85 1976 : 402-404.

BLEYER, U., JOHN, R.W. and LIEBSCHER, D.-E. On a new method of determining the gravitational constant. In : Thesis of the Fourth Soviet Conference on Gravitation, Minsk, USSR, 1976 : 146-148.

BLEYER, U. and JOHN, R.W. Zur theoretischen Analyse einer neuen Methode zur Bestimmung der Gravitationskonstante. II. Bewegung der Probemasse. Gerlands Beitr. Geophys. (Leipzig), 86 1977 : 11-22.

BLEYER, U., JOHN, R.W. and LIEBSCHER, D.-E. On a new method of determining the gravitational constant. Gerlands Beitr. Geophys. (Leipzig), 86 1977 : 148-152.

BLEYER, U., JOHN, R.W. and LIEBSCHER, D.-E.\* A new method of determining the gravitational constant using superconductive suspension. 1978 (unpublished).

BLOCK, B., MOORE, R.D. and ROOS, P. Do-it-yourself Cavendish balance. Am. J. Phys., 33 1965 : 963-965.

BOUGUER, P. La Figure de la Terre, Paris, 1749.

BOUGUER, P.\* Sur la direction qu'affectent les fils-à-plomb. Hist. de l'Acad. Roy. des Sci. avec les Mém. de Math. et de Phys. 1754 : 1-10.

BOUGUER, P.\* Sur la direction qu'affectent les fils-à-plomb. Hist. de l'Acad. Roy. des Sci. avec les Mém. de Math. et de Phys. 1754 : 150-168.

BOULANGER, Yu.D. and SAGITOV, M.U.\* Comments on the term 'Cavendish constant of gravitation'. In : Problems of Gravitational Measurements. Experimental Physics, Ser.B, v.1, Moscow, VNIIIFI, 1971.

BOULANGER, Yu.D., and SAGITOV, M.U. Determination of gravity constant and measurement of certain fine gravity effects. In : Determination of the Gravity Constant and Measurement of Certain Fine Gravitational Effects, edited by Yu.D. Boulanger and Sagitov, M.U., NASA Technical Translation F-15 722, Accession Code No. N74-30831, Washington, D.C., U.S. Government Printing Office, 1974 : 1-7.

BOYLE, R.\* Works, v.5, edited by T. Birch, London, Folio, 1744.

BOYS, C. Vernon. The radio-micrometer. Philos. Trans. R. Soc. London, Ser.A, 180 1889 : 159-186.

BOYS, C.V. On the Cavendish experiment. Proc. R. Soc. London, 46 1889 : 253-268.

BOYS, C.V. Royal Society Conversazione. Nature (London), 40 1889 : 65.

BOYS, C.V. On the Cavendish experiment. Nature (London), 41 1889 : 155-159.

- BOYS, C.V. The newtonian constant of gravitation. Proc. R. Instit.  
(G.B.), 14 1894 : 353-377.
- BOYS, C.V. On the newtonian constant of gravitation. Nature  
(London), 50 1894 : 330-334.
- BOYS, C.V. On the newtonian constant of gravitation. Nature  
(London), 50 1894 : 366-368.
- BOYS, C.V. On the newtonian constant of gravitation. Nature  
(London), 50 1894 : 417-419.
- BOYS, C.V. The newtonian constant of gravitation. Nature (London),  
50 1894 : 571.
- BOYS, C.V. On the newtonian constant of gravitation. Proc. R. Soc.  
London, 56 1894 : 131-132.
- BOYS, C.V. The attachment of quartz fibers. Philos. Mag., 37  
1894 : 463-467.
- BOYS, C.V. Ueber die newton'sche Gravitationskonstante. Beiblätter  
für Physik, 19 1895 : 229-230.
- BOYS, C.V. On the newtonian constant of gravitation. Philos. Trans.  
R. Soc. London, Ser.A, 186, 1895 : 1-72.
- BOYS, C.V. The newtonian constant of gravitation. Arch. Sci. Phys.  
Nat., 33 1895 : 179-180.
- BOYS, C.V. La constante de la gravitation. In : Rapports présentés  
au Congrès Internationale de Physique, v.3, Paris, Gauthiers-Villars,  
1900 : 306-349.
- BOYS, C.V. Discussion. Proc. Phys. Soc. London, 29 1917 : 163-  
170.
- BOYS, C.V. Discussion. Chem. News, 115 1917 : 116-117.
- BOYS, C.V. Earth, the mean density of the. In : A Dictionary of  
Applied Physics, edited by Sir Richard Glazebrook, London, Macmillan,  
1923 : 279-285.
- BOYS, C.V. Quartz fibers. In : A Dictionary of Applied Physics,  
edited by Sir Richard Glazebrook, London, Macmillan, 1923 : 695-  
699.
- BOYS, C.V. Radio-micrometer and some other instruments depending upon  
quartz fibers. In : A Dictionary of Applied Physics, edited by Sir  
Richard Glazebrook, London, Macmillan, 1923 : 720-723.

BRAUN, Carl. Die Gravitations-Konstante, die Masse und mittlere Dichte der Erde nach einer neuen experimentellen Bestimmung. Denkschriften der Academie von Wissenschaft zu Wien, Mathematische und Naturwissenschaftliche Klasse, 64 1897 : 187-258.

BRAUN, C. Die Gravitations-Konstante, die Masse und mittlere Dichte der Erde nach einer neuen experimentellen Bestimmung. Naturwissenschaftliche Rundschau, 12 1897 : 273-277.

BRAUN, C. A new determination of the gravitation constant and the mean density of the earth (reported by J.H. Poynting). Nature (London), 56 1897 : 127-128.

BRAUN, C. The gravitation constant. Nature (London), 56 1897 : 198.

BRAUN, C. Die Gravitations-Konstante, die Masse und mittleren Dichte der Erde nach einer neuen experimentellen Bestimmung. Beiblätter für Physik, 21 1897 : 561-563.

BRAUN, C. Ueber eine neue Bestimmung der mittleren Dichte der Erde durch Pater Braun (reported by F.K. Ginzel). Himmel und Erde, 10 (9) 1898 : 385-395.

BRAUN, C. A new determination of the earth's density (reported by F.K. Ginzel). Nature (London), 58 1898 : 160.

BRAUN, C. Die Gravitations-Konstante, die Masse und mittlere Dichte der Erde nach einer neuen experimentellen Bestimmung (reported by F. Richarz). Vierteljahrsschrift der Astronomischen Gesellschaft, 33 1898 : 33-44.

BRYZZHEV, L.D.\* Weighting technique for the determination of the constant of gravitation. In : Measurements of the Gravitational Acceleration and Constant, Kharkov, KhGNIIM, 1972.

BUCHNEVA, L.G.\* Nomograms allowing for torsion balance asymmetry in determination of the Cavendish constant. In : Problems of Gravitational Measurements, Experimental Physics, Ser.B, v.1, Moscow, VNIIIFI, 1971.

BURGESS, George Kimbel. Méthode pour déterminer la constante newtonienne. C.R. Acad. Sci., 129 1899 : 407-409.

BURGESS, G.K. Recherches sur la constante de gravitation. Thèses présentées à la Faculté des Sciences de Paris pour obtenir le titre de Docteur de l'Université de Paris, Paris, Librairie Scientifique A. Hermann, 1901, 62pp.

BURGESS, G.K. A new form of Cavendish balance. Phys. Rev., 14 1902 : 247-256.

BURGESS, G.K. The value of the gravitation constant. Phys. Rev., 14 1902 : 257-264.

BURGESS, G.K. Constant of gravitation. In : Annual Report of the Director of the Bureau of Standards to the Secretary of Commerce for the Fiscal Year Ended June 30, 1927. National Bureau of Standards (U.S.), Miscellaneous Publication 81, Washington, D.C., U.S. Printing Office, 1927 : 6.

CARLINI, Francesco. Osservazioni della lunghezza del pendolo semplice fatte all'altezza di mille tese sul livello del mare. Eff. Astron. di Milano, 1824 : 28-40.

CARLINI, F.\* Osservazioni della lunghezza del pendolo semplice fatte all'altezza di mille tese sul livello del mare. Bull. des Sc. Math. (Férussac), 3 1825 : 298-301.

CAVENDISH, Henry. Experiments to determine the density of the earth. Philos. Trans. R. Soc. London, 88 1798 : 469-526.

CAVENDISH, H. Experiments to determine the density of the earth (Expériences pour déterminer la densité de la terre). Bibliothèque Britannique, Genève, 11 1799 : 233-241.

CAVENDISH, H. Versuche um die Dichtigkeit der Erde zu bestimmen. Ann. Phys. (Leipzig), 2 1799 : 1-62.

CAVENDISH, H. Expériences pour déterminer la densité de la terre. Journal de l'Ecole Polytechnique, 10 1815 : 263-320.

CHAPMAN, Philip K. A Cavendish experiment in earth orbit. M.I.T. preprint, 1969 (unpublished).

CLARKE, A.R. Geodesy, Oxford, 1880.

COOK, A.H. and PARKER, R.L. Some preliminary studies for a new determination of the constant of gravitation. Report No. ST-3, National Physical Laboratory, Standards Division, Teddington, England, October 1962, 27pp.

COOK, A.H. A new determination of the constant of gravitation. Contemp. Phys., 9 1968 : 227-238.

COOK, A.H. The experimental determination of the constant of gravitation. In : Precision Measurement and Fundamental Constants I, edited by D.N. Langenberg and B.N. Taylor, National Bureau of Standards (U.S.) Special Publication 343, Washington, D.C., United States Printing Office, 1971 : 475-483.

COOK, A.H. and CHEN, Y.T. On the significance of the radial Newtonian gravitational force of the finite cylinder. J. Phys. A : Math. Gen., 15 1982 : 1591-1597.

CORNU, A. and BAILLE, J.. Détermination nouvelle de la constante de l'attraction et de la densité moyenne de la terre. C.R. Acad. Sci., 76 1873 : 954-958.

CORNU, A. and BAILLE, J. Mutual determination of the constant of attraction, and of the mean density of the earth. Chem. News, 27 1873 : 211.

CORNU, A. and BAILLE, J. Etude de la résistance de l'air dans la balance de torsion. C.R. Acad. Sci., 86 1878 : 571-574.

CORNU, A. and BAILLE, J. Sur la mesure de la densité moyenne de la terre. C.R. Acad. Sci., 86 1878 : 699-702.

CORNU, A. and BAILLE, J. Influence des termes proportionnels au carré des écarts, dans le mouvement oscillatoire de la balance de la torsion. C.R. Acad. Sci., 86 1878 : 1001-1004.

CORNU, A. and BAILLE, J. Bestimmung der mittleren Dichtigkeit der Erde. Beiblätter zu den Annalen der Physik und Chemie, 2 1878 : 453-454.

CORNU, A. Researches on the mean density of the earth. Mon. Not. R. Astron. Soc., 51 1890 : 446-447.

CORNU, A. Researches on the mean density of the earth. Nature (London), 44 1891 : 327.

CREMIEU, V. Détermination nouvelle de la constante newtonienne. C.R. Acad. Sci., 149 1909 : 700-702.

DE BOER, H. Berichte der Abteilungen. 2.1.1 (Mechanik). In : Physikalisch-Technische Bundesanstalt Jahresbericht-1976, Braunschweig, PTB, 1977 : 38.

DE BOER, H. Berichte der Abteilungen. 2.1.1 (Mechanik). In : Physikalisch-Technische Bundesanstalt Jahresbericht-1978, Braunschweig, PTB, 1979 : 40.

DE BOER, H., HAARS, H. and MICHAELIS, W. Schwingungsisolierter Messtisch mit Niveauregelung. In : Physikalisch-Technische Bundesanstalt Jahresbericht-1979, Braunschweig, PTB, 1980 : 138.

DE BOER, H., HAARS, H. and MICHAELIS, W. Ein schwingungsisolierter Messtisch mit niveau Regelung. Feinwerktechnik und Messtechnik, 88 1980 : 233-236.

DE BOER, H., HAARS, H., MICHAELIS, W. and SCHLIMME, E. Quadrantenelektrometer als Drehmomentmesser für kleine Drehmomente. Feinwerktechnik und Messtechnik, 88 1980 : 237-241.

DE BOER, H., HAARS, H. and MICHAELIS, W. Selbstzentrierendes haftreibungsfreies Quecksilberlager. In : Physikalisch-Technische Bundesanstalt Jahresbericht-1980 Kurzfassung, Braunschweig, PTB, 1981 : 141.

- DE BOER, H., HAARS, H. and MICHAELIS, W.\* Ein selbstzentrierendes Quecksilberlager. Feinwerktechnik und Messtechnik, to be published.
- DE LA CONDAMINE, Ch. M. Journal du Voyage, Paris, 1751.
- DE LA CONDAMINE, Ch. M. Supplément au Journal Historique, 2 parts, Paris, 1752.
- DUANE, Bernard H. Design of an apparatus to measure the gravitational constant. B.S. Thesis, M.I.T., 1950, unpublished, 49pp.
- ESPOSITO, Pasquale B. Evaluation of the geocentric gravitational constant from Viking doppler and range data. J. Geophys. Res., 84 1979 : 3654-3658.
- EÖTVÖS, R. Untersuchungen über Gravitation und Erdmagnetismus. Ann. Phys. (Leipzig), 59 1896 : 354-400.
- EÖTVÖS, R.\* Math. és Term.-tud. Ert. (Hungary), 14 1896 : 221-266.
- EÖTVÖS, R.\* Math. und Naturwiss. Berichten aus Ungarn, 13 1896 : 193-243.
- EÖTVÖS, R.\* Gesammelte Arbeiten, edited by P. Selényi, Budapest, 1953.
- EÖTVÖS, R. Determination of the gravity constant. In : The Constant of Gravitation, edited by L. Stegna and M.U. Sagitov, Budapest, Eötvös University, Akadémiai Kiado, 1979 : 247-254.
- FACY, Leopold and PONTIKIS, Constantin. Détermination de la constante de gravitation par une méthode de résonance. C.R. Acad. Sci., 270 1970 : 15-18.
- FACY, L. and PONTIKIS, C. Détermination de la constante de gravitation par la méthode de résonance. C.R. Acad. Sci., 272 1971 : 1397-1398.
- FARINELLA, Paolo, MILANI, Andrea and NOBILI, Anna M.\* Measurement of the gravitational constant in space. In : Instabilities in Dynamic Systems, edited by V.G. Szebehely, NATO Advanced Study Institute Series C, v. 47, Dordrecht, Reidel, 1979 : 296-297.
- FARINELLA, P., MILANI, A. and NOBILI, A.M. Measurement of the gravitational constant in space. INIS ATOMINDEX, 11 1980 : 3275.
- FARINELLA, P., MILANI, A. and NOBILI, A.M. The measurement of the gravitational constant in an orbiting laboratory. Astrophys. Space Sci., 73 1980 : 417-433.

FAYE, M. Sur les instruments géodésiques et sur la densité moyenne de la terre. C.R. Acad. Sci., 56 1863 : 557-566.

FAYE, M. Sur les variations séculaires de la figure mathématique de la terre. C.R. Acad. Sci., 90 1880 : 1185-1191.

FAYE, M. Sur la réduction des observations du pendule au niveau. C.R. Acad. Sci., 90 1880 : 1443-1446.

FERRARI, A.J., SINCLAIR, W.S., SJOGREN, W.L., WILLIAMS, J.G. and YODER, C.F. Geophysical parameters of the earth-moon system. J. Geophys. Res., 85 1980 : 3939-3951.

FIALOVSKY, L. Nonlinear effects in the Eötvös method of the determination of the gravity constant. In : The Constant of Gravitation, edited by L. Stegna and M.U. Sagitov, Budapest, Eötvös University, Akadémiai Kiado, 1979 : 221-245.

FIALOVSKY, L. On a new method of determining the gravitational constant. Gerlands Beitr. Geophys. (Leipzig), 90 1981 : 448.

FORWARD, Robert L. Determination of the newtonian gravitational constant. In : Research Toward Feasibility of an Instrument for Measuring Vertical Gradients of Gravity, principal investigator Robert L. Forward, Final Report AFCRL-67-0631, Contract No. AF-19(628)-6134, Malibu, California, Hughes Research Laboratories, 1967 : 7-18.

GERSCHUN, A. Méthode pour déterminer la densité moyenne de la terre et la constante gravitationnelle. C.R. Acad. Sci., 129 1899 : 1013-1015.

GERSCHUN, A.\* An averaging method for the mean density of the earth and the constant of gravitation. Proc. Russian Astron. Soc., 8 1900.

GILBERT, W.\* De Magnete Magneticisque Corporibus et de Magno Magnete Tellure Physiologia Nova, London, 1600.

GOSSELIN, P.F.J.\* Nouvel examen sur la densité moyenne de la terre. Mém. Acad. Imp. de Metz, 7 1859 : 469-485.

GROTHEN, E. and THYSSEN-BORNEMISZA, S. Die Bestimmung der Gravitationskonstanten. Z. für Vermessungswesen, 97 1972 : 105-106.

GUGEL, L.G.\* Torsion balance-based determination of the constant of gravitation by the resonance technique. Communications of the Sternberg Astronomical Institute, No. 187, Moscow, Publications House of the Moscow University, 1974.

GUGEL, L.G.\* Comments on determination of the Cavendish constant of gravitation in stationary and pulsating gravitational fields. Communications of the Sternberg Astronomical Institute, No. 194, Moscow, Publications House of the Moscow University, 1974.

GUGEL, L.G.\* A study of techniques for determination of the constant of gravitation. Candidate Thesis, Moscow, Sternberg Institute, 1975, unpublished.

HAUGHTON, S. On the density of the earth, deduced from the experiments of the astronomer royal in the Harton coal-pit. Philos. Mag., 12 1856 : 50-51.

HAUGHTON, S. Ueber die Dichtigkeit der Erde, hergeleitet aus den Versuchen des königlichen Astronom (Hrn. Airy) in der Kohlengrube Harton. Ann. Phys. (Leipzig), 99 1856 : 332-334.

HAUGHTON, S.\* Ueber die Dichtigkeit der Erde, hergeleitet aus den Pendelbeobachtungen des Herrn Airy in der Kohlengrube Harton. Zeit. Math. Phys., 2 1857 : 68-70.

HAUGHTON, S.\* On the density of the earth, deduced from the experiments of the astronomer royal, in the Harton coal-pit. Am. J. Sci., 24 1857 : 158.

HEYL, Paul R. A redetermination of the newtonian constant of gravitation. Proc. Nat. Acad. Sci. (U.S.), 13 1927 : 601-605.

HEYL, P.R. A redetermination of the constant of gravitation. Nat. Bur. Stand. (U.S.) J. of Res., 5 1930 : 1243-1290.

HEYL, P.R. and CHRZANOWSKI, Peter. A new redetermination of the constant of gravitation. Nat. Bur. Stand. (U.S.) J. of Res., 29 1942 : 1-31.

HOOKE, R.\* Posthumous Works, London, Folio, 1705.

HULETT, Michael Jeffrey. On the newtonian gravitational constant. B.A. Thesis, Wesleyan University, 1969, 97pp.

HUTTON, Charles. An account of the calculations made from the survey and measures taken at Schehallian, in order to ascertain the mean density of the earth. Philos. Trans. R. Soc. London, 68 1779 : 689-788.

HUTTON, C. Calculations to determine at what point in the side of a hill its attraction will be the greatest, etc. Philos. Trans. R. Soc. London, 70 1780 : 1-14.

HUTTON, C. Calculations to determine at what point in the side of a hill its attraction will be the greatest, etc. Philos. Trans. R. Soc. London, 70 1780 : 603-607.

HUTTON, C. Letter from Dr. Hutton on the calculations for ascertaining the mean density of the earth. Philos. Mag., 38 1811 : 112-116.

HUTTON, C.\* Tracts on Mathematical and Philosophical Subjects, 3 v., London, 1812.

