# Re-Thinking Newton's Principia as Exposed within Newtonian Geneva Edition

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## Outline

PHILOSOPHIÆ NATURALIS PRINCIPIA MATHEMATICA.

The publication of the Newton Geneva Edition (GE) dates back to 1739–1742. The edition is divided into four volumes: I) The 1739 volume includes the first book of the Principia; 2) The 1740 volume includes the second book of the *Principia*; 3) The 1742 volume includes the initial 24 propositions of the third book of the Principia; 4) The 1742 volume includes propositions XXV-XLI of the third book and the General Scholium. The commentators Le Seur and Jacquier were mathematicians. They were not Jesuits, but they belonged to the "Gallicana Minimorum Familia" (Newton 1822, Frontispiece) – they were Minim Friars. Swiss scientist Jean–Louis Calandrini's (1703–1758) contributions were fundamental. He also organized and financed the edition. Calandrini's notes are indicated by an asterisk. The second edition of the GE was printed in Colonia Allobrogum (Geneva) in 1760 by the publishing house Cl. and An. Philibert. This edition corrected some mistakes (especially typos) in the first edition. It is made up of three volumes corresponding to the three books of Principia. The third edition appeared in 1822 and was published in Glasgow by publishers Andrew and John Duncan. This edition, in four volumes, is important because the editors analysed the two previous editions, comparing and emending them, where necessary. A recent publication (Bussotti and Pisano 2014) opens a series of studies concerning the GE, whose final scope is to highlight the conceptual aspects of the GE and its role in the spreading of scientific ideas and Science in Context. Main Statement of the Research

AUCTORE ISAACO NEWTONO, EQ. AURATO. PERPETUIS COMMENTARIIS ILLUSTRATA, **COMMUNI STUDIO** PP. THOMÆ LE SEUR ET FRANCISCI JACQUIER EX GALLICANA MINIMORUM FAMILIA, MATHESEOS PROFESSORUM. EDITIO NOVA. MMA CURA RECENSITA VOLUMEN PRIMUM GLASGUÆ: EX PRELO ACADEMICO, TYPIS ANDREÆ ET JOANNIS M. DUNCAN. VENEUNT APUD LACKINGTON & SOC., R. PRIESTLEY, G. & W. B. WHITTAKER, J. CUTHEL, G. COWIE & SOC., J. COLLINGWOOD, TREUTTEL & WÜRTZ, ET TREUTTEL, JUN. & RICHTER, LONDINI; NECNON PARISIIS, ET ARGENTORATI APUD TREUTTEL & WÜRTZ.

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History of Mathematics — Newton's Philosophiae Naturalis Principia Mathematica "Jesuit" Edition: The Tenor of a Huge Work, by PAOLO BUSSOTTI and RAFFAELE PISANO, communicated on 26 June 2014.

Our purposes are:

1) to highlight the relationships between mathematics and physics in the Principia to understand how Newton's use of geometry and infinitesimal procedures influenced his

ABSTRACT. — This paper has the aim to provide a general view of the so called *Jesuit Edition* (hereafter JE) of Newton's Philosophiae Naturalis Principia Mathematica (1739–1742). This edition was conceived to explain all Newton's methods through an apparatus of notes and commentaries. Every Newton's proposition is annotated. Because of this, the text-in four volumes-is one of the most important document to understand Newton's way of reasoning. This edition is well known, but systematic works on it are still missing. We are going to fill this gap by means of a project exposed in the final remarks of this paper. In this paper we will: A) expound the way in which the notes and the additions to the JE were conceived by the commentators; B) provide some pieces of information about the commentators; C) summarize the most important of their notes; D) examine closely their notes as to a particularly important question: the so called "inverse problem of the central forces".

KEY WORDS: Newton, Jesuit Edition, commentaries, relationships geometry-mathematics-physics, history of mathematics and physics.

MATHEMATICS SUBJECT CLASSIFICATION: 01A50, 01A55, 01A85.

1. Aims of the paper

The purpose of this article is twofold:

- a) To highlight the features of the so called *Jesuit Edition* of Newton's *Principia*, published in the period 1739–1742 as a reprint of the third edition (1726) of Newton's masterpiece (Newton [1726, 1739–42, 1760], 1822) calling attention to:
- 1) The general structure of the edition;
- 2) The personalities of the editors;

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3) The role of the JE among Principia's editions and commentaries published from 1687—first original edition of Newton's work—to 1833.

