

De motu corporum in medijs
regulariter cedentibus.

Definitiones.

Def. 1. Tempus absolutum est quod sua natura absq[ue]
relatione ad aliud quodvis equabiliter fuit. Tale est,
cujus equationem investigant Astronomi, alio nomine dictum
Duratio.

Def. 2. Tempus relativum est quod ^{speciatum} respectu ^{aliquis sensibilib[us] transiens} ~~aliquis sensibilib[us] transiens~~ seu transitus sui ~~aliquis sensibilib[us] transiens~~ consideratur ut aequabile.
Tale est tempus dierum mensium et
aliorum periodorum caelestium, ~~ex hypothese quod h[ab]entur sunt equaliter~~
~~quae vulgo ~~considerantur~~ et equaliter ~~considerantur~~ sa multo vulgo~~
~~et vulgo ~~considerantur~~ et equaliter ~~considerantur~~ sa multo vulgo~~

Def. 3. Spatium absolutum dicitur est quod sua natura absq[ue]
relatione ad aliud quodvis semper manet immobile. Ut partium
temporis ordo immutabilis est. Sic etiam partium spatii. Moventur
haec de locis suis et moventur de seipsis. Nam tempora et spatia
sunt successorum et rerum omnium loca. In tempore quoad ordinem
successionis, in spatio quoad ordinem situs locantur universa. De
illorum essentia est ut sint loca et loca ^{primaria} moveri ^{ad gradum 40}. Porro
si illata moveatur una pars spatii et si ^{tantum} ad omnes ^{in infinitum} partes ap-
plicata movebitur totum, quod rursus absurdum est.

Def. 4. Spatium relativum est quod respectu ^{aliquis sensibilib[us] alterius} ~~aliquis sensibilib[us] alterius~~ conside-
ratur ut immobile: ut spatium aeris nostri respectu terrae. Distinguen-
tur autem haec spatia ab intimo ipso facto per descensum gravium
quae in spatio absoluto recte ~~potunt~~ ^{potunt} centrum in relative absolute
gyrante deflectunt ad latera.

Def. 5. Corpora ^{omnia} ~~omnia~~ ^{in se} ~~in se~~ et mobilia quae se mutuo
penetrare nequeunt.

Def. 6. ~~Centrum corporis est quod vulgo dicitur centrum gravitatis~~
Def. 7. Locus corporis est pars spatii in quo corpus existit, estq[ue]
pro genere spatii vel absolutus vel relativus.

Def. 8. Quies corporis est perseverantia eius in eodem loco, estq[ue]

motus axis corporis, linea quavis recta per centrum transiens.

vel absoluta vel relativa pro genere loci.

Def. 9. Motus corporis est translatio ejus de loco in locum, estque
idem vel absolutus vel relativus pro genere loci. Distinguitur autem
ipso facto motus absolutus a relativo in gyrationibus, per conatum reci-

pendendi a centro, quippe qui de gyratione nude relativa nullus est, in
relativa quiescentibus aut potius in gyrationibus calidibus quibusdam ~~causis~~

Porro motum et quietem absolute dicere non penderet a situ et relatione
corporum ad invicem manifestum est ex eo quod haec nunquam mutan-
tur nisi in ipsum corpus motum vel quiescens impressa, tali autem
in semper mutantur; ab relativa mutari possunt in solummodo
impressa in altera corpora ad quae fit relatio et non mutari in
impressa in utraque sic ut situs relativus conservetur.

Def. 10. ^{Velocitas} ~~Celeritas~~ motus est quantitas momentanea translatio-
nis quoad longitudinem itineris. ^{certo tempore contenti} Hic vero est quod corporis puncto me-
diano describitur a geometri dicto centro gravitatis. ^{Logpor de motu progressivo}

Def. 11. Quantitas motus est que oritur ex velocitate et
quantitate corporis translati conjunctim. Estimatur autem quantitas
corporis ex copia materiae corporeae quae gravitati suae ~~pro~~ pro-
portionalis esse solet. Pendulis aequalibus numerentur oscillati-
ones corporum duorum ejusdem ponderis, et copia materiae in
utroque erit reciproca ut numerus oscillationum eodem tempore
factorum.