HUTTON, C.\* Letters to Laplace. J. Phys. (Blainville), 90 1820 : 307-312.

HUTTON, C. On the mean density of the earth. Philos. Trans. R. Soc. London, 111 1821 : 276-292.

HUTTON, C. On the mean density of the earth. Philos. Mag., 58 1821 : 3-13.

JAMES, H. On the deflection of the plumb-line at Arthur's Seat and the mean specific gravity of the earth. Philos. Trans. R. Soc. London, 146 1856 : 591-606.

JAMES, H. On the figure, dimensions, and mean specific gravity of the earth, as derived from the ordnance trigonometrical survey of Great Britain and Ireland. Philos. Trans. R. Soc. London, 146 1856 : 607-626.

JAMES, H. Account of the observations and computations made for the purpose of ascertaining the amount of the deflection of the plumbline at Arthur's Seat, and the mean specific gravity of the earth. Philos. Mag., 12 1856 : 314-316.

JAMES, H. On the deflection of the plumb-line at Arthur's Seat and on the mean density of the earth. Proc. R. Soc. Edinburgh, 3 1857 : 364-366.

JAMES, H. On the figure, dimensions, and mean specific gravity of the earth, as derived from the ordnance trigonometrical survey of Great Britain and Ireland. Proc. R. Soc. London, 8 1857 : 111-116.

JAMES, H. On the figure, dimensions, and mean specific gravity of the earth as derived from the ordnance trigonometrical survey of Great Britain and Ireland. Philos. Mag., 13 1857 : 129-132.

JAMES, H. On the deflection of the plumb-line at Arthur's Seat, and the mean specific gravity of the earth. Mon. Not. R. Astron. Soc., 18 1858 : 220.

JAMES, H. On the figure, dimensions, and mean specific gavity of the earth, as derived from the ordnance trigonometrical survey of Great Britain and Ireland. Mon. Not. R. Astron. Soc., 18 1858 : 220-222.

JAMES, H. and CLARKE, A.R.\* Ordnance Trigonometrical Survey of Great Britain and Ireland. Account of the Observations and Calculations of the Principal Triangulation ; and of the Figure, Dimensions, and Mean Specific Gravity of the Earth as Derived Therefrom, 2 v., London, 1858.

JAMES, H. and CLARKE, A.R. Ordnance trigonometrical survey of Great Britain and Ireland. Account of the observations and calculations of the principal triangulations ; and of the figure, dimensions, and mean specific gravity of the earth as derived therefrom. Mon. Not. R. Astron. Soc., 19 1859 : 194-199.

JOLY, J. Notice of the December 13, 1889, meeting of the university experimental science association, Dublin, Ireland. Nature (London), 41 1890 : 256.

KALINNIKOV, I.I.\* A study of horizontal torsion balance for gravitational experiments. Candidate Thesis, 1973, unpublished.

KALINNIKOV, I.I. and KOLOSNTSYN, N.I.\* Comments on the theory of the horizontal torsion balance with six degrees of freedom. In : Problems in Standardization, Metrology and the Precise Measurement Technique, Moscow, Publication House of Standards, 1973.

KALINNIKOV, I.I. and SAGITOV, M.U.\* Application of the transformation procedure to the determination of the Cavendish constant of gravitation. Communications of the Sternberg Astronomical Institute, No. 195, Moscow, Publications House of Moscow University, 1975.

KALINNIKOV, I.I. and SAGITOV, M.U. In : Thesis of the Fourth Soviet Conference on Gravitation, Minsk, USSR, 1976 : 144-146.

KELLER, Filippo. Sulla diminuzione della gravità coll'altezza. Atti Accad. Lincei, 9 1881 : 103-117.

KELLER, F. Sul metodo di Jolly per la determinazione della densità media della terra. Atti Accad. Lincei, 2 1886 : 145-149.

KELLFR, F. Sulla deviazione del filo a piombo prodotta dal prosciugamento del lago di Fucino. Atti Accad. Lincei, 3 1887 : 493-501.

KEZHUTIN, N.G.\* On errors in determination of the constant of gravitation caused by pendular oscillations of the torsion balance. In : Problems of Gravitational Measurements, Experimental Physics, Ser.B, v.1, Moscow, VNIIIFI, 1971.

KEZHUTIN, N.G. and MILYUKOV, V.K.\* Technical conditions of the experiment for determination of the constant of gravitation through the dynamic technique. In : Problems of Gravitational Measurements, Experimental Physics, Ser.B, v.1, Moscow, VNIIIFI, 1971.

KEZHUTIN, N.G. et al.\* Experience in production and precise measurement of cylindrical experimental masses for determination of the constant of gravitation. In : Problems in the Theory of Gravitation and Elementary Particles, Moscow, Atomizdat, 1975.

KEZHUTIN, N.G.\* Pendular oscillations of the torsion balance. Communications of the Sternberg Astronomical Institute, No. 135, Moscow, Publications House of Moscow University, 1975.

KOLDEWYN, W.A. and FALLER, J.E. New method of measuring the gravitational constant, G. Bull. Am. Phys. Soc., 17 1972 : 472.

KOLDEWYN, W.A. A new method for measuring the newtonian gravitational constant, G. Ph.D. Dissertation, Wesleyan University, 1976, 171pp.

KOLDEWYN, W.A. A new method for measuring the newtonian gravitational constant, G. Dissertation Abstracts International, 37B 1976 : 1731-B.

KOLDEWYN, W.A. A new method for measuring the newtonian gravitational constant, G. Scientific and Technical Aerospace Reports, 15 1977 : 254.

KÖNIG, A. and RICHARZ, F. Eine neue Methode zur Bestimmung der Gravitationskonstante. Sitzungsberichte der Königlich Preussischen Akademie von Wissenschaft zu Berlin, 1884 : 1203-1205.

KÖNIG, A. and RICHARZ, F. Eine neue Methode zur Bestimmung der Gravitationskonstante. Ann. Phys. Chem., 24 1885 : 664-668.

KÖNIG, A. Notice of discussion at a physical society meeting of Dec. 19, 1884. Nature (London), 31 1885 : 260.

KÖNIG, A. and RICHARZ, F. Proposed new method of measuring the density of the earth. Science, 5 1885 : 217-218.

KÖNIG, A. and RICHARZ, F. Communication to the Berlin Physical Society, Feb. 6, 1885. Nature (London), 31 1885 : 475-476.

KÖNIG, A. and RICHARZ, F. Remarks on our method for determining the density of the earth. Nature (London), 31 1885 : 484.

KUNZ, Jakob. Resonanzmethoden für die Bestimmung der Gravitationskonstante, G. Phys. Z., 31 1930 764-768.

LANGEVIN, Paul. Résonance et forces de gravitation. Ann. Phys. (Paris), 17 1942 : 265-271.

LASKA, W. Ueber einen neuen Apparat zur Bestimmung der Erddichte. Z. für Instrumentenkunde, 9 1889 : 354-355.

LIPPmann, G. Sur l'entretien du mouvement pendulaire sans perturbation. Entretien du pendule géodésique. C.R. Acad. Sci., 127 1899 : 15-18.

LIPPmann, G. Sur la mesure absolue du temps, déduite des lois de l'attraction universelle. J. Phys. (Paris), 8 1899 : 401-407.

LOWRY, R.A., TOWLER, W.R., PARKER, H.M., KULTHAU, A.R. and BEAMS, J.W. The gravitational constant G. In : Atomic Masses and Fundamental Constants, v.4, edited by J.H. Sanders and A.H. Wapstra, New York, Plenum, 1972 : 521-527.

LOWRY, R.A. and TOWLER, W.R. Precision measurement of the newtonian gravitational constant, G. University of Virginia Progress Report ESS-4145-101-73U, January 1973, unpublished, 6pp.

LUTHER, G.G., TOWLER, W.R., DESLATTE, R.D., LOWRY, R.A. and BEAMS, J.W. Initial results from a new measurement of the newtonian gravitational constant. In : Atomic Masses and Fundamental Constants, v.5, edited by J.H. Sanders and A.H. Wapstra, New York, Plenum, 1976 : 592-598.

LUTHER, G.G. and TOWLER, W.R. Redetermination of the newtonian gravitational constant, G. Phys. Rev. Lett., 48 1982 : 121-123.

LUTHER, G.G. and TOWLER, W.R. Redetermination of the newtonian gravitational constant, G. In : Precision Measurement and Fundamental Constants II, edited by B.N. Taylor and W.D. Phillips, National Bureau of Standards (U.S.) Special Publication 617, Washington, D.C., U.S. Printing Office, 1983, in press.

LUTHER, G.G. Determination of the gravitational constant. In : Proc. of the 3rd Marcel Grossmann Meeting on General Relativity, in press.

MARK, Robert, MASON, J. and NEIMAN, M. Gravitational Constant Study. RCA Laboratories Report No. AFCRL-63-842, 1963, unpublished, 105pp.

MARTIN, C.F. and OH, I.H. Utilization of satellite-satellite tracking data for determination of the geocentric gravitational constant GM. J. Geophys. Res., 84 1979 : 3944-3950.

MARUSSI, Antonio. Un nuovo esperimento per la determinazione della costante universale della gravitazione. Memorie Soc. Astron. Ital., 43 1972 : 823-824.

MASKELYNE, Nevil. A proposal for measuring the attraction of some hill in this kingdom by astronomical observations. Philos. Trans. R. Soc. London, 65 1775 : 495-499.

MASKELYNE, N. An account of observations made on the mountain Schehallian for finding its attraction. Philos. Trans. R. Soc. London, 65 1775 : 500-542.

MASKELYNE, N. How the earth was weighed (reported by S. Leadstone). Scots Magazine, 115 1981 : 379-381.

MAYER, Alfred M. Methods of determining the density of the earth. Nature (London), 31 1885 : 408-409.

MEISSNER, Hans. Demonstration of gravitational attraction with the Cavendish balance. Am. J. Phys., 25 1957 : 639-640.

MENABREA, L.F. Calcul de la densité de la terre. Mem. Accad. Torino, 2 1840 : 305-368.

MENDENHALL, T.C. Determination of the acceleration due to the force of gravity, at Tokio, Japan. Am. J. Sci., 20 1880 : 124-132.

MENDENHALL, T.C. On a determination of the force of gravity at the summit of Fujiyama, Japan. Am. J. Sci., 21 1881 : 98-103.

MENDENHALL, T.C. Annual meeting of the U.S. National Academy of Sciences. Nature (London), 56 1897 : 19.

METHERELL, A.J.F. The gravitational field of a hollow cylinder. Cavendish Laboratory Preprint, 1981, unpublished.

METHERELL, A.J.F. The potential function of a right-circular hollow cylinder. Cavendish Laboratory Preprint, 1981, unpublished.

METHERELL, A.J.F., SPEAKE, C.C., CHEN, Y.T. and FALLER, J.E. Optimizing the shape of the attracting mass in precision measurements of G. In : Precision Measurements and Fundamental Constants II, edited by B.N. Taylor and W.D. Phillips, National Bureau of Standards (U.S.) Special Publication 617, Washington, D.C., United States Printing Office, 1983, in press.

MICHAELIS, W. Work carried out at the PTB to determine the gravitation constant. Physikalisch-Technische Bundesanstalt Preprint, 1981, unpublished.

MILYUKOV, V.K. and SAGITOV, M.U.\* Formulas for calculation of the derivatives of attraction potential of a circular finite-length cylinder. In : Problems of Gravitational Measurements, Experimental Physics, Ser.B, v.1, Moscow, VNIIIFI, 1971.

MONAKHOV, E.A.\* The Sternberg Institute setup for a new determination of the constant of gravitation. Communications of the Sternberg Astronomical Institute, No. 216, Moscow, Publications House of Moscow University, 1977.

NASH, J.H., NEELEY, A.C. and STEGER, P.J. High-density tungsten spheres. Union Carbide Corporation Nuclear Division, Oak Ridge Y-12 Plant Technical Report No. Y-1654, November 18, 1968, unpublished, 20pp.

National Academy of Sciences - National Research Council. Space research - directions for the future. NAS/NRC Publication 1403, Chapter IV, Washington, D.C., 1966 : 329.

NAZARENKO, V.S. A torsion oscillator recording system in the experiment of the Sternberg Institute for new determination of the constant of gravitation. Communications of the Sternberg Astronomical Institute, No. 202-203, Moscow, Publications House of Moscow University, 1977.

NEWTON, Isaac. Philosophiae Naturalis Principia Mathematica, London, 1687.

NEWTON, I. De Mundi Systemate, London, 1727.

PARKER, Hermon M., LOWRY, Ralph A., KULTHAU, A.R. and BEAMS, J.W. Precision method for measuring small torques, and its application to the universal gravitational constant. Bull. Am. Phys. Soc., 11 1966 : 850.

PARKER, H.M. Discussion and analysis of the University of Virginia newtonian gravitational constant experiment. In : Research Toward Feasibility of an Instrument for Measuring Vertical Gradients of Gravity, principal investigator Robert L. Forward, Final Report AFCRL-67-0631, Contract No. AF-19(628)-6134, Malibu, California, Hughes Research Laboratories, 1967 : E-1 - E-34.

PECHMANN, E.\* Die Abweichung der Lothlinie bei astronomischen Beobachtungsstationen und ihre Berechnung als Erforderniss einer Gradmessung. Denkschrift. Akad. Wiss. Wien, Math.-Naturwiss. Kl., 22 1864 : 41-88.

PLAYFAIR, John. Account of a lithological survey of Schehallian, made in order to determine the specific gravity of the rocks which compose that mountain. Philos. Trans. R. Soc. London, 101 1811 : 347-377.

PONTIKIS, C. Détermination de la constante de gravitation par la méthode de résonance. C.R. Acad. Sci., 274 1972 : 437-440.

PONTIKIS, C. Sur une détermination de la constante de gravitation par résonance. D.Sc. Thesis, Université de Paris VI, 1972, 86 pp.

PONTIKIS, C. Sur une méthode de détermination de la constante de gravitation par résonance. Dissertation Abstracts, 41 1978 : 867, [Abstract No. 5/5835c].

POPOV, Ye.I. Fused quartz as a material for gravitational instruments.  
In : Determination of Gravity Constant and Measurement of Certain Fine Gravity Effects, edited by Yu.D. Boulanger and M.U. Sagitov, NASA Technical Translation F-15,722, Accession Code No. N74-30831, Washington, D.C., U.S. Government Printing Office, 1974 : 83-94.

POYNTING, J.H. On the estimation of small excesses of weight by the balance from the time of vibration and the angular deflection of the beam. Manchester Literary and Philosophical Society Proceedings, 18 1879 : 33-38.

POYNTING, J.H. On a method of using the balance with great delicacy, and on its employment to determine the mean density of the earth. Proc. R. Soc. London, 28 1879 : 2-35.

POYNTING, J.H. On a method of using the balance with great delicacy, and on its employment to determine the mean density of the earth (reported by F. Richarz). Vierteljahrsschrift der Astronomischen Gesellschaft, 24 1889 : 18-32.

POYNTING, J.H. On a determination of the mean density of the earth and the gravitational constant by means of the common balance. Nature (London), 44 1891 : 165-166.

POYNTING, J.H. On a determination of the mean density of the earth and the gravitation constant by means of the common balance. Philos. Trans. R. Soc. London, Ser.A, 182 1892 : 565-656.

POYNTING, J.H. Ueber die Bestimmung der mittleren Dichte der Erde und der Gravitationskonstante mittels der gewöhnlichen Wage. Physikalische Revue (Stuttgart), 1 1892 : 456-468.

POYNTING, J.H. Ueber die Bestimmung der mittleren Dichte der Erde und der Gravitationskonstante mittels der gewöhnlichen Wage. Physikalische Revue (Stuttgart), 1 1892 : 561-596.

POYNTING, J.H. Ueber die Bestimmung der mittleren Dichte der Erde und der Gravitationskonstante mittels der gewöhnlichen Wage. Physikalische Revue (Stuttgart), 1 1892 : 700-719.

POYNTING, J.H. Ueber die Bestimmung der mittleren Dichte der Erde und der Gravitationskonstante mittels der gewöhnlichen Waage. Z. für Instrumentenkunde, 12 1892 : 422-427.

POYNTING, J.H. Ueber die Bestimmung der mittleren Dichtigkeit der Erde und der Gravitationsconstante mittelst der gewöhnlichen Waage (reported by O. Krigar-Menzel). Naturwissenschaftliche Rundschau, 8 1893 : 625-629.

POYNTING, J.H. The mean density of the earth. Nature (London), 48 1893 : 370.

POYNTING, J.H. and TODD, G.W. On a method of determining the sensibility of a balance. Philos. Mag., 18 1909 : 132-135.

POYNTING, J.H. Collected Scientific Papers, Cambridge, Cambridge University Press, 1920.

PRATT, John Henry. On the attraction of the Himalaya mountains, and of the elevated regions beyond them, upon the plumb-line in India. Philos. Trans. R. Soc. London, 145 1855 : 53-100.

PRATT, J.H. On the effect of local attraction upon the plumb-line at stations on the English arc of the meridian, between Dunnose and Burleighmoor ; and a method of computing its amount. Philos. Trans. R. Soc. London, 146 1856 : 31-52.

PRATT, J.H. On the attraction of the Himalaya mountains and of the elevated regions beyond them, upon the plumb-line in India. Mon. Not. R. Astron. Soc., 16 1856 : 36-41.

PRATT, J.H. Report on the Himalayan plumbline experiments. Mon. Not. R. Astron. Soc., 16 1856 : 104-105.

PRATT, J.H.\* A Treatise on Attractions, La Place's Functions, and the Figure of the Earth, 3rd ed., Cambridge, 1865.

PRESTON, Erasmus Darwin. Geodesy. Determinations of latitude, gravity, and the magnetic elements at stations in the Hawaiian islands, including a result for the mean density of the earth. In : Report of the U.S. Coast and Geodetic Survey, Appendix No. 12, Washington, D.C., United States Printing Office, 1893 : 512-639.

PRESTON, E.D. Mean density of the earth. Philos. Soc. Washington, 12 1895 : 369-395.

PRESTON, E.D. Die mittlere Dichte der Erde. Beiblätter für Physik, 21 1897 : 488-489.

PRESTON, E.D. Mean density of the earth (Densité moyenne de la terre - reviewed by E. Bouthy). J. Phys. (Paris), 6 1897 : 542-544.

REICH, Ferdinand. Extrait d'un mémoire de M. Reich sur la densité de la terre (Communiqué par M. Elie de Beaumont). C.R. Acad. Sci., 5 1837 : 697-700.

REICH, F. Versuche Ueber die Mittlere Dichtigkeit der Erde Mittelst der Drehwage, Freiberg, J.G. Engelhardt Verlag, 1838, 66pp.

REICH, F. On the repetition of the Cavendish experiment for determining the mean density of the earth (reported by F. Baily). Philos. Mag., 12 1838 : 283-284.

REICH, F. On the repetition of the Cavendish experiment, for determining the mean density of the earth (reported by F. Baily). Mon. Not. R. Astron. Soc., 4 1839 : 96-97.

REICH, F. Neue Versuche mit der Drehwaage. Abhandlungen der Königliche S. Ges. der Wissenschaften (Leipzig), Mathematische-Naturwissenschaftliche Klasse, 1 1852 : 385-430.

REICH, F. Neue Versuche über die mittlere Dichtigkeit der Erde. Ann. Phys. (Leipzig), 161 1852 : 189-198.

REICH, F. Nouvelles expériences sur la densité moyenne de la terre. Ann. Chim. Phys. (Paris), 38 1853 : 382-383.

REICH, F. New experiments on the mean density of the earth. Philos. Mag., 5 1853 : 153-158.

RENNER, Ya.\* New determination of the gravitational constant. Eötvös University Preprint, 1968, unpublished.

RENNER, Ya.\* On experimental studies for new determination of the constant of gravitation. Communications of the Sternberg Astronomical Institute, No. 167, Moscow, Publications House of the Moscow University, 1970.