For, in 1833, the mathematician John Martin Frederick Wright wrote A commentary on Newton's Principia (Wright, 1833), which is particularly significant in this context. The tradition of the commentaries to Newton's Principia is still living nowadays. The text of Subrahmanyan Chandrasekhar (1910–1995) Newton's

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utraque feretur corpus illud eodem tempore in diagonali ab A ad D. Nam (<sup>b</sup>) quoniam vis N agit secundum lineam A C ipsi B D parallelam, hæc vis per Legem 11. nihil mutabit velocitatem accedendi ad lineam illam B D a vi altera genitam. Accedet igitur corpus eodem tempore ad lineam BD, sive vis N imprimatur, sive non; (°) atque ideo in fine illius temporis re-

ambiguitas, nihil aliud per hanc legem intellec-tum volumus, nisi æquales fieri in corpore agente et patiente statûs mutationes; cùm enim nulla possit esse actio corporis in aliud corpus, quin mutua fiat horumce corporum collisio (8), mu-tatio statûs æqualiter in utroque corpore recipi debet; undè licet actioni æqualis semper sit et contraria reactio, non idcircò tamen inter corpus agens et patiens fieri debet æquilibrium, idque Newtoniano exemplo manifestum est; si equi lapidem trahentis conatus seu vis activa major sit vi quâ lapis per gravitatem suam, plani scabriti-em, mediique resistentiam, equo trahenti reluc-tatur, equus lapidem trahet cum eâ totius suæ vis parte, quæ post superatam lapidis gravitatem, vis parte, quæ post superatam lapidis gravitatem, spatio tertiâ vi descripto pari ratione componatur, plani scabriticm, mediique resistentiam, ipsi re-

## physics;

2) to understanding why Newton's mathematical methods were rapidly replaced by more analytical methods; this phenomenon is connected to the development of science and mathematics. Although the GE edition is celebrated, it has been seldom commented upon in

literature.



Newton in Context within our Researches

#### We aim at:

a) clarifying the nature, the purposes and the structure of the notes added to



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onference of Physics

sidua est; si autem totus trahentis equi conatus hisce tribus resistentiis minor sit, vel si ipsis sit æqualis, equus lapidem non movebit. Quare totus ac integer lapidis renixus qui componitur ex ipsius gravitate, plani scabritie, resistentiâ medii et inertiâ quæ lapidi etiam omnibus aliis viribus destituto inest, actioni equi lapidem trahentis est semper æqualis.

(b) 33. Quoniam vis N, agit secundum line-am A C, ipsi B D, parallelam, hæc vis, (per Leg 2.) nihil nisi velocitatem secundum lineam Leg 2.) nihil nisi velocitatem secundum lineam B D, a vi alterâ genitam; cum corpus iners duabus hisce viribus ac directionibus simul obse-qui possit, et (per leg. 1.), debeat, atque hîc sup-ponatur vires *M*, et *N*, in mobile eodem modo simul agere ac si singulæ seorsim in illud qui-escens imprimerentur.

(c) 34. Idcircò cum in fine ejusdem tempo-ris, corpus quod hîc tanquam punctum conside-ratur, simul esse debcat in utraque lineâ C D, D et B D, in utriusque lineæ concursu D reperi-atur, necesse cst; quia autem initio et fine tem-poris dati corpus reperitur in rectâ A D, nempè primùm in A, et deindè in D, toto tempore dato motum fuit per lineam A D, nam ex duobus punctis A, et D, datis, recta, A D, positione data est; et corpus quibuslibet viribus impulsum, cessante virium actione, movetur uniformiter in directum secundum ultimam directionem ex

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Graphic: R

resolvitur, idemque de motu per A C, et de

ipsi B D, parallelam producet, ac proindè non ratione acceleretur vel retardetur, sive quod mutabit velocitatem accedendi ad lineam illam idem est, si spatia A B, et A D, AC, et A F,

viribus impressis resultantem, (per Leg. 1. et 9.) E B, (34) adeóque in earum intersectione E; 35. Motus compositus per diagonalem A D, similiter ductis F G, ad A C, et C G, ad A F, 35. Motus compositus per diagonalem A D, motibus per latera A B, AC, disjunctis non est æqualis, sed tantùm æquipollet. Nam cum eadem sit corporis massa, motûs quantitates per diagonalem et per latera sunt ut velocitates unifor-mes (6) seu ut spatia A D, A B, A C, eodem tem-pore percursa (5); est autem summa laterum A B + A C, major diagonali A D; ergo summa quantitatum motús per latera, major est quanti-39. Si spatia secundúm unam directionem

#### Notes (Newton, [1726] [1739–1742], 1822), I, p. 18).



Notes (Ivi, Sect. VIII, Prop. XLI, p. 246).

Newton's text by the commentators, providing a useful guide to understanding the relevance of Newton's mathematical methods within his physics. A physical and mathematical analysis of the most important notes is necessary as well as a comparison between the methods the commentators used to prove or to clarify some of Newton's theorems and the methods used by other authors, some of whom lived before Le Seur and Jacquier's time and others who wrote during the same period;

b) verifying how the relationship between physics and mathematics changed in the period between 1687 and the publication of the GE and understand how physics dense

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