Def. 12. ~~Vis corporis~~ ^{vis insita innata et essentialis} ~~corporis~~ ^{innata} est potentia qua
in conatur perseverare in statu suo quiescendi vel movendi unifor-
miter in linea recta. ^{estque corporis quantitati proportionalis, ex reser-}
^{vero proportionaliter mutationem statum} ^{vis insita innata et essentialis} ^{vis insita innata et essentialis} ^{vis insita innata et essentialis}

Def. 13. ~~Vis motus~~ ^{vis insita innata et essentialis} ~~corporis~~ ^{innata} est qua
corpus quantitatem ^{totam} sui motus conservare conatur. ~~Est~~ ^{Est} vulgo dicitur
impetus estque motui proportionalis, et pro genere motus vel absoluta
est vel relativa. ~~Ad absolute referenda est vis centrifuga gyrationum~~

Def. 14. ~~Vis impetus~~ ^{vis insita innata et essentialis} ~~corporis~~ ^{innata} est qua corpus iurgetur mutare statum
suum movendi vel quiescendi. ^{estque diversarum specierum} ^{vis insita innata et essentialis} ^{vis insita innata et essentialis}

Def. 15. Vim centripetam appello qua corpus impellitur vel
attrahitur versus punctum aliquod quod ut centrum spectatur. Hujus
generis est gravitas tendens ad centrum terrae, vis magnetica ten-
dens ad centrum magnetis et vis caelestis cohibens Planctus ne
abiant in tangentibus orbitarum orbitarum.

Def. 17. ^{vis insita innata et essentialis} ~~Resistentia~~ ^{vis insita innata et essentialis} est vis media regulariter impediens. ~~Ali-~~

est motus
tamen a
videtur. Co
ratis illi
cras usque
et dicitur
tus arguit
tam aliam
determinat
esse motu
quantitatem
singulis cor
poribus, a
relativitas
vis insita
in motu
relativitas
motu
motu
motu

reflexionem ~~et~~ ~~non~~ ~~comprobat~~. hinc et alia viri in corpore
 elasticitate, mobilitate, leuitate et prudentia quae dicuntur considero.

Def. 10. Momenta quantitatum sunt ipsarum principia gene-
 rantia vel alterantia fluxu continuo: ut tempus praesens praeter-
 riti et futuri, motus praesens praeteriti et futuri, vis centrifuga
 aut alia quavis momentanea impetus, punctum linea, linea super-
 ficiei, superficies solidi et angulus contactus anguli rectilinei.

Def. 13. Exponentes temporum spatiorum motuum claritate
 et virum sunt quantitates a se invicem proportionales exponendis

haec omnia fecit explicare usum est ut Lector, ~~aliam~~ ^{praesens} et distinctis
 principiorum Mechanicorum conceptibus imbutus accederet ad sequentia
 Quantitati autem absolutae et relativae ab invicem ~~accideret~~ ^{sedulo} distingu-
 -ri ~~non~~ ^{non} ~~est~~ ^{est} eo, quod phenomena omnia pendant ab absolutis,
 Vulgus autem qui cogitationes a sensibus abstrahere nesciunt
 semper loquuntur de relativis, usque adeo ut absurdum foret vel
 sapientibus ~~aut~~ ^{vel etiam} prophetis apud hos aliter loqui. Unde et sacra liti-
 -ra et scripta Theologorum de relativis semper intelligenda sunt,
 et crasso laboraret praesidio qui inde de rerum naturalium
 moribus absolutis ^{philosophis} disputationes moueret. ~~Primum est ac si qui~~
~~in magnitudine non apparente ad absoluta~~ ~~inter duo~~
~~maxima lumina~~ ~~quorum~~ ~~inter~~ ~~contradict.~~ ~~quarta~~

Leges motus.