RENNER, Ya. Determination of gravitational constant in Budapest. In : Determination of Gravity Constant and Measurement of Certain Fine Gravity Effects, edited by Yu.D. Boulanger and M.U. Sagitov, NASA Technical Translation F-15,722, Accession Code No. N74-30831, Washington, D.C., U.S. Government Printing Office, 1974 : 26-31.

RICHARZ, Franz and KRIGAR-MENZEL, Otto. Die Abnahme der Schwere mit der Höhe, bestimmt durch Wägungen. Sitzungsberichte der Königlich Preussischen Akademie der Wissenschaften zu Berlin, No. 16 1893 : 163-183.

RICHARZ, F. and KRIGAR-MENZEL, O. Die Abnahme der Schwere mit der Höhe, bestimmt durch Wägungen. Mathematische und Naturwissenschaftliche Mittheilungen aus den Sitzungsberichten der Königlich Preussischen Akademie der Wissenschaften zu Berlin, 1893 : 81-101.

RICHARZ, F. and KRIGAR-MENZEL, O. Die Abnahme der Schwere mit der Höhe, bestimmt durch Wägungen. Ann. Phys. (Leipzig), 51 1894 : 559-583.

RICHARZ, F. and KRIGAR-MENZEL, O. Gravitationskonstante und mittlere Dichtigkeit der Erde, bestimmt durch Wägungen. Sitzungsberichte der Königlich Preussischen Akademie der Wissenschaften zu Berlin, 48 1896 : 1305-1318.

RICHARZ, F. and KRIGAR-MENZEL, O. Gravitationskonstante und mittlere Dichtigkeit der Erde, bestimmt durch Wägungen. Mathematische und Naturwissenschaftliche Mittheilungen aus den Sitzungsberichten der Königlich Preussischen Akademie der Wissenschaften zu Berlin, 1896 : 681-696.

RICHARZ, F. and KRIGAR-MENZEL, O. The gravitation constant and the mean density of the earth. Nature (London), 55 1897 : 296.

RICHARZ, F. and KRIGAR-MENZEL, O. Gravitationskonstante und mittlere Dichtigkeit der Erde, bestimmt durch Wägungen. Z. für Instrumentenkunde, 17 1897 : 119-121.

RICHARZ, F. and KRIGAR-MENZEL, O. Gravitationskonstante und mittlere Dichtigkeit der Erde, bestimmt durch Wägungen. Ann. Phys. (Leipzig), 66 1898 : 177-193.

RICHARZ, F. and KRIGAR-MENZEL, O.\* Bestimmung der Gravitationskonstante und mittleren Dichtigkeit der Erde durch Wägungen. Anhang zu den Abhandlungen der Königlich Preussischen Akademie der Wissenschaften zu Berlin, 1898 : 1-196.

RICHARZ, F. and KRIGAR-MENZEL, O. Bestimmung der Gravitationskonstante und der mittleren Dichtigkeit der Erde durch Wägungen (reported by C. Braun). Vierteljahrsschrift der Astronomische Gesellschaft, 34 1899 : 51-66.

RICHARZ, F. and KRIGAR-MENZEL, O. Waage zur Bestimmung der mittleren Dichtigkeit der Erde. Z. für Instrumentenkunde, 19 1899 : 40-56.

RICHARZ, F. and KRIGAR-MENZEL, O. Remarques sur le rapport de M.C.V. Boys. In : Travaux du Congrès International de Physique, Paris, Gauthier-Villars, 1901 : 69-73.

RITTER, Rogers Charles and GILLIES, George Thomas. A satellite measurement of G to a part per million. University of Virginia Preprint, 1981, unpublished.

ROSE, R.D. A new method for determination of Newton's gravitational constant. Ph.D. Thesis, University of Virginia, 1969, 90pp.

ROSE, R.D., PARKER, H.M., LOWRY, R.A., KULTHAU, A.R., and BEAMS, J.W. Determination of the gravitational constant G. Phys. Rev. Lett., 23 1969 : 655-658.

SAGITOV, M.U.\* Contribution to the theory of determination of the constant of gravitation by means of torsional oscillations of a beam with masses. Communications of the Sternberg Astronomical Institute, No. 135, Moscow, Publications House of Moscow University, 1964.

SAGITOV, M.U.\* Contribution to the theory of a technique for determination of the constant of gravitation. In : Problems of Gravitation, Tbilissi, Abstracts of the Second Soviet Gravitation Conference, 1965 : 265.

SAGITOV, M.U.\* Allowance for the influence of gravitational fields of neighboring masses on the result of determination of the constant of gravitation by means of the torsion balance technique. Scientific News of the Moscow University, Physics and Astronomy, No. 3, 1969.

SAGITOV, M.U.\* Determination of the constant of gravitation and the mass of the earth : an overview. In : Determination of the Constant of Gravitation, the Mass and the Mean Density of the Earth, Moscow, Abstracts of the Conference, October 13-16, 1970.

SAGITOV, M.U.\* Brief review of experiments for determination of the constant of gravitation. In : Measurements of the Gravitational Acceleration and the Constant of Gravitation, Kharkov, KhGNIIM, 1970.

SAGITOV, M.U.\* Comments on the theory of determination of the constant of gravitation by means of the torsion balance technique. Communications of the Sternberg Astronomical Institute, No. 167, Moscow, Publications House of Moscow University, 1970.

SAGITOV, M.U.\* The moment of mutual attraction forces between the experimental masses in the problem of determination of the constant of gravitation. Communications of the Sternberg Astronomical Institute, No. 167, Moscow, Publications House of Moscow University, 1970.

SAGITOV, M.U. Bulletin d'Information, No. 27, Paris, Bureau Gravimetrique International, Nov. 1971 : 1-21 - 1-22.

SAGITOV, M.U.\* Necessity for a new determination of the Cavendish constant of gravitation. In : Problem of Gravitational Measurements, Experimental Physics, Ser.N, v.1, Moscow, VNIIIFI, 1971.

SAGITOV, M.U. and CHESNOKOVA, G.S.\* The mutual attraction force moment of experimental masses in the form of circular cylinders. In : Problems of Gravitational Measurements, Experimental Physics, Ser.B, v.1, Moscow, VNIIIFI, 1971.

SAGITOV, M.U. and BUCHNEVA, L.G.\* Determination of the constant of gravitation in the case of non-symmetrical and non-symmetrically disposed experimental masses. In : Measurements of the Gravitational Acceleration and the Constant of Gravitation, Kharkov, KhGNIIM, 1972.

SAGITOV, M.U.\* On the moment of mutual attraction forces between experimental masses. Communications of the Sternberg Astronomical Institute, No. 187, Moscow, Publications House of Moscow University, 1974.

SAGITOV, M.U.\* A procedure for derivation of unknown parameters in the problem of determination of the constant of gravitation.  
Communications of the Sternberg Astronomical Institute, No. 187, Moscow, Publications House of Moscow University, 1974.

SAGITOV, M.U. and CHESNOKOVA, G.S. Experiment in determination of a general law for attenuation of vibrations. In : Determination of Gravity Constant and Measurement of Certain Fine Gravity Effects, edited by Yu.D. Boulanger and M.U. Sagitov, NASA Technical Translation F-15,722, Accession Code No. N74-30831, Washington, D.C., U.S. Government Printing Office, 1974 : 69-74.

SAGITOV, M.U. and KEZHUTIN, N.G. A correction in determination of the Cavendish constant. In : Determination of Gravity Constant and Measurement of Certain Fine Gravity Effects, edited by Yu.D. Boulanger and M.U. Sagitov, NASA Technical Translation F-15,722, Accession Code No. N74-30831, Washington, D.C., U.S. Government Printing Office, 1974 : 32-37.

SAGITOV, M.U. et al. Thesis of the Fourth Soviet Conference on Gravitation, Minsk, USSR, 1976 : 143-144.

SAGITOV, M.U. et al.\* On determination of the Cavendish constant of gravitation. Communications of the Sternberg Astronomical Institute, No. 202, Moscow, Publications House of Moscow University, 1977.

SAGITOV, M.U., MILYUKOV, V.R., MONAKHOV, E.A., NAZARENKO, V.S. and TADZHIDINOV, Kh.G. New determination of the Cavendish gravitational constant. Dok. Akad. Nauk SSSR, 245 (3) 1977 : 567-569.

SAGITOV, M.U., MILYUKOV, V.R., MONAKHOV, E.A., NAZARENKO, V.S. and TADZHIDINOV, Kh.G. New determination of the Cavendish gravitational constant. Int. Aerospace Abstracts, No. A79-37197, 1979 : 2866.

SAGITOV, M.U., MILYUKOV, V.K., MONAKHOV, E.A., NAZARENKO, V.S., CHESNOKOVA, T.S., TADZHIDINOV, Kh.G. and DMITRIEVA, T.I. Determination of the Cavendish gravitational constant at the Sternberg State Astronomical Institute of the Moscow University. In : The Constant of Gravitation, edited by Lajos Stegna and Marat U. Sagitov, Budapest, Lorand Eötvös University, Akadémiai Kiado, 1979 : 25-203.

SAGITOV, M.U. et al. Abstracts of the conference. In : Fifth Soviet Conference on Gravitation, Moscow, USSR, July 1-3, 1981 : 294-296.

SCHAAR, M. Rapport de M. Schaar sur un mémoire de M. Montigny relatif aux expériences pour déterminer la densité de la terre. Bull. Acad. Roy. Belgique, 19 (part 2) 1852 : 476-481.

SMALLEY, Larry L. Gravitational clock : A proposed experiment for the measurement of the gravitational constant G. NASA Technical Memorandum X-64,920, Accession Code No. N75-22974, Washington, D.C., U.S. Government Printing Office, 1975, 31 pp.

SMALLEY, L.L. Gravitational clock : A proposed experiment for the measurement of the gravitational constant G. Scientific and Technical Aerospace Reports, 13 1975 : 1687.

SOUTHWELL, William H. Using pendulums to measure the universal gravitational constant. Am. J. Phys., 35 1967 : 1160-1161.

SPEAKE, Clive C. and METHERELL, A.J.F. The design of a beam balance for a determination of G. In : Precision Measurement and Fundamental Constants II, edited by B.N. Taylor and W.D. Phillips, National Bureau of Standards (U.S.) Special Publication 617, Washington, D.C., U.S. Printing Office, 1983, in press.

SPEAKE, C.C. A beam balance method for determination of the Newtonian constant of gravitation. Ph.D. Thesis, Cambridge University, 1983, 148 pp.

STACEY, Frank D. Possibility of a geophysical determination of the newtonian gravitational constant. Geophys. Res. Lett., 5 1978 : 377-378.

STEGNA, Lajos\* In : Proceedings of the Second Symposium of the Working Group 6.6 ("Constant of Gravitation and Mass of the Earth") of the KAPS, Moscow, Commission of the Academies of Socialist Countries for Planetary Geophysics, December 3-4, 1974.

STEGNA, L. and SAGITOV, M.U. The constant of gravitation in various systems of units and a brief overview of the determinations of the Cavendish constant of gravitation. In : The Constant of Gravitation, edited by L. Stegna and M.U. Sagitov, Budapest, Lorand Eötvös University, Akadémiai Kiado, 1979 : 5-24.

STEGNA, L. The Eötvös experiment for the determination of the gravity constant. In : The Constant of Gravitation, edited by L. Stegna and M.U. Sagitov, Budapest, Lorand Eötvös University, Akadémiai Kiado, 1979 : 205-220.

STERN, Theodore E. A determination of the newtonian constant of gravitation by a study of the vibrations of a torsion pendulum. Science, 67 1928 : 377-378.

STRUVE, O.\* Ueber einen von General Schubert an die Akademie gerichteten Antrag betreffend die Russisch-Scandinavische Meridiangradmessung. Bull. Acad. St. Petersburg, Physikalisch-Mathematische Classe, 3 1861 : 395-424.

TAJIDINOV, Kh.G.\* Special cases of decomposition of the moment of mutual attraction forces between the experimental masses. Communications of the Sternberg Astronomical Institute, No. 187, Moscow, Publications House of Moscow University, 1974.

TANGL, K.\* Versuch über die Gravitation mit einer Drehwaage, deren Gehänge in Wasser taucht. Mathematische und Naturwissenschaftliche Anzeiger der Akademie der Wissenschaften zu Budapest, 43 1926.

TARAKANOV, Yu.A. and KARATSUBA, V.B. Effects of microseisms on torsion balances. In : Determination of Gravity Constant and Measurement of Certain Fine Gravity Effects, edited by Yu.D. Boulanger and M.U. Sagitov, NASA Technical Translation F-15,722, Accession Code No. N74-30831, Washington, D.C., U.S. Government Printing Office, 1974 : 48-59.

TOWLER, William Russell. A control system for driving a precision rotary table. M.S. Thesis, University of Virginia, 1967, 66 pp.

TOWLER, W.R. and McVEY, Eugene S. Control system for use in the measurement of ultrasmall torques. IEEE Trans. Auto. Control, AC-14 1969 : 190-192.

TOWLER, W.R., PARKER, H.M., LOWRY, R.A., KULTHAU, A.R. and BEAMS, J.W. Measurement of the Newton gravitational constant G. In : Precision Measurement and Fundamental Constants I, edited by D.N. Langenberg and B.N. Taylor, National Bureau of Standards (U.S.) Special Publication 343, Washington, D.C., U.S. Printing Office, 1971 : 485-492.

TOWLER, W.R. Analysis and evaluation of errors in the measurement of the newtonian gravitational constant (G). University of Virginia Progress Report No. ESS-3896-101-76, April 1976, unpublished, 28pp.

TURMLIRZ, O. Die Dichte der Erde, berechnet aus der Schwerkraftsverteilung und der Abplattung. Denkschrift. Akad. Wiss. Wien, Math.-Naturwiss. Kl., 59 1892 : 1528-1536.

VINTI, John P. Analysis of an experiment to determine the gravitational constant in an orbiting space laboratory. M.I.T. Measurement Systems Laboratory Report No. RE-72. In : NASA Contractor Report No. CR-115139, Cambridge, Mass., M.I.T., 1970, 55pp.

VINTI, J.P. Analysis of the gravitational field in Wilk's sphere with three tunnels. M.I.T. Measurement Systems Laboratory Report No. RE-73. In : NASA Contractor Report No. CR-115139, Cambridge, Mass., M.I.T., 1970, 31pp.

VINTI, J.P. Theory of an experiment in an orbiting space laboratory to determine the gravitational constant. Celest. Mech., 5 1972 : 204-254.

VON JOLLY, Ph. Die Anwendung der Waage auf Probleme der Gravitation. Ann. Phys. (Leipzig), 5 1878 : 112-134.

VON JOLLY, Ph. Die Anwendung der Waage auf Probleme der Gravitation.  
Abhandlungen der Bayerischen Akademie der Wissenschaften, classe 2,  
13 (Abteilung 1) 1878 : 157-176.

VON JOLLY, Ph. Die Anwendung der Waage auf Probleme der Gravitation.  
Zweite Abhandlung. Ann. Phys. (Leipzig), 14 1881 : 331-355.

VON JOLLY, Ph. Die Anwendung der Waage auf Probleme der Gravitation.  
Zweite Abhandlung. Abhandlungen der Bayerischen Akademie der  
Wissenschaften, classe 2, 14 (Abteilung 2) 1881 : 3-26.

VON JOLLY, Ph. A new weighing of the earth. Popular Science Monthly,  
21 1882 : 565.

VON JOLLY, Ph. Die Anwendung der Waage auf Probleme der Gravitation  
(reported by F. Richarz). Vierteljahrsschrift der Astronomischen  
Gesellschaft, 24 1889 : 18-32.

VON STERNECK, Robert. Untersuchungen über die Schwere im Innern der Erde. Mittheilungen des Kaiserliche Königliche Militär-Geographischen Institutes (Wien), 2 1882 : 77-120.

VON STERNECK, R. Wiederholung der Untersuchungen über die Schwere im Innern der Erde. Mittheilungen des Kaiserliche Königliche Militär-Geographischen Institutes (Wien), 3 1883 : 59-94.

VON STERNECK, R. Untersuchungen über die Schwere auf der Erde.  
Mittheilungen des Kaiserliche Königliche Militär-Geographischen Institutes (Wien), 4 1884 : 89-155.

VON STERNECK, R. Forsetzung der Untersuchungen über die Schwere auf der Erde. Mittheilungen des Kaiserliche Königliche Militär-Geographischen Institutes (Wien), 5 1885 : 77-105.

VON STERNECK, R. Untersuchungen über die Schwere im Innern der Erde.  
Mittheilungen des Kaiserliche Königliche Militär-Geographischen Institutes (Wien), 6 1886 : 97-119.

WHEWELL, M. and AIRY, G.B. On experiments at Dolcoath mine in Cornwall to determine the density of the earth. Philos. Mag., 1 1827 : 385-386.

WILSING, J. Ueber die Anwendung des Pendels zur Bestimmung der mittleren Dichtigkeit der Erde. Sitzungsberichte der Königlich Preussischen Akademie der Wissenschaften zu Berlin, Erster Halbband 1885 : 13-15.

WILSING, J. Ueber die Anwendung des Pendels zur Bestimmung der mittleren Dichtigkeit der Erde. Beiblätter für Physik, 9 1885 : 768.

WILSING, J. Teil G. Vermischte astronomische oder physikalische Beobachtungen (reported by H.C. Vogel). Vierteljahrsschrift der Astronomischen Gesellschaft, 20 1885 : 126.

WILSING, J. Instrumente. Vierteljahrsschrift der Astronomischen Gesellschaft, 21 1886 : 132.

WILSING, J. Teil G. Vermischte astronomische und physikalische Beobachtungen (reported by H.C. Vogel). Vierteljahrsschrift der Astronomischen Gesellschaft, 21 1886 : 141-142.

WILSING, J. Teil G. Vermischte astronomische und physikalische Beobachtungen. Vierteljahrsschrift der Astronomischen Gesellschaft, 22 1887 : 149-151.

WILSING, J. Bestimmung der mittleren Dichtigkeit der Erde mit Hilfe eines Pendelapparates. Publicationen des Astrophysikalischen Observatoriums zu Potsdam, 6 (22) 1887 : 35-127.

WILSING, J. Mittheilung über die Resultate von Pendelbeobachtungen zur Bestimmung der mittleren Dichtigkeit der Erde. Sitzungsberichte der Königlich Preussischen Akademie der Wissenschaften zu Berlin, Erster Halbfband 1887 : 327-334.

WILSING, J. Mittheilung über die Resultate von Pendelbeobachtungen zur Bestimmung der Dichtigkeit der Erde. Mathematische und Naturwissenschaftliche Mittheilungen aus den Sitzungberichten der Königlich Preussischen Akademie der Wissenschaften zu Berlin, 1887 : 157-164.

WILSING, J. Teil G. Vermischte astronomische und physikalische Beobachtungen. Vierteljahrsschrift der Astronomischen Gesellschaft, 23 1888 : 128-130.

WILSING, J. Determination of the mean density of the earth by means of a pendulum principle (translated by J.H. Gore). Annual Report of the Board of Regents of the Smithsonian Institution, 1888 : 635-646.

WILSING, J. Bestimmung der mittleren Dichtigkeit der Erde mit Hilfe eines Pendelapparatus (reported by F. Richarz). Vierteljahrsschrift der Astronomischen Gesellschaft, 24 1889 : 18-32.

WILSING, J. Bestimmung der mittleren Dichtigkeit der Erde mit Hilfe eines Pendelapparates (Zweite Abhandlung). Publicationen des Astrophysikalischen Observatoriums zu Potsdam, 6 (23) 1889 : 133-193.

WILSING, J. Bestimmung der mittleren Dichtigkeit der Erde mit Hilfe eines Pendelapparatus (Zweite Abhandlung). Vierteljahrsschrift der Astronomischen Gesellschaft, 24 1889 : 184-186.

