DISSERTATIO PHYSICO-MATHEMATICA,

PHÆNOMENA LUMINIS, VIRIBUS ATTRACTIVIS & REPULSIVIS CORPORUM SUBJACERE & EX HIS DERIVARI POSSE,

STATUENS;

CUJUS PARTEM PRIMAM,

CONSENTIENTE AMPLISS. ORDINE PHILOSOPH. IN IMPERIALI ACADEMIA ABOËNSI,

PRÆSIDE

Mag. JOH. FREDR. AHLSTEDT,

Mathem. Professore, Publ. & Ordin.

PRO GRADU

PUBLICE VENTILANDAM SISTIT

ADOLPHUS IVARUS ARVIDSSON,

Stipend. Publ. Viburgensis.

In Auditorio Juridico die 31 Maji 1815.

h. a. m. solitis.

ABOÆ, Typis FRENCKELLIANIS.

MINA HULDASTE FÖRÄLDRAR!

Ett barn ifrån en älſkad moders bröſt,
Med glättigt ſinne blomman lopp att ſinna,
I fjärran irrande han ſes förſvinna,
Och väntas bäfvande till hennes tröſt;

Dock! kallad åter af den Huldas röſt,
Med tårad blick deſs famn han ſnart ſes hinna,
Och räcka blomman, den han gick att vinna,
En barnſlig gärd af ſtödet för deſs höſt.

En varm, en tackſam tår uti mitt öga,
Jag Er en frukt af ungdoms mödan räcker,
Och blickar åt Er biſtånd från det Höga.

Men när ſin ſvarta hand mot Er utſträcker
Den kalla döden, och till bortgång manar,
Välſignelſen då i Er blick jag anar.

ADOLF IWAR.

Centum & undecim jam ſunt anni, ut Newton, Opticen ſuam omni ævo æſtimandam in lucem emittens, auguravit, & in fine hujus Operis, hanc propoſuit quæſtionem, aliis ſolvendam: "*Annon Corpora ac Lumen agunt in ſe mutuo: Corpora videlicet in Lumen, emittendo id, reflectendo, refringendo & inflectendo; Lumen autem in Corpora, ad ea calefacienda ſcilicet, motumque vibrantem, in quo calor conſiſtit, in partibus ipſorum exitandum?*" * Nemo autem, quantum conſtat, ad noſtrum usque tempus, ſufficiens & calculo probatum huic quæſtioni reſponſum dedit, etiamſi multi alii Phyſicorum minime dubitarunt, Phænomena laudata a viribus inter Lumen & Cor-

* Optices: ſive de Reflexionibus, Refractionibus, Inflexionibus & Coloribus Lucis, Libri Tres, Auctore Iſaaco Newton; Lauſannæ & Genevæ 1740, pagina 271, quæſtio 5.

pora mutuis pendere. Nobis igitur, Specimen edituris Academicum, visum est, ut periculum responsionis adeamus. Haud vero persvasi, vires nostras huic Problemati perfecte solvendo sufficere, Te L. B. rogamus, velis conamina nostra meliorem in partem interpretari.

Inter omnes quidem Astronomos jam constat, Legem attractionis cælestis, a Newtone inventam, qua actio corporis sphærici *A* in corpus itidem sphæricum *B* definitur, esse in ratione Massæ ipsius *A* directa, & quadrati distantiæ inter centra ipsorum *A* & *B* inversa. Utrum vero eadem Lex attractionis in affinitate corporum valeat, nec ne, est, de quo adhuc disputatur. Si enim Massæ sive ponderis Luminis in corpus tenue rationem habere velis, invenies illam aut nullam aut saltim ita esse exiguam, ut sensus omnes fugiat, nec experimentis vel accuratissimis determinari possit. Cum vero experimentis Chemicis satis jam probatum esse intellexerimus, affinitatem corporum chemicam, rationem ponderum haud sequi, dubium apud nos ortum est, annon hujus affinitatis potius, quam ponderis absoluti, ratio sit habenda? Ponamus igitur, quo innotescat aut veritas aut falsitas Legis assumtæ, Luminis radium attrahi sive repelli, (duo enim hæc phænomena pariter occurrunt,) in ratione affinitatis corporis attrahentis sive repellentis directa, & in ratione quadrati distantiæ inversa,

par-

particulamque Luminis vi projectionis ad vicinias corporis attrahentis sive repellentis pervenisse, * & investigemus: *quales oriantur lineæ curvæ, quas particula Luminis, his acta viribus, describat.*