Lex 1. Vi impetata corpus ~~sempiternum~~ ^{semper} perseverare in statu suo quies-
 -cendi vel movendi uniformiter ^{in linea recta} nisi, quatenus visus
 impetris ~~et~~ ~~impetris~~ cogitur statum illum mutare. Motus autem

Lex 2. Mutationem motus proportionalem esse vi impetris et fieri
 secundum lineam rectam quae vis illa imprimitur. Haec duas leges
 jam receptissimas Galileus novit projectilia gravitate uniformiter et secundum lineas parabolae

Lex 3. Corpus omne tantum pati reactione quantum agit in
 alterum. ~~Lex 4. Si repica aere plena promit vel firit alteram~~

sibi consimilem cedet utraq; equaliter introsum. ~~Si repica tra-~~
~~hit ferens ipse in prima~~ ~~tertiora~~ ~~trahitur~~. Si corpus impingens in
 alterum vi sua mutat motum alterius et ipsius motus (ob equali-
 -tatem pressuris mutue) vi alterius tantum mutabitur. Si magnus
 trahit ferrum icche missim tantum trahitur, et sic in aliis. ^{Consid}
 vix haec Lex per Def. 12 et 14 in quantum vi corporis id statu sui conservacionem

Lex 4. Porphyrium dato spatio inclusorum eodem esse motus
 inter se sine spatium illud absente quiescat sine moveat id perpetuo

status praesens praeteriti et futuri
 motus praesens praeteriti et futuri
 vis centrifuga
 punctum linea
 linea superficies
 superficies solidi
 angulus contactus
 anguli rectilinei
 principia
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et uniformiter in directum absq[ue] motu circulari. E.g. Motus rerum
in navi perinde se habent sive navis quiescat sive moveat ea uni-
formiter in directum.

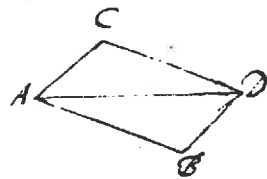
Lex 5. Motus corporum actionibus commune centrum gra-
vitatatis non mutare statum suum motus vel quietis. Hæc lex
et due superiores se mutuo probant.

Lex 6. Resistentiam mediij esse ut mediij illius densitas et
sphaerici corporis moti superficies et velocitas conjunctim. Hanc
legem exactam esse non affirmo. Sufficit quod sit vero proxima.
Corpora vero Sphaerica hæc suppono in sequentibus, ne opus sit
circumstantias diversarum figurarum considerare.

Lemmata

Lem. 1. Corpus viribus conjunctis diagonalem parallelo-
grammi eodem tempore describere quo latera separatis.

Si corpus dato tempore vi sola m ferretur
ab A ad B et vi sola n ab A ad C , com-
pleatur parallelogrammum $ABDC$ et vi
utraq[ue] ferretur id eodem tempore ab A ad
 D . Nam quoniam vis m agit secundum



lineam AC ipsi BD parallelam, hæc vis nihil mutabit veloci-
tatem accedendi ad lineam illam BD vi altera impressam. Acce-
det igitur corpus eodem tempore ad lineam BD sive vis AC im-
primatur sive non, atq[ue] ad id in fine illius temporis reperietur
alicubi in linea illa BD . Eodem argumento in fine temporis
ejusdem reperietur alicubi in linea CD , et prout in utriusq[ue]
linea concursus D reperiri necesse est.

Lem. 2. Spatium quod corpus urgente quacunq[ue] vi centri-
peta ipso motu metho describit, esse in duplicata ratione
temporis.