WOODWARD, R.S. The gravitational constant and the mean density of the earth. Astron. J., 18 1898 : 121-122.

WOODWARD, R.S. The gravitation constant and the mean density of the earth. Proc. Am. Assoc. Adv. Sci., 47 1898 : 73-74.

ZAHRADNICEK, Josef. Mesure de la période du gravimètre. Publications de la Faculté des Sciences de l'Université Masaryk, No. 118, 1930 : 1-14.

ZAHRADNICEK, J. Mesure de la constante de gravitation par la balance de torsion. Publications de la Faculté des Sciences de l'Université Masaryk, No. 153, 1932 : 1-29.

ZAHRADNICEK, J. Bemerkungen zum Aufsatz : 'Resonanzmethoden für die Bestimmung der Gravitationskonstanten G' von Jacob Kunz, in der Physik. Zeitsch. 31, 764, 1930. Phys. Z., 32 1932 : 149-150.

ZAHRADNICEK, J. Resonanzmethode für die Messung der Gravitationskonstante mittels der Drehwaage. Phys. Z., 34 1933 : 126-133.

ZENKOV, V.S. et al.\* Effect of the light beam on a high quality torsion balance in vacuum. Communications of the Sternberg Astronomical Institute, No. 194, Moscow, Publications House of Moscow University, 1977.

2. Comments and Reviews of Measurements of G

ASPDEN, Harold. Charge induction by thermal radiation.  
J. Electrostatics, 13 1982 : 71-80.

BABINET, J. Note sur le calcul de l'expérience de Cavendish, relative à la masse et à la densité moyenne de la terre. Cosmos, 24 1864 : 543-545.

BRANDES, H.W.\* Theoretische Untersuchungen über die Oscillationen der Drehwaage bei Cavendish's Versuchen über die Attraction kleiner Massen. Mag. für den Neuesten Zustand der Naturkunde, 12 1806 : 300-310.

BRILLOUIN, Marcel. Constante de la gravitation universelle. Sur une cause de dissymétrie dans l'emploi de la balance de Cavendish.  
C.R. Acad. Sci., 131 1900 : 1293-1296.

BULLEN, K.E. The Earth's Density, London, Chapman and Hall, 1975, 420pp.

CHAMPION, F.C. and DAVY, N. The Newtonian constant of gravitation.  
In : Properties of Matter, 3rd ed., New York, Philosophical Library, 1959 : (Chapter 3) 38-52.

CHICK, Helen J. Theory of Gravitation 1959-1963 (Bibliography). Los Alamos Scientific Laboratory Report No. LA(MS)-3099, Sept 1, 1964 (unpublished), 67 pp.

CLARKE, R.G.S. The Constant Concern, Cambridge University Press, submitted for publication.

COHEN, Richard E. and TAYLOR, Barry N. The 1973 least-squares adjustment of the fundamental constants. J. Phys. Chem. Ref. Data, 2 1973 : 663-734.

DAVIES, P.C.W. Experimenting with controlled gravity. Nature (London), 268 1977 : 397-398.

DE BOER, H. Experiments relating to the gravitational constant. In : Precision Measurement and Fundamental Constants II, edited by B.N. Taylor and W.D. Phillips, National Bureau of Standards Publication 617, Washington, D.C., U.S. Printing Office, 1983, in press.

DROBISCH, M.W. Ueber die in den Minen von Dolcoath in Cornwall neuerlich angestellten Pendelbeobachtungen. Ann. Phys. (Leipzig), 10 1827 : 444-456.

DROBISCH, M.W. Ausführlicher Bericht über mehrere in den Jahren 1826 und 1828 in den Minen von Dolcoath in Cornwall zur Bestimmung der mittleren Dichtigkeit der Erde angestellte Pendelversuche. Ann. Phys., 14 1828 : 409-427.

EVERTT, C.W.F. Gravitation, relativity and precise experimentation. In : Proc. of the First Marcel Grossmann Meeting on General Relativity, edited by Remo Ruffini, Amsterdam, North Holland, 1977 545-615.

FOLIE, F.\* Sur le calcul de la densité moyenne de la terre, d'après les observations d'Airy. Bull. Acad. Roy. Belgique, 33 1872 : 369-372.

FOLIE, F.\* Sur le calcul de la densité moyenne de la terre, d'après les observations d'Airy. Bull. Acad. Roy. Belgique, 33 1872 : 389-409.

FRESDORF, G.\* Die Methoden zur Bestimmung der mittleren Dichte der Erde. In : Wissenschaftliche Beilage zum Jahresberichtem des Gymnasium zu Weissenburg in Elsass, Weissenburg, Germany, 1894.

GASKELL, T.H., BULLERWELL, W., COOK, A.H. and WYCKOFF, R.D. Gravitation. In : Encyclopedia Britannica, 14th ed., v.10, New York, Helen Hemingway Benton, 1972 : 711-727.

GILBERT, L.W. Bericht von einer lithologischen Aufnahme des Schehallian, um das specifische Gewicht der Gebirgsarten desselben, und daraus die mittlere Dichtigkeit der Erde zu bestimmen von J. Playfair. Ann. Phys., 43 1813 : 62-75.

GILLIES, G.T. The Newtonian Gravitational Constant : An Index of Measurements, Rapport BIPM-82/9, 1982, 83 pp.

GIULIO, C.I. Sur la détermination de la densité moyenne de la terre, déduite de l'observation du pendule faite à l'hospice du Mont-Cenis par M. Carlini en septembre 1821. Mem. Acad. Torino, 2 1840 : 379-384.

GORE, J. Howard. Earth, density of. In : A Bibliography of Geodesy, U.S. Coast and Geodetic Survey, Appendix 16, Washington, D.C., U.S. Government Printing Office, 1887 : 366-367.

GORE, J.H. Earth, density of. In : A Bibliography of Geodesy, 2nd ed., U.S. Coast and Geodetic Survey Annual Report, Appendix 8, Washington, D.C., U.S. Government Printing Office, 1902 : 516-518.

HAUPT, E. and TAKE, E. Untersuchungen der bei der Bestimmung der Gravitationskonstante in Spandau benutzten Materialien. Z. für Instrumentenkunde, 24 1904 : 185-186.

HEARN, George Whitehead. On the cause of the discrepancies observed by Mr. Baily with the Cavendish apparatus for determining the mean density of the earth. Philos. Trans. R. Soc. London, 137 1847 : 217-229.

HEYL, Paul R. Weighing the earth. Scientific Monthly, 20 1925 : 602-606.

HEYL, P.R. What is gravitation? Scientific Monthly, 47 1938 : 114-123.

HEYL, P.R. Gravitation - still a mystery. Scientific Monthly, 78 1954 : 303-306.

HICKS, W.M. On some irregularities in the values of the mean density of the earth as determined by Baily. Proc. Cambridge Philos. Soc., 5 1884 : 156-161.

HOOGE, F.N. and POULIS, J.A. Fundamental limits to the measurements of the gravitational constant G. Appl. Sci. Res., 33 1977 : 191-195.

JACOB, W.S. On the causes of the great variation among the different measures of the earth's mean density. Proc. R. Soc. London, 8 1857 : 295-299.

JACOB, W.S. On the causes of the great variation among the different measures of the earth's mean density. Philos. Mag., 13 1857 : 525-528.

JEFFREYS, H.\* Theory of Probability, 1st ed., Oxford, Clarendon Press, 1939.

JEFFREYS, H. The Earth, 5th ed., Cambridge University Press, 1970.

KNOPF, O.\* Über die Methoden zur Bestimmung der Mittleren Dichtigkeit der Erde, Jena, Germany, 1880.

LIER, Ruth H. Theory of Gravitation 1929 to present (Bibliography). Los Alamos Scientific Laboratory Report No. LAMS-2338, April 20, 1960 (unpublished), 155 pp.

MACKENZIE, Arthur Stanley. The Laws of Gravitation : Memoirs by Sir Isaac Newton, Pierre Bouguer, and Henry Cavendish together with Abstracts of Other Important Memoirs, New York, American Book Co., 1900.

MENABREA, L.F. Calcul de la densité de la terre. Bibliothèque Universelle de Genève, 27 1840 : 168-175.

MENABREA, L.F. On Cavendish's experiment. Philos. Mag., 19 1841 : 62-63.

- MUNCKE, H. Dichtigkeit der Erde. In : Gehler's Physikalisches Wörterbuch, v.3E, Leipzig, E.B. Schwickert Verlag, 1827 : 940-970.
- NORDTVEDT, Jr., K., FALLER, J.E. and REAMS, J.W. Gravitation. In : Encyclopedia Britannica, 15th ed., v.10, New York, Helen Hemingway Benton, 1974 : 286-295.
- PETERS, C.A.F. Von den kleinen Ablenkungen der Lothlinie und des Niveaus, welche durch die Anziehungen der Sonne, des Mondes, und einiger terrestrischen Gegenstaende hervorgebracht werden. Astron. Nachr., 22 1845 : 33-42.
- POULIS, J.A. and HOOGE, F.N. Thermal noise in balances and its significance for physical measurements. J. Vac. Sci. Technol., 15 1978 : 795-799.
- POYNTING, J.H. A history of the methods of weighing the earth. Birmingham Phil. Soc. Proc., 9 1894 : 1-23.
- POYNTING, J.H. The Mean Density of the Earth - An Essay, London, Charles Griffin and Co., Ltd., 1894, 164pp.
- POYNTING, J.H. Recent studies in gravitation. Nature (London), 62 1900 : 403-408.
- POYNTING, J.H. Recent studies in gravitation. Proc. R. Institution (G.B.), 16 1901 : 278-294.
- POYNTING, J.H. Recent studies in gravitation. In : Annual Report of the Board of Regents of the Smithsonian Institution, Washington, D.C., U.S. Government Printing Office, 1902 : 199-214.
- POYNTING, J.H. and THOMSON, J.J. Gravitation. In : A Textbook of Physics : Properties of Matter, London, Charles Griffin and Co., Ltd., 1902 : (Chapter 3) 28-52.
- POYNTING, J.H. Gravitation. In : Encyclopedia Britannica, 11 ed., v.12, New York, Encyclopedia Britannica, 1910 : 384-389.
- PRINGLE, John. A discourse on the attractions of mountains. In : Anniversary Meeting of the Royal Society, London, R. Soc. London, 1775, 33pp.
- PRINGLE, J. Discours sur l'attraction des montagnes ; traduit par M. le Roy. J. Phys. (Rozier), 7 1776 : 418-434.
- ROCHE, Eduard-Albert. Note sur la loi de la densité à l'intérieur de la terre. C.R. Acad. Sci., 39 1854 : 1215-1217.
- ROCHE, E.-A. La variation de la pesanteur à l'intérieur de la terre. Mémoires de l'Académie des Sciences de Montpellier, 3 1857 : 107-124.

SABINE, E. An account of Prof. Carlini's experiments on Mont-Cenis.  
Quarterly Journal of Science, 24 1827 : 153-159.

SAGITOV, Marat Usmanovich. The Gravitational Constant and the Mass  
of the Earth, Moscow, Nauka, 1969, 188pp.

SAGITOV, M.U. Gravitationskonstante, Masse, und mittlere Dichte der  
Erde. Vermessungstechnik, 19 1971 : 59-63.

SAGITOV, M.U. Current status of determinations of the gravitational  
constant and the mass of the earth. Sov. Astron., 13 (4) 1976 :  
712-718 [translation of Astron. Zh., 46 (4) 1969 : 907-915].

SAIGEY, J.F.\* Densité du globe. Rev. Scient. et Ind.-(Quesneville),  
11 1842 : 149-160.

SAIGEY, J.F.\* Densité du globe. Rev. Scient. et Ind. (Quesneville),  
12 1842 : 373-388.

SCHEFFLER, H. Ueber die mittlere Dichtigkeit der Erde. Z. für  
Mathematik und Physik, 10 1865 : 224-227.

SCHELL, A.\* Ueber die Bestimmung der Mittleren Dichtigkeit der Erde,  
Göttingen, Germany, 1869.

SERGENT, E. Sulla densità della materia nell'interno del globe, e  
sulla potenza della crosta terrestre. Atti della Soc. Ital. di Sci.  
Nat. Milano, 2 1859 : 169-175.

STEGNA, L. and SAGITOV, M.U. The Constant of Gravitation, Budapest,  
Hungary, Lorand Eötvös University, Kiado Akadémiai, 1979, 255pp.

THÜRING, Bruno. Studien über die sogenante Gravitationskonstante.  
Ann. der Akademie Scientifische Fennicae, AIII (61) 1961 :  
269-283.

THÜRING, B. Studies on the so-called gravitational constant. Science  
Abstracts, 65 1962 : 1686.

VAN DIJK, H.H.J., POULIS, J.A., and HOOGE, F.N. Noise in weighing.  
Appl. Sci. Res., 31 1976 : 445-454.

VON ZACH, F.X.\* Ueber die Möglichkeit die Gestalt der Erde aus  
Gradmessungen zu bestimmen. Monatliche Correspondanz, 20 1809 :  
3-9.

VON ZACH, F.X.\* Ueber die Densität der Erde und deren Einfluss auf  
geographische Ortsbestimmungen. Monatliche Correspondanz, 21  
1810 : 293-310.

VON ZACH, F.X.\* L'Attraction des Montagnes, et ses Effets sur les  
Fils à Plomb ou sur les Niveaux des Instruments d'Astronomie, 2 v.,  
Avignon, France, 1814.

WALLENTIN, J.G. Ueber die Methoden zur Bestimmung der mittleren Dichte  
der Erde und eine neue diesbezügliche Anwendung der Waage.  
Humboldt, 1 1882 : 212-217.

WORDEN, P.W., Jr. and EVERITT, C.W.F. Resource letter GI-1 : gravity  
and inertia. Am. J. Phys., 50 1982 : 494-500.

YOUNG, Thomas. Remarks on the probabilities of error in physical  
observations, and on the density of the earth, considered, especially  
with regard to the reduction of experiments on the pendulum. In a  
letter to Captain Henry Kater. Philos. Trans. R. Soc. London, 109  
1819 : 70-95.

YOUNG, T.\* Miscellaneous Works and Life, 4 v., London, Peacock and  
Lietch, 1855.

ZANOTTI-BIANCO, O.\* Il Problema Meccanico della Figura della Terra,  
2 parts, Florence, Italy, 1880.

### 3. Measurements of Gravitational Permeability, Absorption and Shielding

ALLAIS, Maurice F.C. Test de périodicité. Généralisation du test de Schuster au cas de séries temporelles autocorrélées. C.R. Acad. Sci., 244 1957 : 2469-2471.

ALLAIS, M.F.C. Observation des mouvements du pendule paraconique. C.R. Acad. Sci., 245 1957 : 1697-1700.

ALLAIS, M.F.C. Analyse harmonique des mouvements du pendule paraconique. C.R. Acad. Sci., 245 1957 : 1875-1878.

ALLAIS, M.F.C. Mouvements du pendule paraconique et éclipse totale de soleil du 30 juin 1954. C.R. Acad. Sci., 245 1957 : 2001-2003.

ALLAIS, M.F.C. Théorie du pendule paraconique et influence lunisolaire. C.R. Acad. Sci., 245 1957 : 2170-2173.

ALLAIS, M.F.C. Application du test de Schuster généralisé à l'analyse harmonique des azimuts du pendule paraconique. C.R. Acad. Sci., 245 1957 : 2467-2470.

ALLAIS, M.F.C. Doit-on reconSIDérer les loIS de la gravitation ? Perspectives X, 31 1958 : 90-104.

ALLAIS, M.F.C. Nouvelles expéRIences sur le pendule paraconique à support anisotrope. C.R. Acad. Sci., 247 1958 : 1428-1431.

ALLAIS, M.F.C. Structure périodique des mouvements du pendule paraconique à support anisotrope à Bougival et Saint-Germain en Juillet 1958. C.R. Acad. Sci., 247 1958 : 2284-2287.

ALLAIS, M.F.C. Should the laws of gravitation be reconsidered? Part I. Abnormalities in the motion of a paraconical pendulum on an anisotropic support. Aerospace Engineering, 18 September 1959 : 46-52.

ALLAIS, M.F.C. Should the laws of gravitation be reconsidered? Part II. Experiments in connection with the abnormalities noted in the motion of the paraconical pendulum with an anisotropic support. Aerospace Engineering, 18 October 1959 : 51-55.

ALLAIS, M.F.C.\* Should the laws of gravitation be reconsidered? Aerospace Engineering, 18 November 1959 : 55.

ALLEN, Mildred and SAXL, Erwin J. Elastic torsion in wires under tension. J. Appl. Phys., 40 1969 : 2505-2509.

ARMELLINI, Giuseppe. Il moto del perielio di mercurio nell'ipotesi di un assorbimento del flusso gravitazionale attraverso i mezzi materiali. Atti della Reale Accademia dei Lincei, Rendiconti, 5 1948 : 288-294.

AUSTIN, Louis W. and THWING, Charles B. An experimental research on gravitational permeability. Phys. Rev., 5 1897 : 294-300.

BANNA, P.\* Interpretazioni nella gravitazione universale. Tekne Messina, 1958/1959.

BANNA, P.\* Lineamenti dell'universo fisico. Tekne Messina, 1962.

BOCCHIO, Franco. Old and new approaches in the study of gravitational absorption. Geophys. J. R. Astron. Soc., 24 1971 : 101-102.

BOCCHIO, F. On the effects of gravitational absorption on orbits of artificial earth satellites. Memorie della Societa Astronomica Italiana, 42 1971 : 131-143.

BOTTLINGER, K.F.\* Die Gravitationstheorie und die Bewegung des Mondes. Dissertation, University of Munich, Freiburg, Germany, C. Troemer Verlag, 1912, 57pp.

BOTTLINGER, K.F. Zur Frage der Absorption der Gravitation. Sitzungsberichte der Mathematisch-Physikalischen Klasse der Königlich Bayerischen Akademie der Wissenschaften zu München, 44 1914 : 223-239.

BRAGINSKY, V.B., RUDEJKO, V.N. and RUKMAN, G.I. An experimental investigation of an intermediate medium on gravitational interaction. Sov. Phys. - JETP, 16 1963 : 36-41 (translation of Zh. Eksp. Teor. Fiz., 43 July 1962 : 51-58).

BREIN, Rudolf. Die Schwerkraftregistrierungen. Beitrag zur Frage einer Absorption der Schwere. Deutsche Geodätische Kommission bei der Bayerischen Akademie der Wissenschaft, Reihe B : Angewandte Geodäsie-Heft Nr. 34, Mitteilung Nr. 16 des Instituts für Angewandte Geodesie (Abteilung II des Deutschen Geodätischen Forschungsinstituts) 1957 : 30-45.

BRUSH, Charles F. Discussion of the kinetic theory of gravitation IV : Correlation of continual generation of heat in some substances, and impairment of their gravitational acceleration. Proc. Am. Philos. Soc., 67 1928 : 105-117.

BRUSH, C.F. Gravitation. Proc. Am. Philos. Soc., 68 1929 : 55-68.

CAPUTO, Michele. Observations taken at Trieste, with the great horizontal pendulums at the time of the solar eclipse of February, 1961. In : Quatrième Symposium International sur les Marées Terrestres, edited by Paul Melchior, Communications de l'Observatoire Royal de Belgique, No. 188, Série Géophysique No. 58, Brussels, Belgium, 1961 : 64-65.

CAPUTO, M. Un nuovo limite superiore per il coefficiente di assorbimento della gravitazione. Atti della Reale Accademia di Lincei, Rendiconti, 32 1962 : 509-515.

CAPUTO, M. Experiments concerning gravitational shielding. In : Gravitation Sperimentale, edited by Bruno Bertotti, Accademia Nazionale dei Lincei, Rome, 1977 : 193-212.