Sit $AH_{,}$, $AH_{,,}$ directio initialis qua particula luminis ad vicinitatem *A Plani attrahentis*, sive *repellentis FK*, vi projectionis & celeritate altitudini c debita, pervenerit, & agat superficies Plani FK in ratione supra explicata in particulam Luminis per A projectam. Sit distantia inter punctum A, (ubi vis plani sensibilis evadit,) & Planum attrahens sive repellens FK, h. e. $AF = e$, & dicantur Abscissa $AP = x$, Ordinata $PM = y$, harumque fluxiones $Pp = dx$ & $nr = dy$, unde $Mn = ds = \sqrt{dx^2 + dy^2}$, & radius osculi $r = \frac{ds^3}{-dx\,ddy}$. Sit porro angulus, quem directio initialis Luminis cum plano FK continet $HAB = \phi$, altitudo velocitati in M debita $= v$, & vis attractiva sive repulsiva plani in $A = \pm \frac{f^2}{e^2}$, (exprimente f^2 illam vim, qua planum FK in distantia quadam, unitati æquali, agit in Lucis radiolum). Hinc vis sollicitans in puncto

* Qua vi Lumen e Sole ad Terram accedat, sive id fiat attractione Terræ in particulas Luminis, sive alii adscribendum sit causæ, præsentis non est instituti ut exploretur. Proposito enim nostro sufficit, celeritatem hanc Lucis uniformem in A assumsisse.

M erit $= \frac{\mp f^2}{(e \pm y)^2}$, quam vero, quo formulæ generales pateant, designabimus quantitate P. E principiis Mechanicis jam constat, esse

$$1{:}o \; dv = \pm Pdy, \;\&\; 2{:}o \; 2vds = \pm Prdx,$$

ubi signum $+$ valet pro Attractione, $-$ autem pro Repulsione plani. Integrata æquatione priori, oritur $v = C \pm \int Pdy$, quæ ita corrigatur, ut, existente $y = o$, fiat $v = c$. Est vero in formula notissima $r = \frac{ds^3}{-dx\, ddy}$, dx constans; hinc ergo differentiale æquationis $ds^2 = dx^2 + dy^2$ erit $2\, ds\, dds = 2\, dy\, ddy$, & $ddy = \frac{ds\, dds}{dy}$; quo valore ipsius ddy æquationi $r = \frac{ds^3}{-dx\, ddy}$ inserto, invenietur $r = \frac{ds^2 dy}{-dx\, dds}$, unde æquatio $2\, vds = \pm Prdx$ abit in hanc

$$2\, vds = \mp \frac{Pds^2 dy}{dds}, \;\&\; \frac{dds}{ds} = \mp \frac{Pdy}{2v}. \quad (3).$$

Substituatur jam valor, pro v inventus, in æquat. (3), quo facto prodit $\frac{dds}{ds} = \mp \frac{Pdy}{2(C \pm \int Pdy)}$, cujus Integrale est $\text{Log}\, \frac{ds}{dx} = -\frac{1}{2}\, \text{Log}\, \frac{C \pm \int Pdy}{D}$, sive

$$\frac{ds}{dx} = \left(\frac{C \pm \int Pdy}{D}\right)^{-\frac{1}{2}} = \left(\frac{D}{C \pm \int Pdy}\right)^{\frac{1}{2}}.$$

Hinc

Hinc $\frac{ds^2}{dx^2} = \frac{D}{C \pm \int P dy} = \frac{dx^2 + dy^2}{dx^2}$, unde

$$dx = \frac{dy}{\sqrt{\frac{D}{C \pm \int P dy} - 1}}. \quad (A).$$

Inveniuntur ex æquatione (A) Subtangens $\frac{y dx}{dy} = \frac{y}{\sqrt{\frac{D}{C \pm \int P dy} - 1}}$, Subnormalis $\frac{y dy}{dx} = y \sqrt{\frac{D}{C \pm \int P dy} - 1}$,

Tangens $\frac{y ds}{dy} = y \sqrt{\frac{D}{D - C \mp \int P dy}}$, Normalis $\frac{y ds}{dx} = y \sqrt{\frac{D}{C \pm \int P dy}}$, $ds = dy \sqrt{\frac{D}{D - C \mp \int P dy}}$, & elementum Temporis t in AM impenſi $\frac{ds}{\sqrt{v}} = dt = \frac{dx \sqrt{D}}{C + \int P dy} = \frac{dy \sqrt{D}}{\sqrt{(C \pm \int P dy)(D - C \mp \int P dy)}}$.

Æquationes omnes ſupra erutæ valent in eo caſu, ubi potentiæ P directio, cum elemento Lineæ curvæ, acutum continet angulum. Quod ſi vero obtuſus hic fuerit angulus, erit $dv = \mp P dy$ & $2 v ds = \pm P r dx$.

In

In hoc jam casu proveniunt $v = C \mp \int P\,dy$ & $\frac{dds}{ds} = \mp \frac{P\,dy}{2(C \mp \int P\,dy)}$, unde Log $\frac{ds}{dx} = \frac{1}{2}$ Log $\left(\frac{C \mp \int P\,dy}{D,}\right)$, $\frac{ds}{dx} = \sqrt{\frac{C \mp \int P\,dy}{D,}}$ &

$$dx = \frac{dy}{\sqrt{\frac{C \mp \int P\,dy}{D,} - 1}}. \quad (B).$$

Ex his elicitur: Subtangens $= \frac{y}{\sqrt{\frac{C \mp \int P\,dy}{D,} - 1}}$, Subnormalis $= y\sqrt{\frac{C \mp \int P\,dy}{D,} - 1}$, Tangens $= y\sqrt{\frac{C \mp \int P\,dy}{C \mp \int P\,dy - D,}}$, Normalis $= y\sqrt{\frac{C \mp \int P\,dy}{D,}}$, $ds = dy\sqrt{\frac{C \mp \int P\,dy}{C \mp \int P\,dy - D,}}$ & $dt = \frac{dy}{\sqrt{C \mp \int P\,dy - D,}}$.