Exponantur tempora per lineas AB , AD datus Ab Ad
proportionalis, et urgente vi centripeta æquali exponantur
spatia descripta per areas rectilineas ABF ADH perpendiculariter

De Motu Corporum in Mediis Regulariter Cedentibus

The aim of explaining all these things at length is that the reader may be freed from certain vulgar prejudices and imbued with the distinct principles of mechanics may agree in what follows to distinguish carefully from each other quantities which are both absolute and relative, a thing very necessary since all phenomena depend on absolute quantities. But ordinary people who fail to abstract thought from sensible appearances always speak of relative quantities, so much so that it would be absurd for wise men or even Prophets to speak to them otherwise. Hence both the sacred writings and theological writings are always to be understood in terms of relative quantities, and he who would on this account bandy words with philosophers concerning the absolute motions of natural things would be labouring under a gross misapprehension.

Def. 4. Relative space is that which is regarded as immobile in relation to any sensible thing: such as the space of our air in relation to the Earth. However, **these spaces are in fact distinguished from each other through the descent of heavy bodies which in absolute space seek the centre directly but in relative space rotating absolutely are deflected to one side.**

Def. 9. The motion of a body is its translation from one place to another, and is consequently either absolute or relative according to the kind of place. **But absolute motion is in fact distinguished from relative in circular motions by the endeavour to recede from the centre,** which in an entirely relative circular motion is zero, but in a circular motion relative to bodies at rest may be very large, as in the celestial bodies which the Cartesians believe to be at rest, although they endeavour to recede from the Sun. The fact that this endeavour is certain and determinate argues some certain and determinate quantity of real motion in individual bodies in no wise dependent on the relations [between bodies] which are innumerable and make up as many relative motions. For example, **that motion and rest absolutely speaking do not depend on the situation and relation of bodies between themselves is evident from the fact that these are never changed except by force impressed on the body moved or at rest, and are always changed after such a force; but the relative can be changed by forces impressed only on other bodies to which the relation belongs, and is not changed by a force impressed on both so that their relative situation is preserved.**

From ... *in mediis regulariter cedentibus*

Def. 11. The quantity of motion is that which arises from the velocity and the quantity of a body in translation [*corporis translati*] jointly. Moreover, the quantity of a body is to be reckoned [*aestimatur*] from the amount [*copia*] of the corporeal matter, which is usually proportional to its gravity [*gravitati*]. The oscillations of two equal pendulums with bodies of equal heaviness [*ponderis*] are counted, and the amount [*copia*] of matter in each will be reciprocally as the number of oscillations made in the same time.

Def. 12. [~~*Vis corporis seu*~~ [^]*Corporis vis insita, innata, et essentialis* [^]] The internal, innate, and essential force of a body is the power by which it ~~*conatur*~~ perseveres in its state of rest or of moving uniformly in a straight line. It is proportional to the quantity of the body, and is truly [*vero*] exercised [*exercetur*] proportionally to the change brought about [^]of state [^], [^]and insofar as it is exercised it can be said to be the exercised force of the body, of which one kind is the centrifugal force of rotating [*gyrantium*] bodies [^].

{Canceled: Def. 13. The force of a motion or of a body [*Vis motus seu corpori*] from motion at its approach [*ex motu sua adventitia*] is that by which a body endeavors to preserve the [^]total [^] quantity of its motion. It is commonly called impetus and is proportional to its motion, and according to its kind is absolute or relative. ~~The centrifugal force of rotating bodies is of the absolute kind.}~~

Def. 14. The force brought against and impressed on a body [*Vis corpori illata et impressa*] is that by which a body is urged to change its state of moving or rest [^]and is of diverse kinds such as impulse or pressure of percussion, continuous pressure, centripetal force, resistance of a medium, etc. [^]

Def. 16. I call centripetal force that by which a body is impelled or attracted [*atrahitur*] towards a certain point regarded as its center. Of this kind is gravity [*gravitas*] tending toward the center of the earth, magnetic force tending toward the center of a loadstone, and the celestial force restraining [*cohibens*] the Planets from going off [*abeant*] along the tangents of their orbits.