CEROFOLINI, G.F. Quantum mechanics and gravitation. Lett. Nuovo Cimento, 23 1978 : 509-512.

CREMIEU, Victor. Attraction observée entre gouttes liquides suspendues dans un liquide de même densité. C.R. Acad. Sci., 140 1905 : 80-83.

CREMIEU, V. Recherches sur la gravitation. C.R. Acad. Sci., 141 1905 : 653-656.

CREMIEU, V. Recherches sur la gravitation. C.R. Acad. Sci., 141 1905 : 713-715.

CREMIEU, V. Recherches experimentales sur la gravitation. Soc. Française de Physique, Bull. Scéances, November 17, 1905 : 485-499.

CREMIEU, V. Recherches sur la gravitation. C.R. Acad. Sci., 143 1906 : 887-889.

CREMIEU, V. Recherches sur la gravitation. J. Phys. (Paris), 5 1906 : 25-39.

CREMIEU, V. Recherches comparées sur les forces de gravitation dans les gaz et les liquides. Soc. Française de Physique, Bull. Scéances, February 1, 1907 : 33-47.

CREMIEU, V. Recherches comparées sur les forces de gravitation dans les gaz et les liquides. J. Phys. (Paris), 6 1907 : 284-298.

CREMIEU, V. Le problème de la gravitation. Rev. Gén. Sci. Pur. et Appl., 18 1907 : 7-13.

CREMIEU, V. Emploi de la balance de torsion comme sismographe. C.R. Acad. Sci., 148 1909 : 1161-1163.

CREMIEU, V. Détermination nouvelle de la constante newtonienne. C.R. Acad. Sci., 149 1909 : 700-702.

CREMIEU, V. Sur une erreur systématique qui limite la précision de l'expérience de Cavendish. Méthode nouvelle pour l'étude de la gravitation. C.R. Acad. Sci., 150 1910 : 863-866.

CREMIEU, V. Recherches expérimentales sur al gravitation. C.R. Acad. Sci., 165 1917 : 586-589, 688(E).

CREMIEU, V. Nouvelles recherches expérimentales sur la gravitation. C.R. Acad. Sci., 165 1917 : 670-672.

- CROWLEY, R.J., WOODWARD, J.F. and YOURGRAU, W. Gravitational attenuation and the internal heating of planetary bodies. Astron. Nachr., 295(5) 1974 : 203-206.
- DE SITTER, W.\* The absorption of gravity and the longitude of the moon. Amsterdam Proceedings, 21 1912.
- DE SITTER, W. Absorption of gravitation. The Observatory, 35 1912 : 387-393.
- DOBROKHOTOV, Yu.S., PARIISKY, N.N. and LYSenko, V.I. Observations of tidal variations of gravity in Kiev during the solar eclipse of February 15, 1961. In : Quatrième Symposium International sur les Marées Terrestres, edited by Paul Melchior, Communications de l'Observatoire Royal de Belgique, No. 188, Série Géophysique No. 58, Brussels, Belgium, 1961 : 66-68.
- EDDINGTON, Arthur S. Majorana's theory of gravitation. Astrophys. J., 56 1922 : 71-72.
- EICHELBERGER, W.S. and MORGAN, H.R. On the daily variation in clock corrections. Astron. J., 34 1922 : 15-17.
- EÖTVÖS, R. Etude sur les surfaces de niveau et la variation de la pesanteur et du champ magnétique. In : Rapports présentés au Congrès International de Physique, v.3, Paris, Gauthier-Villars, 1900 : 371-393.
- ERISMANN, Theodor. Zur Frage nach der Abhängigkeit der Gravitationskraft vom Zwischenmedium. Vierteljahrsschrift der Naturforschenden Gesellschaft in Zurich, 53 1908 : 157-185.
- ERISMANN, T. Sur la dépendance de la force de gravitation du milieu intermédiaire à travers lequel elle s'exerce. Arch. Sci. Phys. Nat., 31 1911 : 36-45.
- FLINT, F.V.\* Should the laws of gravitation be reconsidered? Discussion. Aerospace Engineering, 19 May 1960 : 113-114.
- FORWARD, Robert L. General relativity for the experimentalist. Proc. Inst. Radio Eng., 49 1961 : 892-904.
- GROTHEN, Erwin. The problem of gravitational absorption. Geophys. J. R. Astron. Soc., 27 1972 : 447-448.
- HARRINGTON, Elmer A. Further experiments on the continuous generation of heat in certain silicates. Proc. Am. Philos. Soc., 72 1933 : 333-349.
- HARRISON, J.C. A note on the paper 'Earth-tide observations made during the international geophysical year'. J. Geophys. Res., 68(5) 1963 : 1517-1518.

HEYL, Paul R. Gravitational absorption. Science, 55 1922 : 349-350.

HOFFMANN, Banesh. Noon-midnight red shift. Phys. Rev., 121 1961 : 337-342.

ISENKRAHE, C. Ueber die Zurückführung der Schwere auf Absorption und die daraus abgeleiteten Gesetze. Abhandlungen zur Gesellschaft der Mathematik und Physik (Zeitschrift für Mathematik und Physik), 37 (Anhang) 1892 : 163-204.

KLEINER, A. Gravitation considérée comme une force se faisant sentir de proche en proche. Arch. Sci. Phys. Nat., 20 1905 : 420-423.

KOLESNIKOV, S.M., KOLESNIKOVA, E.M., MASLOV, E.M. and STAVSKII, A.K. Observation of non-newtonian gravitation effects. Probl. Teorii Gravitatsii i Elem. Chastits (USSR), No. 5 1974 : 192-199.

LAAGER, Fritz. Versuch mit der Drehwage die Abhängigkeit der Gravitation vom Zwischenmedium nachzuweisen. Dissertation, Univ. Zurich, Bern, Switzerland, Haller'sche Buchdruckerei, 1904, 34pp.

MAJORANA, Quirino. Expériences sur la gravitation. C.R. Acad. Sci., 169 1919 : 719-721.

MAJORANA, Q. Sulla gravitazione. Atti della Reala Accademia dei Lincei, Rendiconti, 28 1919 : 165-174. The name of this journal will be abbreviated for the remainder of Prof. Majorana's entries.

MAJORANA, Q. Sulla gravitazione. Atti Accad. Lincei, 28 1919 : 221-223.

MAJORANA, Q. Sulla gravitazione. Atti Accad. Lincei, 28 1919 : 313-317.

MAJORANA, Q. Sulla gravitazione. Atti Accad. Lincei, 28 1919 : 416-421.

MAJORANA, Q. Sulla gravitazione. Atti Accad. Lincei, 28 1919 : 480-489.

MAJORANA, Q. Sur la gravitation. C.R. Acad. Sci., 169 1919 : 646-649.

MAJORANA, Q. Sulla gravitazione. Atti Accad. Lincei, 29 1920 : 23-32.

MAJORANA, Q. Sulla gravitazione. Atti Accad. Lincei, 29 1920 : 90-99.

MAJORANA, Q. Sulla gravitazione. Atti Accad. Lincei, 29 1920 : 163-169.

MAJORANA, Q. Sulla gravitazione. Atti Accad. Lincei, 29 1920 : 235-240.

MAJORANA, Q. On gravitation. Theoretical and experimental reseaches. Philos. Mag., 39 1920 : 488-504.

MAJORANA, Q. Sull'assorbimento della gravitazione. Atti Accad. Lincei, 30 1921 : 75-79.

MAJORANA, Q. Sull'assorbimento della gravitazione. Atti Accad. Lincei, 30 1921 : 289-294.

MAJORANA, Q. Sull'assorbimento della gravitazione. Atti Accad. Lincei, 30 1921 : 350-354.

MAJORANA, Q. Sull'assorbimento della gravitazione. Atti Accad. Lincei, 30 1921 : 442-446.

MAJORANA, Q. Sur l'absorption de la gravitation. C.R. Acad. Sci., 173 1921 : 478-479.

MAJORANA, Q. Sull'assorbimento della gravitazione. Atti Accad. Lincei, 31 1922 : 41-45.

MAJORANA, Q. Sull'assorbimento della gravitazione. Atti Accad. Lincei, 31 1922 : 81-86.

MAJORANA, Q. Sull'assorbimento della gravitazione. Atti Accad. Lincei, 31 1922 : 141-146.

MAJORANA, Q. Sull'assorbimento della gravitazione. Atti Accad. Lincei, 31 1922 : 221-226.

MAJORANA, Q. Sull'assorbimento della gravitazione. Atti Accad. Lincei, 31 1922 : 343-346.

MAJORANA, Q. Quelques recherches sur l'absorption de la gravitation. J. Phys. Radium, 1 1930 : 314-324.

MAJORANA, Q. Su di un'ipotesi cosmogonica. Atti Accad. Lincei, 17 1954 : 150-157.

MAJORANA, Q. Su di una nuova teoria della gravitazione. Atti Accad. Lincei, 19 1955 : 95-101.

MAJORANA, Q. Sull'ipotesi dell'assorbimento gravitazionale. Atti Accad. Lincei, 22 1957 : 392-397.

MAJORANA, Q. Ipotetiche conseguenze dell'assorbimento gravitazionale. Atti Accad. Lincei, 22 1957 : 397-402.

RADZIEVSKII, V.V. and KAGAL'NIKOVA, I.I.\* Bulletin of All-Union Astronomogeophysical Society, No. 26 1960 : 3.

RUSSEL, Henry Norris. On Majorana's theory of gravitation.  
Astrophys. J., 54 1921 : 334-346.

SAXL, Erwin J. and ALLEN, Mildred. Period of a torsion pendulum as affected by adding weights. J. Appl. Phys., 40 1969 : 2499-2504.

SAXL, E.J. and ALLEN, M. 1970 solar eclipse as 'seen' by a torsion pendulum. Phys. Rev. D, 3 1971 : 823-825.

SCHLOMKA, Teodor. Ueber die Abhängigkeit der Schwerkraft vom Zwischenmedium. Z. für Geophys. 1927 : 397-400.

SCHNEIDEROV, A.J. On a criticism of Majorana's theory of gravitation. Bollettino di Geofisica Teorica ed Applicata, 3 1961 : 77-79.

SIGL, R. and EBERHARD, O. Horizontalpendelbeobachtungen in Berchtesgaden während der Sonnenfinsternis vom February 15, 1961. In : Quatrième Symposium International sur les Marées Terrestres, edited by Paul Melchoir, Communications de l'Observatoire Royal de Belgique, No. 188, Série Géophysique No. 58, Brussels, Belgium, 1961 : 70-75.

SLICHTER, Louis B., CAPUTO, Michele, and HAGER, Clarence L. An experiment concerning gravitational shielding. J. Geophys. Res., 70 (6) 1965 : 1541-1551.

TOMASCHEK, Rudolf. Tidal gravity measurements in the Shetlands. Effect of the total eclipse of June 30, 1954. Nature (London), 175 1955 : 937-939.

TOMASCHEK, R. Conditions d'observation de l'éclipse de soleil du 15 février 1961 pour les instruments de mesure des marées terrestres. Marées Terrestres Bulletin d'Information, No. 23, 3 janvier 1961 : 460-465 (bis).

TOMASCHEK, R. and GROTHEN, E. Untersuchung von Gravitationswirkungen während der totalen Sonnenfinsternis am 15 Februar 1961. Nachrichten aus dem Karten- und Vermessungswesen, Reihe 1 : Deutsche Beiträge und Informationenheft Nr. 25, Frankfort a/M, Germany, Verlag des Instituts für Angewandte Geodäsie, 1963 : 17-26.

VON SEELIGER, H. Ueber die Anwendung der Naturgesetze auf das Universum (abstract). Sitzungsberichte der Mathematisch-Physikalischen Klasse der Königlich Bayerischen Akademie der Wissenschaften zu München, 1909 : 18.

VON SEELIGER, H. Ueber die Anwendung der Naturgesetze auf das Universum. Sitzungsberichte der Königlich Bayerischen Akademie der Wissenschaften, Mathematisch-Physikalische Klasse, 4. Abhandlung, May 1, 1909, 25pp.

WEBER, Joseph. Gravitational shielding and absorption. Phys. Rev., 146 1966 : 935-937.

4. Measurements of the Local Directive Action of the Gravitational Force

HEYL, Paul R. Gravitational anisotropy in crystals. Scientific Papers of the Bureau of Standards (U.S.), 19 1924 : 307-324.

MACKENZIE, Arthur Stanley. On the attractions of crystalline and isotropic masses at small distances. Phys. Rev., 2 1895 : 321-343.

POYNTING, John Henry and GRAY, P.L. An experiment in search of a directive action of one quartz crystal on another. Proc. R. Soc. London, Ser. A : 64 1898 : 121-122.

POYNTING, J.H. and GRAY, P.L. An experiment in search of a directive action of one quartz crystal on another. Philos. Trans. R. Soc. London, Ser. A : 192 1899 : 245-256.

ZEEMAN, Pieter. Some experiments on gravitation. The ratio of mass to weight for crystals and radioactive substances. Proceedings of the Section of Sciences, Koninklijke Akademie van Wetenschappen te Amsterdam, 20 1918 : 542-553.

5. Measurements of the Dependence of G on the Physical State of Masses

COOK, A.H. A new determination of the constant of gravitation. Contemp. Phys., 9 1968 : 227-238.

COWSIK, R. A new torsion balance for studies in gravitation and cosmology. Indian J. Phys., 55B 1981 : 497-502.

CREMIEU, Victor. Recherches comparées sur les forces de gravitation dans les gaz et les liquides. J. Phys. (Paris), 6 1907 : 284-298.

EÖTVÖS, Roland von. Ueber die Anziehung der Erde auf verschiedene Substanzen. Beiblätter für Physik, 15 1891 : 688-689.

EÖTVÖS, R.\* Ueber die Anziehung der Erde auf verschiedene Substanzen. Ungar. Ber., 8 1891 : 65-68.

KRIECHGAUER, Hr.\* Verhandlungen der Berliner Physikalische Gesellschaft, 10 1892 : 13.

LEE, William N. A preliminary analysis of the effects of using non-spherical masses in a Beams-type measurement of G or  $\Delta G/G$ . M.I.T. Measurement Systems Laboratory Report No. RF-74, NASA Contractor Report No. CR-115139, Cambridge, Mass., M.I.T., 1970, 44 pp.

MILLS, Allen P., Jr. Proposed null experiments to test the inverse square law of gravitation. Gen. Relativ. Gravit., 11 1979 : 1-11.

METHERELL, A.J.F., SPEAKE, C.C., CHEN, Y.T. and FALLER, J.E. Optimizing the shape of the attracting mass in precision measurements of G. In : Precision Measurement and Fundamental Constants II, edited by B.N. Taylor and W.D. Phillips, National Bureau of Standards Special Publication 617, Washington, D.C., U.S. Printing Office, 1983, in press.

6. Measurements of the Dependence of G on the Chemical State of Masses

BRUSH, Charles F. Discussion of a kinetic theory of gravitation, II, and some new experiments in gravitation. Phys. Rev., 18 1921 : 125-126.

BRUSH, C.F. Discussion of a kinetic theory of gravitation, II, and some new experiments in gravitation. Proc. Am. Philos. Soc., 60 1921 : 43-61.

BRUSH, C.F. Discussion of a kinetic theory of gravitation, II, and some new experiments in gravitation. Second paper. Proc. Am. Philos. Soc., 61 1922 : 167-183.

BRUSH, C.F. Discussion of a kinetic theory of gravitation, II, and some new experiments in gravitation. Third paper. Proc. Am. Philos. Soc., 62 1923 : 75-89.

BRUSH, C.F. Some new experiments in gravitation. Fourth paper. Proc. Am. Philos. Soc., 63 1924 : 57-61.

BRUSH, C.F. Some experimental evidence supporting the kinetic theory of gravitation. J. Franklin Institute, 206 1928 : 143-149.

BURTON, C.V. The possible dependence of gravitational attraction on chemical composition, and the fluctuations of the moon's longitude which might result therefrom. Philos. Mag., 26 1914 : 252-256.

EÖTVÖS, Roland von. Beiträge zum Gesetze der Proportionalität von Trägheit und Gravität. Ann. Phys. (Leipzig), 68 1922 : 11-66.

GILVARRY, J.J. and MULLER, P.M. Possible variation of the gravitational constant over the elements. Phys. Rev. Lett., 28 1972 : 1665-1669.

KREUZER, Lloyd B. The equivalence of active and passive gravitational mass. Ph.D. Thesis, Princeton University, 1966, 107pp.

KREUZER, L.B. Experimental measurement of the equivalence of active and passive gravitational mass. Phys. Rev., 169 1968 : 1007-1012.

LANDOLT, H. Untersuchungen über etwaige Änderungen des Gesamtgewichtes chemisch sich um setzender Körper. Sitzungsberichte der Königlich Preussischen Akademie der Wissenschaften zu Berlin, No. 22 1893 : 301-334.

- LANDOLT, H. Untersuchungen über etwaige Aenderungen des Gesamtgewichtes chemisch sich unsetzender Körper. Z. Phys. Chem., 12 1893 : 1-34.
- MORRISON, Daniel and HILL, Henry A. Current uncertainty in the ratio of the active-to-passive gravitational mass. Phys. Rev. D, 8 1973 : 2731-2733.
- POTTER, Harold H. Note on the gravitational acceleration of bismuth. Phys. Rev., 19 1922 : 187-188.
- POTTER, H.H. Some experiments on the proportionality of mass and weight. Proc. R. Soc. London, Ser. A, 104 1923 : 588-610.
- SANFORD, Fernando and RAY, Lillian E. On a possible change of weight in chemical reactions. Phys. Rev., 5 1897 : 247-253.
- WAPSTRA, A.H. and NIJGH, G.J. The ratio of gravitational to kinetic mass for the constituents of matter. Physica, 21 1955 : 796-798.
- WILL, Clifford M. Active mass in relativistic gravity : theoretical interpretation of the Kreuzer experiment. Astrophys. J., 204 1976 : 224-234.
- WILL, C.M. Theory and Experiment in Gravitational Physics, Cambridge, U.K., Cambridge University Press, 1981.
- WILSON, H.A. Note on the ratio of mass to weight for bismuth and aluminum. Phys. Rev., 20 1922 : 75-77.

7. Measurements of the Dependence of G on Temperature

BARTON, E.H. Gravitation and temperature. Nature (London), 97  
1916 : 461-462.

BARTON, E.H. Thermodynamics and gravitation. Nature (London), 99  
1917 : 45.

BARUS, Carl. The displacement of the gravitating needle in its  
dependence on atmospheric temperatures. Proc. Nat. Acad. Sci.  
U.S.A., 5 1919 : 547-550.

BARUS, C. Special articles. The interaction of gravitating and radiant  
forces. Science, 50 1919 : 279-282.

DONNAN, F.G. Heat of reaction and gravitational field. Nature  
(London), 104 1919 : 392-393.

FITZGERALD, George Francis. Helmholtz memorial lecture. J. Chem.  
Soc., Trans., 69 1896 : 885-912.

LARMOR, Joseph. Gravitation and temperature. Nature (London), 97  
1916 : 321.

LARMOR, J. Gravitation and temperature. Nature (London), 97 1916 :  
421.

LARMOR, J. Thermodynamics and gravitation. Nature (London), 99  
1917 : 44-45.

LINDEMANN, F.A. and BURTON, C.V. The temperature coefficient of  
gravity. Nature (London), 98 1917 : 349.

LODGE, Oliver. Gravitation and thermodynamics. Nature (London), 99  
1917 : 104.

LODGE, O. Continued discussion of the astronomical and gravitational  
bearings of the electrical theory of matter. Philos. Mag., 35  
1918 : 141-156.

PATERSON, C.C. Discussion. Chem. News, 115 1917 : 116-117.

PATERSON, C.C. Discussion. Proc. Phys. Soc. London, 29 1917 :  
163-170.

PETTERSSON, Hans. A new micro-balance and its use. Thesis, Göteborg  
University, Sweden, Vet. of Vitterh. Samhalle's Handlanger, Wald.  
Zachrissons Boktryckeri A.-B., 1914, 91 pp.

PETTERSSON, H. Experiments with a new micro-balance. Proc. Phys. Soc. London, 32 1920 : 209-211.

POYNTING, John Henry and PHILLIPS, Percy. An experiment with the balance to find if change of temperature has any effect upon weight. Proc. R. Soc. London, Ser. A, 76 1905 : 445-457.

SHAW, Philip E. The newtonian constant of gravitation as affected by temperature. Philos. Trans. R. Soc. London, 216 1916 : 349-392.

SHAW, P.E. Gravitation and temperature. Nature (London), 97 1916 : 400-401.

SHAW, P.E. and SAMPSON, R.A. Mathematics and physics at the British Association. Nature (London), 98 1916 : 120.

SHAW, P.E. Response to Lindemann and Burton. Nature (London), 98 1917 : 350.

SHAW, P.E. and HAYES, C. Societies and academies, London Physical Society. Nature (London), 99 1917 : 77.

SHAW, P.E. Gravitation and thermodynamics. Nature (London), 99 1917 : 84-85.

SHAW, P.E. Gravitation and thermodynamics. Nature (London), 99 1917 : 165.

SHAW, P.E. and HAYES, C. A special test on the gravitation temperature effect (Physical Society Annual General Meeting notice), Chem. News, 115 1917 : 116-117.

SHAW, P.E. and HAYES, C. A special test on the temperature effect of gravitation. Proc. Phys. Soc. London, 29 1917 : 163-170.

SHAW, P.E. and DAVY, N. The effect of temperature on gravitational attraction. Proc. R. Soc. London, 102 1922 : 46-47.

SHAW, P.E. and DAVY, N. The effect of temperature on gravitational attraction (meeting notice). Nature (London), 109 1922 : 462.

SHAW, P.E. and DAVY, N. The effect of temperature on gravitational attraction. Phys. Rev., 21 1923 : 680-691.

SMITH, F.E. Discussion. Chem. News, 115 1917 : 116-117.

SMITH, F.E. Discussion. Proc. Phys. Soc. London, 29 1917 : 163-170.

SOUTHERNS, L. Experimental investigation as to dependence of gravity on temperature. Proc. R. Soc. London, Ser. A, 78 1906 : 392-403.

THOMAS, J.S.G. Gravitation and thermodynamics. Nature (London), 99  
1917 : 405.

THOMPSON, Benjamin (Count of Rumford).\* In : The Complete Works of  
Count Rumford, v.2, Boston, American Academy of Arts and Sciences,  
1873 : 21.

TODD, George W. Thermodynamics and gravitation : a suggestion.  
Nature (London), 99 1917 : 5-6.

TODD, G.W. Gravitation and thermodynamics. Nature (London), 99  
1917 : 104-105.

8. Measurements of the Dependence of G on the Radioactivity of Masses

COMPTON, Arthur H. Radioactivity and the gravitational field.  
Philos. Mag., 39 1920 : 659-662.

GEIGEL, Robert. Ueber Absorption von Gravitationsenergie durch radioaktiv Substanz. Ann. Phys. (Leipzig), 10 1903 : 429-435.

KAUFMANN, W. Bemerkungen zu der Arbeit des H.R. Geigel : 'Ueber die Absorption von Gravitationsenergie durch radioaktiv Substanz'. Ann. Phys. (Leipzig), 10 1903 : 894-896.

RUTHERFORD, E. and COMPTON, A.H. Radio-activity and gravitation.  
Nature (London), 104 1919 : 412.

SAGNAC, Georges. Une relation possible entre la radioactivité et la gravitation. J. Phys. (Paris), 5 1906 : 455-462.

SOUTHERNS, L. A determination of the ratio of mass to weight for a radioactive substance. Proc. R. Soc. London, 84 1910 : 325-344.

THOMSON, J.J.\* Ratio of weight to mass for a radioactive substance.  
Presidential address of the British Association, Winnipeg,  
Manitoba, Canada, 1909.

ZEEMAN, Pieter. Some experiments on gravitation. The ratio of mass to weight for crystals and radioactive substances. Proceedings of the Section of Sciences, Koninklijke Akademie van Wetenschappen te Amsterdam, 20 1918 : 542-553.

9. Measurements of the Dependence of G on the Electromagnetic Energy Content of Masses

BAUER, L.A. Hunting the magnetic pole. Van Norden Magazine, 1907 : 55-67.

BAUER, L.A. Results of careful weighings of a magnet in various magnetic fields. Phys. Rev., 25 1907 : 498-499.

BAUER, L.A.\* The apparent alterations of the mass of a magnet as disclosed by weighings in various magnetic fields. Proc. Philos. Soc. Washington, Oct. 26, 1907.

BAUER, L.A. The apparent alterations of the mass of a magnet as disclosed by weighings in various magnetic fields. Science, 26 1907 : 752-754.

BAUER, L.A. Is the earth's action on the magnet only a couple? Terrestrial Magnetism and Atmospheric Electricity, 13 1908 : 25-34.

BAUER, L.A. On the apparent alterations of mass disclosed by weighings of magnets. Terrestrial Magnetism and Atmospheric Electricity, 14 1909 : 72-76.

BAUER, L. cited in What is gravitation? by Paul R. Heyl. Scientific Monthly, 47 1938 : 114-123.

CREMIEU, Victor. Recherches expérimentales sur la gravitation. C.R. Acad. Sci., 168 1919 : 227-230.

DAVISSON, C. Gravitation and electrical action. Science, 43 1916 : 929.

KENNARD, E.H. Electrical action and the gravitation constant. Science, 43 1916 : 928-929.

LLOYD, Morton G. Does magnetization alter mass? Terrestrial Magnetism and Atmospheric Electricity, 14 1909 : 67-71.

LORING, F.H. Gravitational attraction. Chem. News, 115 1917 : 181-182.

NIPHER, Francis E. Matter in its electrically explosive state. Proc. Am. Philos. Soc., 52 1913 : 283-286.

NIPHER, F.E. Gravitation and electrical action. Science Abstracts, 19 1916 : 234.

NIPHER, F.E. Disturbances impressed upon the earth's magnetic field. Trans. Acad. Sci. St. Louis, 23 1916 : 153-162.

NIPHER, F.E. Gravitation and electrical action. Trans. Acad. Sci. St. Louis, 23 1916 : 163-175.

NIPHER, F.E. Gravitation and electrical action. Science, 43 1916 : 472-473.

NIPHER, F.E. New evidence of a relation between gravitation and electrical action and of local changes in the electrical potential of the earth. Trans. Acad. Sci. St. Louis, 23 1920 : 383-387.

RICHARDSON, O.W. Note on gravitation. Philos. Mag., 43 1922 : 138-145.

SIMONS, L. Appendix to 'A note on gravitation'. Philos. Mag., 43 1922 : 138-145.

TREDER, H.-J., WOODWARD, J.F. and YOURGRAU, W. Electro-gravitational induction : a re-examination. I. On the relativistic theory of Faraday's gravo-electrical speculations. Gerlands Beitr. Geophys., 88 1979 : 11-22.

WALKER, Charles. Weighings of magnets. Terrestrial Magnetism and Atmospheric Electricity, 14 1909 : 75-76.

WOODWARD, James F. An experimental reexamination of faradayan electrogravitational induction. Gen. Relativ. Gravit., 12 1980 : 1055-1069.

10. Measurements of the Dependence of G on Inter-Mass Spacing

BLINNIKOV, S.I. Constraints on the gravitational constant from the observations of white dwarfs. Astrophys. Space Sci., 59 1978 : 13-17.

CHAN, H.A. and PAIK, H.J. A true laplacian detector for null test of the inverse square law of gravitation. In : Abstracts of the Ninth Conference on General Relativity and Gravitation, v.2, edited by E. Schmutzer, Jena, GDR, Friedrich Schiller University, July 1980 : 352.

CHAN, H.A. Null test of the gravitational inverse square law with a superconducting gravity gradiometer. Ph.D. Thesis, University of Maryland, 1982, 240pp.

CHAN, H.A., MOODY, M.V. and PAIK, H.J. Null test of the gravitational inverse square law. Phys. Rev. Lett., 24 1982 : 1745-1748.

CHAN, H.A. and PAIK, H.J. Experimental test of a spacial variation of newtonian gravitational constant at large distances. In : Precision Measurement and Fundamental Constants II, edited by B.N. Taylor and W.D. Phillips, National Bureau of Standards (U.S.) Special Publication 617, United States Printing Office, 1983, in press.

CHEN, Y.T. and SPEAKE, Clive C. A note on the double ring experiment to examine the inverse square law of gravitation. Preprint, Cavendish Laboratory, Cambridge, England, Cambridge University, 1981, unpublished.

CHEN, Y.T. The gravitational field inside a long hollow cylinder of finite length. Proc. R. Soc. London, Sec. A, 382 1982 : 75-82.

COOK, A.H. The nature of gravitation. Nature (London), 287 1980 : 189-190.

DAHLEN, F.A. Variation of gravity with depth in the earth. Phys. Rev. D, 25 1982 : 1735-1736.

FEINBERG, G. and SUCHER, J. Is there a strong van der Waals force between hadrons ? Phys. Rev. D, 20 1979 : 1717-1735.

FINZI, Arrigo. On the validity of Newton's law at a long distance. Mon. Not. R. Astron. Soc., 127 1963 : 21-30.

FINZI, A. Question on the validity of Newton's law at cosmic distances. Nuovo Cimento, 28 1963 : 224-226.

FINZI, A. Test for a possible variation of Newton's constant. Icarus, 9 1968 : 191-196.

FUJII, Yasunori. Dilaton and possible non-newtonian gravity. Nature (London), 234 1971 : 5-7.

FUJII, Y. Scalar-tensor theory of gravitation and spontaneous breakdown of scale invariance. Phys. Rev. D, 9 1974 : 874-876.

FUJII, Y. Spontaneously broken scale invariance and gravitation. Gen. Relativ. Gravit., 6 1975 : 29-34.

FUJII, Y. Composition independence of the possible finite-range gravitational force. Gen. Relativ. Gravit., 13 1981 : 1147-1155.

FUJIMOTO, M.-K. and HIRAKAWA, H. Theory of the detection of continuous gravitational radiation. J. Phys. Soc. Japan, 46 1979 : 703-706.

GIBBONS, G.W. and WHITING, B.F. Newtonian gravity measurements impose constraints on unification theories. Nature (London), 291 1981 : 636-638.

HIRAKAWA, Hiromasa, HIRAMATSU, S. and OGAWA, Yujiro. Damping of Brownian motion by cold load. Phys. Lett. A, 63 1977 : 199-202.

HIRAKAWA, H., TSUBONO, Kimio and OIDE, Katsunobu. Dynamical test of the law of gravitation. Nature (London), 283 1980 : 184-185.

HIRAKAWA, H. Experimental examination of the inverse square law of gravitation. In : Proc. of the 2nd Marcel Grossmann Meeting on General Relativity, edited by Remo Ruffini, Amsterdam, North Holland, 1982 : 1005-1011.

HONGYA, LIU, PINGHUA, ZHANG and RONGXIAN, QIN. Test of newtonian inverse square law at laboratory distances. Kexue Tongbao, in press.

HOSKINS, J.K., NEWMAN, R., SCHULTZ, J. and SPERO, R. Tests of the gravitational inverse square law. In : Precision Measurements and Fundamental Constants II, edited by B.N. Taylor and W.D. Phillips, National Bureau of Standards (U.S.) Special Publication 617, United States Printing Office, 1983, in press.

HULETT, Michael Jeffrey. On the newtonian gravitational constant. B.A. Thesis, Wesleyan University, 1969, unpublished, 97pp.

HUT, P. A constraint on the distance dependence of the gravitational constant. Phys. Lett. B, 99 1981 : 174-178.

KARAGIOZ, O.V., VORONKOV, V.V. and IZMAYLOV, V.P. Effect of swinging on movement of a torsion pendulum. In : Determination of Gravity Constants and Measurements of Certain Fine Gravity Effects, edited by Yu.D. Boulanger and M.U. Sagitov, NASA Technical Translation F-15,722, Accession No. N74-30831, 1974 : 38-47.

KARAGIOZ, O.V., IZMAYLOV, V.P., AGAFONOV, N.I., KOCHERYAN, E.G. and TARAKANOV, Yu.A. The determination of the gravitational constant with an evacuated torsion balance. Izv. Acad. Sci. USSR Phys. Solid Earth, 12 1976 : 351-354 [translation of Izv. Akad. Nauk SSSR, Fiz. Zemli, 12(5) 1976 : 106-111].

KARAGIOZ, O.V., SILIN, A.A. and IZMAYLOV, V.P. On the relation between the constant of gravitation and the distance between the interacting masses. Izv. Akad. Nauk SSSR, Fiz. Zemli, No.1 1981 : 92-97.

KIMURA, S., SUZUKI, T. and HIRAKAWA, H. Low frequency antenna for gravitational radiation. Phys. Lett. A, 81 1981 : 302-304.

LEVITT, L.S. The gravitational constant at time zero. Lett. Nuovo Cimento, 29 1980 : 23-24.

LONG, Daniel R. Theory for mass and gravitation ; calculation of the gravitational constant. Bull. Am. Phys. Soc., 12 1967 : 1057.

LONG, D.R. Predicted gravitational inverse square law anomaly. Bull. Am. Phys. Soc., 15 1970 : 1640-1641.

LONG, D.R. Why do we believe newtonian gravitation at laboratory dimensions? Phys. Rev. D, 9 1974 : 850-852.

LONG, D.R. and OGDEN, Donald. Producing an ultra-high uniformity gravitational field. Phys. Rev. D, 10 1974 : 1677-1680.

LONG, D.R.\* Experimental examination of the gravitational inverse square law at laboratory distances. Experimental Notes, Cheney, Washington, Eastern Washington University Archives, No.75-19, 4 vol., 1975, 1167pp.

LONG, D.R. Experimental examination of the gravitational inverse square law. Nature (London), 260 1976 : 417-418.

LONG, D.R. Vacuum polarization and non-newtonian gravitation. Nuovo Cimento, B 55 1980 : 252-256.

LONG, D.R. Current measurements of the gravitational 'constant' as a function of mass separation. Nuovo Cimento, B 62 1981 : 130-138.

LONG, D.R. Current work on the gravitational inverse square law. In : Precision Measurements and Fundamental Constants II, edited by B.N. Taylor and W.D. Phillips, National Bureau of Standards (U.S.) Special Publication 617, United States Printing Office, 1983, in press.

LUTHER, G.G. and TOWLER, W.R., private communication to R.C. Ritter, cited in Experimental searches for gravitational effects outside of general relativity. In : Proc. of the 2nd Marcel Grossmann Meeting on General Relativity, edited by Remo Ruffini, Amsterdam, North Holland, 1982 : 1039-1070.

MACKENZIE, A.S. On the attractions of crystalline and isotropic masses at small distances. Phys. Rev., 2 1895 : 321-343.

MAPOLES, E.R.\* Development of a superconducting gravity gradiometer for a test of the inverse square law. Ph.D. Thesis, Stanford University, 1981.

MCQUEEN, H.W.S. Independence of the gravitational constant from gross earth data. Phys. Earth Planet. Interiors, 26 1981 : P6-P9.

MIKKELSON, David R. and NEWMAN, Michael J. Constraints on the gravitational constant at large distances. Phys. Rev. D, 16 1977 : 919-926.

MILLS, Jr., Allen P. Proposed null experiments to test the inverse square nature of gravitation. Gen. Relativ. Gravit., 11 1979 : 1-11.

NEWMAN, Riley, PELLAM, J., SCHULTZ, J. and SPERO, R. Experimental test of the gravitational inverse square law at laboratory distances. In : Abstracts of the Eighth Conference on General Relativity and Gravitation, edited by C.B. Collins, Waterloo, Ontario, Canada, Department of Applied Mathematics, University of Waterloo, August 1977 : 268.

NEWMAN, R., HOSKINS, J.K., PELLAM, J., SCHULTZ, J. and SPERO, R. Test of the gravitational inverse square law. In : Abstracts of the Ninth Conference on General Relativity and Gravitation, edited by E. Schmutzler, Jena, GDR, Friedrich Schiller University, July 1980 : 361-362.

NEWMAN, R. Tests of the gravitational inverse square law on a laboratory distance scale. In : Proc. of the 3rd Marcel Grossmann Meeting on General Relativity, in press.

NEWMAN, R. Experiments with a cryogenic torsion balance. In : Proc. of the 3rd Marcel Grossmann Meeting on General Relativity, in press.

NI, Wei-Tou. Measurement of gravitational forces due to oil tank and swimming pool and the inverse square law. Physics (Taiwan), 2 1980 : 2-5.

OELFKE, William C. The measurement of G for small inter-mass spacings. In : Precision Measurements and Fundamental Constants II, edited by B.N. Taylor and W.D. Phillips, National Bureau of Standards (U.S.) Special Publication 617, United States Printing Office, 1983, in press.

OGAWA, Yujiro, TSUBONO, Kimio and HIRAKAWA, H. Experimental test of the law of gravitation. Phys. Rev. D, 26 1982 : 729-734.

O'HANLON, John. Intermediate-range gravity : A generally co-varient model. Phys. Rev. Lett., 29 1972 : 137-138.

OIDE, Katsunobu, OGAWA, Y. and HIRAKAWA, H. Artificial cold resistors. Jap. J. Appl. Phys., 17 1978 : 429-432.

OIDE, K., TSUBONO, K. and HIRAKAWA, H. The gravitational field of a rotating bar. Jap. J. Appl. Phys., 19 1980 : L123-L125.

PAIK, Ho Jung. Superconducting tunable-diaphragm transducer for sensitive acceleration measurements. J. Appl. Phys., 47 1976 : 1168-1178.

PAIK, H.J., MAPOLES, E.R. and WANG, K.Y. Superconducting gravity gradiometers. In : Future Trends in Superconductive Electronics, edited by B.S. Deaver, Jr., C.M. Falco, J.H. Harris and S.A. Wolf, AIP Conference Proceedings No. 44, New York, American Institute of Physics, 1978 : 166-170.

PAIK, H.J. New null experiment to test the inverse square law of gravitation. Phys. Rev. D, 19 1979 : 2320-2324.

PAIK, H.J. and CHAN, Hinghung A. Experimental examination of the inverse-square law of gravitation. In : Proc. of the 2nd Marcel Grossmann Meeting on General Relativity, edited by Remo Ruffini, Amsterdam, North Holland, 1982 : 1013-1018.

PAIK, H.J. New test of the inverse square law. In : Proc. of the 3rd Marcel Grossmann Meeting on General Relativity, in press.

PANOV, V.I. and FRONTOV, V.N. The Cavendish experiment at large distances. Sov. Phys. - JETP, 50 1979 : 852-856 [translation of Zh. Eksp. Teor. Fiz., 77 1979 : 1701-1707.].

PANOV, V.I. and FRONTOV, V.N. Experimental test of the space variability hypothesis for the gravitational constant. In : Abstracts of the Ninth Conference on General Relativity and Gravitation, edited by E. Schmutz, Jena, GDR, Friedrich Schiller University, July 1980 : 363-364.

RITTER, R.C. Experimental searches for gravitational effects outside of general relativity. In : Proc. of the 2nd Marcel Grossman Meeting on General Relativity, edited by Remo Ruffini, Amsterdam, North Holland, 1982 : 1039-1070.

SPERO, Robert Evan, HOSKINS, J.K., NEWMAN, R., PELLAM, J. and SCHULTZ, J. Test of the gravitational inverse square force law at short distances. Bull. Am. Phys. Soc., 24 1979 : 579.

SPERO, R.E. A laboratory test of the inverse square law of gravity. Ph.D. Thesis, University of California at Irvine, 1979, 128pp.

SPERO, R.E., HOSKINS, J.K., NEWMAN, R., PELLAM, J. and SCHULTZ, J. Test of the gravitational inverse square law at laboratory distances. Phys. Rev. Lett., 44 1980 : 1645-1648.

STACEY, F.D., TUCK, G.J., HOLDING, S.C., MAHER, A.R. and MORRIS, D. Constraint on the planetary scale value of the newtonian gravitational constant from the gravity profile within a mine. Phys. Rev. D, 23 1981 : 1683-1692.

STACEY, F.D. and TUCK, G.J. Geophysical evidence for non-newtonian gravity. Nature (London), 292 1981 : 230-232.

STACEY, F.D. and TUCK, G.J. Non-newtonian gravity : geophysical evidence. In : Precision Measurements and Fundamental Constants II, edited by B.N. Taylor and W.D. Phillips, National Bureau of Standards (U.S.) Special Publication 617, United States Printing Office, 1983, in press.

STACEY, F.D. Subterranean gravity and other deep hole geophysics. In : Science Underground, Los Alamos, U.S. Printing Office, in press.

SUGIMOTO, DAIICHIRO. Astrophysical test for dilaton theory of non-newtonian gravity. Prog. Theor. Phys., 48 1972 : 699-700.

SUZUKI, Toshikazu, TSUBONO, Kimio, KURODA, Kazuaki and HIRAKAWA, Hiromasa. Calibration of gravitational radiation antenna by dynamic newton field. Jap. J. Appl. Phys., 20 1981 : L498-L500.

THIESSEN, P.A. and TREDER, H.-J. Gibt es Oberflächeneffekte der Gravitation? Gerlands Beitr. Geophys., 91 1982 : 97-107.

WARBURTON, R.J., BEAUMONT, C. and GOODKIND, J.M. The effect of ocean tide loading on tides of the solid earth observed with the superconducting gravimeter. Geophys. J. R. Astron. Soc., 43 1975 : 707-720.

WULF, Theodor. Zum Nachweis der newtonschen allgemeinen Massenanziehung. Phys. Z., 23 1922 : 154-157.

YABUSHITA, Shin. On Finzi's hypothesis about the long range behavior of newtonian force. Nuovo Cimento, 33 1964 : 769-775.

YAMAGUCHI, Yoshio. On a test of Fujii's theory of gravitation. Prog. Theor. Phys., 58 1977 : 723-724.

YU, Hsou-Tao. An experimental determination of the gravitational constant at distances around ten meters. M.S. Thesis, National Tsing Hua University, Taiwan, 1978, 42pp.

YU, H.-T., NI, W.-T., HU, Chin-Cheng, LIU, Fa-Hsiang, YANG, Chin-Hsiang and LIU, Wu-Nan. An experimental determination of the gravitational constant at distances around ten meters. Chin. J. Phys. (Taiwan), 16 1978 : 201-213.

YU, H.-T., NI, W.-T., HU, C.-C., LIU, F.-H., YANG, C.-H., and LIU, W.-N. Experimental determination of the gravitational forces at separations around ten meters. Phys. Rev. D, 20 1979 : 1813-1815.

YU, H.-T., NI, W.-T., HU, C.-C., LIU, F.-H., YANG, C.-H. and LIU, W.-N. Measurement of the gravitational forces at separations around 10 meters. In : Precision Measurements and Fundamental Constants II, edited by B.N. Taylor and W.D. Phillips, National Bureau of Standards (U.S.) Special Publication 617, United States Printing Office, 1983, in press.

11. Measurements of the Dependence of G on Time

ALPHER, Ralph A. and GAMOW, George. A possible relation between cosmological quantities and the characteristics of elementary particles. General Electric Corp. Research Report, No. 68-C-307, Sept 1968 : 4pp.

ALPHER, R.A. and GAMOW, G. A possible relation between cosmological quantities and the characteristics of elementary particles. Proc. Nat. Acad. Sci. (U.S.), 61 1968 : 363-366.

ALPHER, R.A. Large numbers, cosmology, and Gamow. Am. Sci., 61 1973 : 52-58.

ALPHER, R.A. More on varying G. Phys. Today, 34 (3) 1981 : 12-13.

ANDERSON, John D., KEESEY, M.S.W., LAU, E.L., STANDISH, Jr., E.M. and NEWHALL, X.X. Tests of general relativity using astrometric and radio metric observations of the planets. Astronautica, 5 1978 : 43-61.

ANDERSON, J.D. and ESTARROOK, F.B. Application of DSN spacecraft tracking technology to experimental gravitation. J. Spacecraft and Rockets, 16 1979 : 120-125.

BARRELL, Steven Solomon. Analysis of the effect on graded beds of changing gravitational acceleration with time - a prototype paleogravimeter. M.S. Thesis, Univ. of South Carolina, 1976, 48pp.

BARROW, J.D. A cosmological limit on the possible variation of G. Mon. Not. R. Astron. Soc., 184 1978 : 677-682.

BARROW, J.D. The lore of the large numbers : some historical background to the anthropic principle. Q. J. R. Astron. Soc., 22 1981 : 388-420.

BEAMS, J.W. Proposed method of measuring small variations in the gravitational constant G. Bull. Am. Phys. Soc., 18 1973 : 267.

BENDER, P.L., DICKE, R.H., WILKINSON, D.T., ALLEY, C.O., CURRIE, D.G., FALLER, J.E., MULHOLLAND, J.D., SILVERBERG, E.C., PLOTKIN, H.E., KAULA, W.M. and MACDONALD, G.J.F. The lunar laser ranging experiment. In : Proceedings of the Conference on Experimental Tests of Gravitation Theories, edited by R.W. Davies, NASA Contractor Report NASA-CR-124710, Pasadena, California, California Institute of Technology, November 1, 1971 : 178-181.

BISHOP, N.T. Time-varying gravity and the abundance of helium. Mon. Not. R. Astron. Soc., 188 1979 : 839-840.

BLAKE, G.M. The rate of change of G. Mon. Not. R. Astron. Soc., 178 1977 : 41P-43P.

BLAKE, G.M. Is the earth contracting? Geophys. J. R. Astron. Soc., 51 1977 : 555-559.

BLAKE, G.M. The large numbers hypothesis and the rotation of the earth. Mon. Not. R. Astron. Soc., 185 1978 : 399.

BLEKSLEY, A.E.H. A new approach to cosmology. IV. S. Afr. J. Sci., 50 1953 : 61-64.

BLITCH, Michael Gordon. The feasibility of a gravitational clock to test the general theory of relativity. M.S. Thesis, M.I.T., 1969, 161pp.

BLOOD, Bernard E. An elementary analysis of the adaptation of the Beams' experimental concept to a  $\Delta G/G$  detector to be used in space. M.I.T. Measurement Systems Laboratory Report No. RN-60. In : NASA Contractor Report No. CR-115139, Cambridge, Mass., M.I.T., 1970, 39pp.

BLOOD, B.E. Error study of the Beam's experimental concept used in a  $\Delta G/G$  detector. M.I.T. Measurement Systems Laboratory Report No. RN-63. In : NASA Contractor Report No. CR-115139, Cambridge, Mass., M.I.T., 1971, 55pp.

BOND, A. Variations in the value of G. New Scientist, 33 1967 : 419.

BRAGINSKY, V.B. and GINZBURG, V.L. Possibility of measuring the time dependence of the gravitational constant. Sov. Phys. Dokl., 19 1974 : 290-291 [translation of Dok. Akad. Nauk SSSR, 216 1974 : 300-302].

BRAGINSKY, V.B., CAVES, C.M. and THORNE, K.S. Laboratory experiments to test relativistic gravity. Phys. Rev. D, 15 1977 : 2047-2068.

BRAGINSKY, V.B., CAVES, C.M. and THORNE, K.S. Laboratory experiments to test general relativity. In : Gravitazione Sperimentale, edited by Bruno Bertotti, Accademia Nazionale dei Lincei, Rome, 1977 : 49-72.

CANUTO, V. and LODENQUAI, J. Dirac cosmology. Astrophys. J., 211 1977 : 342-356.

CANUTO, V.M., HSIEH, S.-H., and OWEN, J.R. Scale covariance and G-varying cosmology. III. The  $(m, z)$ ,  $(\theta_m, z)$ ,  $(\theta_1, z)$ , and  $[N(m), m]$  tests. Astrophys. J., Supplement Series, 41 1979 : 263-300.

CANUTO, V.M. and OWEN, J.R. Scale covariance and G-varying cosmology. IV. The  $\log N - \log S$  relation. Astrophys. J., Supplement Series, 41 1979 : 301-326.

CANUTO, V., HSIEH, S.-H. and OWEN, J.R. Varying G. Mon. Not. R. Astron. Soc., 188 1979 : 829-837.

- CANUTO, V. and HSIEH, S.-H. Comment on the paper 'A cosmological limit on the possible variation of G'. Mon. Not. R. Astron. Soc., 191 1980 : 605-606.
- CANUTO, V.M. and HSIEH, S.-H. Cosmological variation of G and the solar luminosity. Astrophys. J., 237 1980 : 613.
- CANUTO, V.M. The earth's radius and the G variation. Nature (London), 290 1981 : 739-744.
- CANUTO, V.M. and GOLDMAN, I. Atomic and gravitational clocks. Nature (London), 296 1982 : 709-713.
- CANUTO, V.M. Variable G and the strong equivalence principle. Int. J. Theor. Phys., 21 1982 : 633-663.
- CANUTO, V.M., GOLDMAN, I. and SHAPIRO, I.I. Testing the strong equivalence principle by radar ranging. Astrophys. J. Lett., in press.
- CANUTO, V.M. and GOLDMAN, I. Astrophysical consequences of a violation of the strong equivalence principle. Nature (London), in press.
- CARR, B.J. and REES, M.J. The anthropic principle and the structure of the physical world. Nature (London), 278 1979 : 605-612.
- CARTER, Brandon. Large number coincidences and the anthropic principle in cosmology. In : Confrontation of Cosmological Theories with Observation, edited by M.S. Longair, Dordrecht, Reidel, 1974 : 291-298.
- CHIN, Chao-wen and STOTHERS, Richard. Solar test of Dirac's large numbers hypothesis. Nature (London), 254 1975 : 206-207.
- CHIN, C.-W. and STOTHERS, R. Limit on the secular change of the gravitational constant based on studies of solar evolution. Phys. Rev. Lett., 36 1976 : 833-835.
- CHOW, T.L. The variability of the gravitational constant. Lett. Nuovo Cimento, 31 1981 : 119-120.
- COUNSELMAN, Charles C. and SHAPIRO, Irwin I. Scientific uses of pulsars. Science, 162 1968 : 352-355.
- CUROTT, David Richard Francis. A pendulum gravimeter for precision detection of scalar gravitational radiation. Ph.D. Thesis, Princeton University, 1965, 123pp.
- DANNEHOLD, Terry. A proposed laboratory experiment to measure G/G. Gen. Relativ. Gravit., 14 1982 : 565-568.
- DAVIES, R.D. Letters (comment on Wesson's G/G article). Phys. Today, 34(3) 1981 : 78.

DEARBORN, David S. and SCHRAMM, David N. Limits on variations of G from clusters of galaxies. Nature (London), 247 1974 : 441-443.

DESABBATA, V. and RIZZATTI, P. A relation between the periodicity of earthquakes and the variation of gravitational constant. Lett. Nuovo Cimento, 20 1977 : 117-120.

DESABBATA, V. and RIZZATTI, P. Is there a relation between the speeds-ups of some binary pulsars and the variation of gravitational constant? Lett. Nuovo Cimento, 22 1978 : 363-366.

DICKE, Robert H. The secular acceleration of the earth's rotation and cosmology. In : The Earth-Moon System, edited by B.G. Marsden and A.G.W. Cameron, New York, Plenum, 1966 : 98-164.

DIRAC, P.A.M. Evolutionary cosmology. Commentarii Pontifica Academia Scientiarum, II (46) 1973 : 1-16.

DIRAC, P.A.M.\* The variation of G and the problem of the moon. Stud. Nat. Sci., 17 1980 : 1-7.

DOUGLASS, Jr., D.H.\* Two gravity experiments, presented at the Third Cambridge Conference on Relativity, New York, Goddard Institute for Space Studies, June 8, 1970, unpublished.

EICHENDORF, W. and REINHARDT, M. How constant are fundamental physical quantities? Z. Naturforsch. Teil A, 32 1977 : 532-537.

EZER, D. and CAMERON, A.G.W. Solar evolution with varying G. Can. J. Phys., 44 1966 : 593-615.

FAULKNER, D.J. Dirac's large numbers hypothesis and the acceleration of the moon's mean longitude. Mon. Not. R. Astron. Soc., 176 1976 : 621-624.

FINZI, Arrigo. Test of possible variations of the gravitational constant by the observation of white dwarfs within galactic clusters. Phys. Rev., 128 1962 : 2012-2015.

FINZI, A. On the hypothesis of the variation of the gravitational constant and on some of its consequences. Ann. Phys. (N.Y.), 26 1964 : 411-417.

GAMOW, G. Electricity, gravity, and cosmology. Phys. Rev. Lett., 19 1967 : 759-761.

GILLIES, G.T., RITTER, R.C., LOWRY, R.A. and BEAMS, J.W. An experiment for detecting changes in the universal gravitational constant. Virginia J. of Sci., 26 1975 : 48.

GILLIES, G.T. Development of a drive system yielding highly constant average speed. M.S. Thesis, University of Virginia, 1976, 83pp.

GILLIES, G.T. and RITTER, R.C. Experiments on variation of the gravitational constant using precision rotations. In : Precision Measurement and Fundamental Constants II, edited by B.N. Taylor and W.D. Phillips, National Bureau of Standards Special Publication 617, United States Printing Office, 1983, in press.

GROTON, Erwin and THYSSEN-BORNEMISZA, Stephen. Approaches in  $\Delta G/G$  determination. Pure Appl. Geophys., 99 1972 : 5-11.

GROTON, E. and THYSSEN-BORNEMISZA, S. Time varying gravitational satellite. Geophys. J. R. Astron. Soc., 29 1972 : 237-239.

HALPERN, Leopold and LONG, Chris. Two methods for measuring the variation of the gravitational parameter, G, using superconducting technology. In : On the Measurement of Cosmological Variations of the Gravitational Constant, edited by L. Halpern, Gainesville, Florida, University Presses of Florida, 1978 : 87-89.

HOFFMANN, William Frederick. A pendulum gravimeter for measurement of periodic annual variations in the gravitational constant. Ph.D. Thesis, Princeton University, 1962, 122pp.

HOFFMANN, W.F. 22-cps pendulum gravimeter for monitoring the gravitational constant as a function of time. Bull. Am. Phys. Soc., 8 1963 : 29.

HOVORKA, J.\* M.I.T. Letter MSL-127-69 to NASA-MSC, September 15, 1969.

HOVORKA, J.\* A force measurement in orbit to check scalar gravitational theory. M.I.T. Measurement Systems Laboratory Report No. RN-57, Cambridge, Mass., M.I.T., 1969.

KROPOTKIN, Pjotr N. Seasonal periodicity of earthquakes and Mach's principle. Gerlands Beitr. Geophys. (Leipzig), 84 1975 : 15-19.

LAMBECK, Kurt. The history of the earth's rotation. In : The Earth : Its Origin, Structure and Evolution, edited by M.W. McElhinny, Academic Press, New York, 1979 : 59-81.

LAPIEDRA, R. and PALACIOS, J.A. Time-varying newtonian gravity : an upper limit for the rate of change of the gravitational constant. Astron. Astrophys., 98 1981 : 382-383.

LEE, William N.\* A space experiment to determine the constancy of the gravitational constant G. In : Review of NASA-sponsored Research at the Measurement Systems Laboratory, Measurement Systems Laboratory Report PR-7, Cambridge, Mass., M.I.T., 1970.

LEE, W.N. A preliminary analysis of the effects of using non-spherical masses in a Beams-type measurement of G or  $\Delta G/G$ . M.I.T. Measurement Systems Laboratory Report No. RE-74. In : NASA Contractor Report No. CR-115139, Cambridge, Mass., M.I.T., 1970, 44pp.

- LEWIS, B.M. Variable G : a solution to the missing mass problem. Nature (London), 261 1976 : 302-304.
- LYTTLETON, R.A. and FITCH, J.P. Cosmological change of G and the structure of the earth. Mon. Not. R. Astron. Soc., 180 1977 : 471-477.
- LYTTLETON, R.A. and FITCH, J.P. Effect of a changing G on the moment of inertia of the earth. Astrophys. J., 221 1978 : 412-413.
- MALAMUD, Herbert. Letters (comment on Wesson's G/G article). Phys. Today, 34(3) 1981 : 78.
- MANSFIELD, V.N. Pulsar spin down and cosmologies with varying gravity. Nature (London), 261 1976 : 560-562.
- MARCHANT, Alan and MANSFIELD, Victor. Evolution of dynamical systems with time-varying gravity. Nature (London), 270 1977 : 699-700.
- McELHINNY, M.W., TAYLOR, S.R. and STEVENSON, D.J. Limits to the expansion of earth, moon, mars, and mercury and to changes in the gravitational constant. Nature (London), 271 1978 : 316-321.
- MORGANSTERN, R.E. Cosmological upper limit on the time variation of G. Nature (London), 232 1971 : 109-110.
- MORGANSTERN, R.E. Time variation of gravity constant. Nature (London), 237 1972 : 198.
- MORGANSTERN, R.E. Curved space cosmological bounds on the time variation of G. Nature Phys. Sci. (London), 237 1972 : 70-71.
- MORRISON, L.V. Rotation of the earth from AD 1663 - 1972 and the constancy of G. Nature (London), 241 1973 : 519-520.
- MULHOLLAND, J. Derral. Scientific achievements from ten years of lunar laser ranging. Rev. Geophys. Space Phys., 18 1980 : 549-564.
- MULLER, Paul H. Determination of the cosmological rate of change of G and the tidal acceleration of the earth and moon from ancient and modern astronomical data. In : On the Measurement of Cosmological Variations of the Gravitational Constant, edited by L. Halpern, Gainesville, Florida, University Presses of Florida, 1978 : 91-116.
- NEWTON, Robert R. Experimental evidence for a secular decrease in the gravitational constant G. J. Geophys. Res., 73 1968 : 3765-3771.
- PEEBLES, P.J. and DICKE, R.H. Cosmology and the radioactive decay ages of terrestrial rocks and meteorites. Phys. Rev., 128 1962 : 2006-2011.

POCHODA, P. and SCHWARZSCHILD, M. Variation of the gravitational constant and the evolution of the sun. Astrophys. J., 139 1964 : 587-593.

REASONBERG, R.D., SHAPIRO, I.I., PETTENGILL, G.H. and CAMPBELL, D.B. Bounds on the secular variation of the gravitational constant. Bull. Am. Astron. Soc., 8 1976 : 308.

REASONBERG, R.D. and SHAPIRO, I.I. Bound on the secular variation of the gravitational interaction. In : Atomic Masses and Fundamental Constants, v.5, edited by J.H. Sanders and A.H. Wapstra, New York, Plenum, 1976 : 643-648.

REASONBERG, R.D. and SHAPIRO, I.I. Solar system tests of general relativity. In : Gravitazione Sperimentale, edited by Bruno Bertotti, Accademia Nazionale dei Lincei, Rome, 1977 : 143-160.

REASONBERG, R.D. and SHAPIRO, I.I. A radar test of the constancy of the gravitational interaction. In : On the Measurement of Cosmological Variations of the Gravitational Constant, edited by L. Halpern, Gainesville, Florida, University Presses of Florida, 1978 : 71-86.

RITTER, R.C., BEAMS, J.W. and LOWRY, R.A. A laboratory experiment to measure the time variation of Newton's gravitational constant. In : Atomic Masses and Fundamental Constants, v.5, edited by J.H. Sanders and A.H. Wapstra, New York, Plenum, 1976 : 629-635.

RITTER, R.C. and GOLDSTEIN, Jr., S.J. A possible limit on  $G$  from the periods of Io. Bull. Am. Phys. Soc., 23 1978 : 544.

RITTER, R.C. and BEAMS, J.W. A laboratory measurement of the constancy of  $G$ . In : On the Measurement of Cosmological Variations of the Gravitational Constant, edited by L. Halpern, Gainesville, Florida, University Presses of Florida, 1978 : 29-70.

RITTER, R.C. Experimental searches for gravitational effects outside of general relativity. In : Proc. of the 2nd Marcel Grossmann Meeting on General Relativity, edited by Remo Ruffini, Amsterdam, North Holland, 1982 : 1039-1070.

ROEDER, R.C. and DEMARQUE, P.R. Solar evolution and Brans-Dicke cosmology. Astrophys. J., 144 1966 : 1016-1023.

ROTHMAN, Tony and MATZNER, Richard. Scale-covariant gravitation and primordial nucleosynthesis. Astrophys. J., 257 1982 : 450-455.

SHAPIRO, Irwin I., SMITH, W.B., ASH, M.B., INGALLS, R.P. and PETTENGILL, G.H. Gravitational constant : experimental bound on its time variation. Phys. Rev. Lett., 26 1971 : 27-30.

SHAPIRO, I.I. Testing general relativity : progress, problems, and prospects. In : Proceedings of the Conference on Experimental Tests of Gravitation Theories, edited by R.W. Davies, NASA Contractor Report NASA-CR-124710, Pasadena, California, California Institute of Technology, November 1, 1971 : 136-147.

SHAPIRO, I.I. Experimental challenges posed by the general theory of relativity. In : Some strangeness in the proportion : a centennial symposium to celebrate achievements of Albert Einstein, Chapter 8, edited by Harry Woolf, Reading, Mass., Addison-Wesley, 1980 : 115-136.

SHAVIV, Giora and BAHCALL, John N.\* Publ. Astron. Soc. Pacific, 79 1967 : 438.

SHAVIV, G. and BAHCALL, J.N. Brans-Dicke cosmology and the solar neutrino flux. Astrophys. J., 155 1969 : 438-439.

SHAVIV, G. and BAHCALL, J.N. The effect of the Brans-Dicke cosmology on solar evolution and neutrino fluxes. Astrophys. J., 155 1969 : 135-143.

SHIPMAN, Harry L. Letters (comment on Wesson's G/G article). Phys. Today, 34 (3) 1981 : 15.

STEPHENSON, L.M. A possible annual variation of the gravitational constant. Proc. Phys. Soc. London, 90 1967 : 601-604.

STEPHENSON, L.M. Gravitation : constant or variable. New Scientist, 33 1967 : 265-267.

STEPHENSON, L.M. A dynamical model for gravitation. Found. Phys., 6 1976 : 143-155.

STEWART, A.D. Is gravity weakening? Spectrum, No. 74, June 1970 : 16.

STOTHERS, R. White dwarfs, the galaxy and Dirac's cosmology. Nature (London), 262 1976 : 477-479.

STOUT, Perry R. and BROWNELL, J.R.\* Principles of soil physics applied to the reassessment of the universal constant of gravitation. Preprint, University of California at Davis, 1974, unpublished.

TELLER, Edward. On the change of physical constants. Phys. Rev., 73 1948 : 801-802.

THYSSEN-BORNEMISZA, S. and GROTE, E. New approaches in dG/G determination. Trans. Am. Geophys. Union, 52 1971 : 820.

THYSSEN-BORNEMISZA, S. Eötvös ratio and equivalence principle distorted by time-varying G. Trans. Am. Geophys. Union, 55 (12) 1974 : 1104.

ULRICH, Roger K. Solar models with low neutrino fluxes. Astrophys. J., 188 1974 : 369-378.

VAN FLANDERN, Thomas C. A new measurement of the rate of change of G. Bull. Am. Phys. Soc., 20 1975 : 543.

VAN FLANDERN, T.C. A determination of the rate of change of G. Mon. Not. R. Astron. Soc., 170 1975 : 333-342.

VAN FLANDERN, T.C. Recent evidence for variations in the value of G. Ann. N.Y. Acad. Sci., 262 1975 : 494-495.

VAN FLANDERN, T.C. Is gravity getting weaker? Sci. Am., 234 1976 : 44-52.

VAN FLANDERN, T.C. Status of the occultation determination of G-dot. In : On the Measurement of Cosmological Variations of the Gravitational Constant, edited by L. Halpern, Gainesville, Florida, University Presses of Florida, 1978 : 21-28.

VAN FLANDERN, T.C. Is the gravitational constant changing? Astrophys. J., 248 1981 : 813-816.

VAN FLANDERN, T.C. Is the gravitational constant changing? In : Precision Measurement and Fundamental Constants II, edited by B.N. Taylor and W.D. Phillips, National Bureau of Standards Special Publication 617, United States Printing Office, 1983, in press.

VINTI, John P. Classical solution of the two-body problem if the gravitational constant diminished inversely with the age of the universe. Mon. Not. R. Astron. Soc., 169 1974 : 417.

WAGNER, Arthur R. Letters (comment on Wesson's G/G article). Phys. Today, 34(3) 1981 : 13-15.

WEISS, Reiner and BLOCK, Barry. A gravimeter to monitor the  ${}^0S_0$  dilatational mode of the earth. J. Geophys. Res., 70 1965 : 5615-5627.

WEISS, R. Gravitation Research. Quarterly Progress Report of the Research Laboratory of Electronics (M.I.T.), 77 1965 : 59-63.

WESSON, Paul S. The implications for geophysics of modern cosmologies in which G is variable. Q. J. R. Astron. Soc., 14 1973 : 9-64.

WESSON, P.S. Cosmology and Geophysics, Bristol, U.K., A. Hilger, 1978.

WESSON, P.S. Does gravity change with time? Phys. Today, 33(7) 1980 : 32-37.

WESSON, P.S. Gravity, Particles, and Astrophysics, Dordrecht,  
Holland, D. Reidel Publishing Co., 1980.

WESSON, P.S. The author comments (on Alpher's letter). Phys. Today,  
34 (3) 1981 : 13.

WESSON, P.S. The author comments (on Wagner's letter). Phys. Today,  
34 (3) 1981 : 15.

WESSON, P.S. The author comments (on the letters of Shipman and  
Davies). Phys. Today, 34 (3) 1981 : 78.

WESSON, P.S. The author comments (on Malamud's letter). Phys. Today,  
34 (3) 1981 : 78.

WESSON, P.S. and GOODSON, Ron E. New pathways in gravitational  
research (or where is variable-G cosmology going?). The  
Observatory, 101 1981 : 105-108.

WILK, Leonard S.\* A gravitational experiment in space. M.I.T.  
Preprint, 1969, unpublished.

WILK, L.S. (editor). Studies of space experiments to measure  
gravitational constant variations and the Eötvös ratio. M.I.T.  
Measurement Systems Laboratory Progress Report No. PR-8 on progress  
to April 1, 1971 on NASA contract NA59-8328, NASA Contractor Report  
CR-115139, Accession code number N71-35444, 1971, 306pp.

WILLIAMS, J.G., SINCLAIR, W.S. and YODER, C.F. Tidal acceleration of  
the moon. Geophys. Res. Lett., 5 1978 : 943-946.

YANG, Jongmann, SCHRAMM, David N., STEIGMAN, Gary and ROOD, Robert T.  
Constraints on cosmology and neutrino physics from big bang  
nucleosynthesis. Astrophys. J., 227 1979 : 697-704.

12. Measurements of Spontaneous Matter Creation

BEKENSTEIN, Jacob D. Astronomical consequences and tests of relativistic theories of variable rest masses. Comments on Astrophysics, 8 1979 : 89-98.

BERNARD, Bruce E. A hybrid double magnetic suspension. M.S. Thesis, University of Virginia, 1982, 73pp.

BERNARD, B.E., CHEUNG, W. Stephen and RITTER, Rogers C. Frequency-modulated coil sensor for magnetic suspensions. Rev. Sci. Instrum., 53 1982 : 1743-1745.

CARIGNAN, C., BEAUDET, G. and SIROIS, A. Dirac's cosmology : solar models to test two hypotheses of matter creation. Astron. Astrophys., 75 1979 : 291-296.

CANUTO, V., ADAMS, P.J. and TSIANG, E. Crystal structure and Dirac's large numbers hypothesis. Nature (London), 261 1976 : 438.

CANUTO, V., ADAMS, P.J., HSIEH, S.-H. and TSIANG, E. Particle creation and Dirac's large numbers hypothesis. Nature (London), 264 1976 : 485.

CANUTO, V. and LOPENQUAI, J. Dirac cosmology. Astrophys. J., 211 1977 : 342-356.

CHEUNG, Wah-Kwan Stephen, GILLIES, George T., LEYH, Carl H. and RITTER, Rogers C. Ultra-stable magnetic suspensions for rotors in gravity experiments. Prec. Engng., 2 1980 : 183-186.

CHEUNG, W.-K.S. Servo driven corotation : development of an inertial clock. Ph.D. Thesis, University of Virginia, 1982, 300pp.

CHIN, Chao-wen and STOTHERS, Richard. Solar test of Dirac's large numbers hypothesis. Nature (London), 254 1975 : 206-207.

COHEN, Samuel Alan. An experimental test of continuous creation. B.S. Thesis, M.I.T., 1968, 23pp.

COHEN, S.A. and KING, J.G. Search for continuously created hydrogen. M.I.T. Research Laboratory of Electronics Quarterly Report, 90 1968 : 1-6.

COHEN, S.A. and KING, J.G. Search for hydrogen appearing in mercury metal. Nature (London), 222 1969 : 1158-1159.

- DANNEHOLD, Terry. An observational test of cosmological particle production theories. Phys. Lett. B, 94 1980 : 450-452.
- DANNEHOLD, T.L. The Bogoliubov transformation and its application to cosmological particle production. Ph.D. Thesis, Washington University, 1981, 80pp.
- EGYED, L. The expanding earth? Nature (London), 197 1963 : 1059-1060.
- GILLIES, G.T., RITTER, R.C. and ROOD, R.T. A new standard in turntable speed constancy. Audio, 62 1978 : 78-84.
- GILLIES, G.T. and RITTER, R.C. Recent progress on the dynamic measurement of matter creation. Bull. Am. Phys. Soc., 25 1980 : 38-39.
- GILLIES, G.T. and RITTER, R.C. Spindown measurements on a protected rotor. Bull. Am. Phys. Soc., 25 1980 : 491.
- GILLIES, G.T. The development of high Q, precision mechanical rotors for use in a dynamic measurement of matter creation. Ph.D. Thesis, University of Virginia, 1980, 141pp.
- GILLIES, G.T. and RITTER, R.C. Experiments on variation of the gravitational constant using precision rotations. In : Precision Measurement and Fundamental Constants II, edited by B.N. Taylor and W.D. Phillips, National Bureau of Standards (U.S.), Special Publication 617, United States Printing Office, 1983, in press.
- GITTUS, J.H. Dirac's large numbers hypothesis and the structure of rocks. Proc. R. Soc. London, Sec.A, 343 1975 : 155-158.
- GITTUS, J.H. Dirac's large numbers theory and a theoretical upper limit to the viscosity of crystalline materials. Proc. R. Soc. London, Sec.A, 348 1976 : 95-99.
- GITTUS, J.H. Multiplicative creation in two-phase materials : boundary diffusion and deposition. United Kingdom Atomic Energy Authority Preprint, 1978, unpublished.
- JONES, George Robert, Jr., GILLIES, G.T. and RITTER, R.C. Measurements of a magnetically suspended precision rotor. Bull. Am. Phys. Soc., 25 1980 : 491.
- JONES, G.R., Jr. Decay time studies of magnetically suspended rotors. M.S. Thesis, University of Virginia, 1981, 111pp.
- JONES, G.R., Jr., GILLIES, G.T. and RITTER, R.C. Decay modes of magnetically suspended precision rotors. Prec. Engng., 4 1982 : 79-83.

JONES, G.R., Jr., RITTER, R.C. and GILLIES, G.T. Fundamental measurements in gravitational physics using precision rotations. I. Motivations and unprotected rotor results. Metrologia, 18 1982 : 209-219.

JONES, G.R., Jr. and RITTER, R.C. Period fluctuation studies of a free magnetically suspended rotor. Bull. Am. Phys. Soc., 27 1982 : 538.

JONES, G.R., Jr. Development of precision rotor experiment for matter creation test. Ph.D. Thesis, University of Virginia, 1983, 220pp.

JONES, G.R., Jr., RITTER, R.C. and GILLIES, G.T. Fundamental measurements in gravitational physics using precision rotations. II. Initial results from protected, corotating-rotor decay studies. Metrologia, to be submitted for publication.

MACDOUGALL, John, BUTLER, Richard, KRONBERG, Philipp and SANDQUIST, Aage. A comparison of terrestrial and universal expansion. Nature (London), 199 1963 : 1080.

MALIN, S. Gravitational field equations and the possibility of time variation of all masses. Phys. Rev. D, 11 1975 : 707-710.

MANSFIELD, V.N. and MALIN, S. Some astrophysical effects of the time variation of all masses. Astrophys. J., 209 1976 : 335-349.

PANOV, V.I. and FRONTOV, V.N. Electromechanical vibrating system for the observation of small periodic mass variations. Instrum. Exp. Tech. (USSR), 22 1979 : 217-220, [translation of Prib. Tekh. Eksp., No. 1 1979 : 204-207].

PHILBERTH, Karl. The generation of matter and the conservation of energy. In : Cosmology, History, and Theology, Chapter 9, edited by Wolfgang Yourgrau and Allen D. Freck, New York, Plenum, 1977 : 113-129c.

RITTER, R.C., GILLIES, G.T., ROOD, R.T. and BEAMS, J.W. Dynamic measurement of matter creation. Nature (London), 271 1978 : 228-229.

RITTER, R.C. Macroscopic rotors and gravitational effects. J. Phys. (Paris), 42, Colloque C8, Supplement No.12, 1981 : C8-429-C8-440.

RITTER, R.C. Experimental searches for gravitational effects outside of general relativity. In : Proc. of the 2nd Marcel Grossmann Meeting on General Relativity, edited by Remo Ruffini, Amsterdam, North Holland, 1982 : 1039-1070.

RITTER, R.C. and JONES, G.R., Jr. Progress in precision rotations for matter creation experiment and inertial clock. In : Proc. of the 3rd Marcel Grossmann Meeting on General Relativity, in press.

ROXBURGH, Ian W. Dirac's continuous creation cosmology and the temperature of the earth. Nature (London), 261 1976 : 301-302.

ROXBURGH, I.W. Large number hypothesis and continuous creation cosmologies. Nature (London), 268 1977 : 504-507.

STEIGMAN, Gary. Particle creation and Dirac's large numbers hypothesis. Nature (London), 261 1976 : 479-480.

STEIGMAN, G. Steigman replies. Nature (London), 264 1976 : 485.

THYSSEN-BORNEMISZA, Stephan and GROten, E. Testing inertial mass variations. Trans. Am. Geophys. Union, 53 (4) 1972 : 345.

THYSSEN-BORNEMISZA, S. and GROten, E. Testing inertial mass variations. Trans. N. Y. Acad. Sci., 34 1972 : 687-690.

TOWE, Kenneth M. Crystal structures, the earth and Dirac's large numbers hypothesis. Nature (London), 257 1975 : 115-116.

TOWE, K.M. Towe replies. Nature (London), 261 1976 : 438.

WESSON, Paul S. The implications for geophysics of modern cosmologies in which G is variable. Q. J. R. Astron. Soc., 14 1973 : 9-64.

WESSON, P.S. Cosmology and Geophysics, Bristol, U.K., A. Hilger, 1978.

WESSON, P. Dynamic measurement of matter creation and earth expansion. Nature (London), 273 1978 : 572.

WESSON, P.S. Gravity, Particles, and Astrophysics, Dordrecht, Holland, D. Reidel Publishing Co., 1980.

13. Measurements of the Dependence of G on the State of Quantization of the Test Masses

BALLENTE, Leslie E. Comment on 'Indirect evidence for quantum gravity'. Phys. Rev. Lett., 48 1982 : 522.

HAWKINS, Bruce. Indirect evidence for quantum gravity? Phys. Rev. Lett., 48 1982 : 520.

NEVILLE, Donald E. Experimental bounds on the coupling of torsion potentials. Phys. Rev. D, 21 1980 : 2075-2080.

NEVILLE, D.E. Experimental bounds on the coupling of massless spin-1 torsion. Phys. Rev. D, 25 1982 : 573-576.

NIETO, Michael Martin and GOLDMAN, T. Measurement of  $G/h$  using a superconducting ac Josephson effect. Phys. Lett. A, 79 1980 : 449-453.

OPAT, Geoffrey I. Molecular interferometry a possible gravitational field measuring technique. In : Proc. of the 3rd Marcel Grossmann Meeting on General Relativity, in press.

PAGE, Don N. and GEILKER, C.D. Indirect evidence for quantum gravity. Phys. Rev. Lett., 47 1981 : 979-982.

PAGE, D.N. Comments : Page responds. Phys. Rev. Lett., 48 1982 : 521.

PAGE, D.N. Comments : Page responds. Phys. Rev. Lett., 48 1982 : 523.

PAGE, D.N. and GEILKER, C.D. An experimental test of quantum gravity. In : Quantum Structure of Space and Time, edited by M.J. Duff and C.J. Isham, Cambridge, U.K., Cambridge University Press, in press.

14. Measurements of the Anisotropies of G and of Inertial Mass

BARBOUR, J.S. and EASTHOPE, P. On the isotropy of mass and of the universe. Nuovo Cimento, B 50 1979 : 344-350.

CARRELLI, A. On Mach's principle. Nuovo Cimento, 13 1959 : 853-856.

CHEUNG, W.-K.S. Experimental implications of Mach's principle. M.S. Thesis, University of Virginia, 1978, 57pp.

COCCONI, G. and SALPETER, E.E. A search for anisotropy of inertia. Nuovo Cimento, 10 1958 : 646-651.

COCCONI, G. and SALPETER, E.E. Upper limit for the anisotropy of inertia from the Mössbauer effect. Phys. Rev. Lett., 4 1960 : 176-177.

DICKE, R.H. Experimental tests of Mach's principle. Phys. Rev. Lett., 7 1961 : 359-360.

DREVER, R.W.P. A search for anisotropy of inertial mass using a free precession technique. Philos. Mag., 6 1961 : 683-687.

EPSTEIN, S.T. On the anisotropy of inertia. Nuovo Cimento, 16 1960 : 587-588.

HUGHES, V.W., ROBINSON, H.G. and BELTRAN-LOPEZ, V. Upper limit for the anisotropy of inertial mass from nuclear resonance experiments. Phys. Rev. Lett., 4 1960 : 342-344.

SHERWIN, C.W., FRAUENFELDER, H., GARWIN, E.L., LÜSCHER, E., MARGULIES, S. and PEACOCK, R.N. Search for the anisotropy of inertia using the Mössbauer effect in Fe<sup>57</sup>. Phys. Rev. Lett., 4 1960 : 399-401.

VINTI, John P. Possible effects of anisotropy of G on celestial orbits. Celestial Mechanics, 6 1972 : 198-207.

WARBURTON, Richard J. and GOODKIND, John M. Search for evidence of a preferred reference frame. Astrophys. J., 208 1976 : 881-886.

WILLIAMS, Emrys and METHERELL, A.J.F. An experimental search for a universal gravitational anisotropy. Cavendish Laboratory, Cambridge University, 1979, unpublished.

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Some of the Russian names are transliterated one way by some publishers, and another way by others. In this listing, I have chosen to use the transliteration selected by the Eastern press authorities rather than those in the West, since this may be more in line with the individual author's wishes.

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