Investigemus jam quales ex æquationibus (*A*) & (*B*), assumta vi $P = \pm \frac{f^2}{(e \pm y)^2}$, oriantur Lineæ curvæ viam Luminis definientes. Sit primo $P = + \frac{f^2}{(e \pm y)^2}$, unde

unde $dv = \frac{f^2 dy}{(e \pm y)^2}$ & $v = C + \int P dy = c \pm \frac{f^2}{e} \mp \frac{f^2}{e \pm y}$, Integrali ita correcto, ut, posito $y = o$, fiat $v = c$. Æquatio ergo (A) hanc induet formam

$$dx = \frac{dy}{\sqrt{\frac{D}{c \pm \frac{f^2}{e} \mp \frac{f^2}{e \pm y}} - 1}}. \quad (A,)$$

Valor vero constantis D ex æquatione $\frac{ds}{dx} = \left(\frac{D}{C + \int P dy}\right)^{\frac{1}{2}} = \left(\frac{D}{c \pm \frac{f^2}{e} \mp \frac{f^2}{e \pm y}}\right)^{\frac{1}{2}}$, posito $y = o$, invenitur. Est enim tum $\frac{ds}{dx} = Sec\,\phi = \left(\frac{D}{c}\right)^{\frac{1}{2}}$, unde $D = c\,Sec\,\phi^2$. Inserto hoc valore pro D, oritur $dx = \frac{dy}{\sqrt{\frac{c\,Sec\,\phi^2}{c \pm \frac{f^2}{e} \mp \frac{f^2}{e \pm y}} - 1}}$, quæ in hanc reduci potest: $dx = \sqrt{\frac{ce \pm f^2}{ce\,Tg\,\phi^2 \mp f^2}} \times dy \sqrt{\frac{ce^2 : (ce \pm f^2) \pm y}{ce^2 : (cetg\,\phi^2 \mp f^2) \pm y}}$. Fiant, brevitatis ergo, $\frac{ce^2}{ce \pm f^2} = a$ & $\frac{ce^2 tg\,\phi^2}{cetg\,\phi^2 \mp f^2} = b$, unde $\sqrt{\frac{ce \pm f^2}{cetg\,\phi^2 \mp f^2}}$ =

$= \sqrt{\frac{b}{atg\,\varphi^2}}$. Erit igitur $dx = \sqrt{\frac{b}{atg\varphi^2}}.\,dy\ \sqrt{\frac{a \pm y}{b \pm y}}$.

Quo Integrale formulæ $dy\ \sqrt{\frac{a \pm y}{b \pm y}}$ pateat, ponatur $\sqrt{a \pm y} + \sqrt{b \pm y} = u$, unde $\sqrt{a \pm y} = \frac{u^2 + a - b}{2u}$, $\sqrt{b \pm y} = \frac{u^2 - a + b}{2u}$, $\pm y = \frac{u^4 - 2(a + b)u^2 + (a - b)^2}{4u^2}$, $dy = \pm \frac{u^4 - (a - b)^2}{2u^3}\,du$ $= \pm \frac{(u^2 - a + b)(u^2 + a - b)}{2u^3}\,du$. Hinc $dy\,\sqrt{\frac{a \pm y}{b \pm y}}$ $= \pm \frac{(u^2 - a + b)(u^2 + a - b)}{2u^3}\,du \times \frac{u^2 + a - b}{u^2 - a + b}$ $= \pm \frac{(u^2 + a - b)^2\,du}{2u^3} = \pm \frac{u^4 + 2(a - b)u^2 + (a - b)^2}{2u^3}du$ $= \pm \frac{udu}{2} \pm \frac{(a - b)\,du}{u} \pm \frac{(a - b)^2\,du}{2u^3}$, cujus Integrale est $\pm \frac{u^2}{4} \pm (u - b)\ Log\ u \mp \frac{(a - b)^2}{4u^2} = \pm (a - b)$. $Log\ u \pm \frac{u^4 - (a - b)^2}{4u^2} = \pm (a - b)\ Log\ u \pm$ $\frac{(u^2 + a - b)(u^2 - a + b)}{4u^2} = \pm \frac{u^2 + a - b}{2u}.\frac{u^2 - a + b}{2u}$ $\pm (a - b)\ Log\ u = \pm \sqrt{(a \pm y)(b \pm y)} \pm (a - b)\ Log\big(\sqrt{a \pm y} + \sqrt{b \pm y}\big) + Const.$

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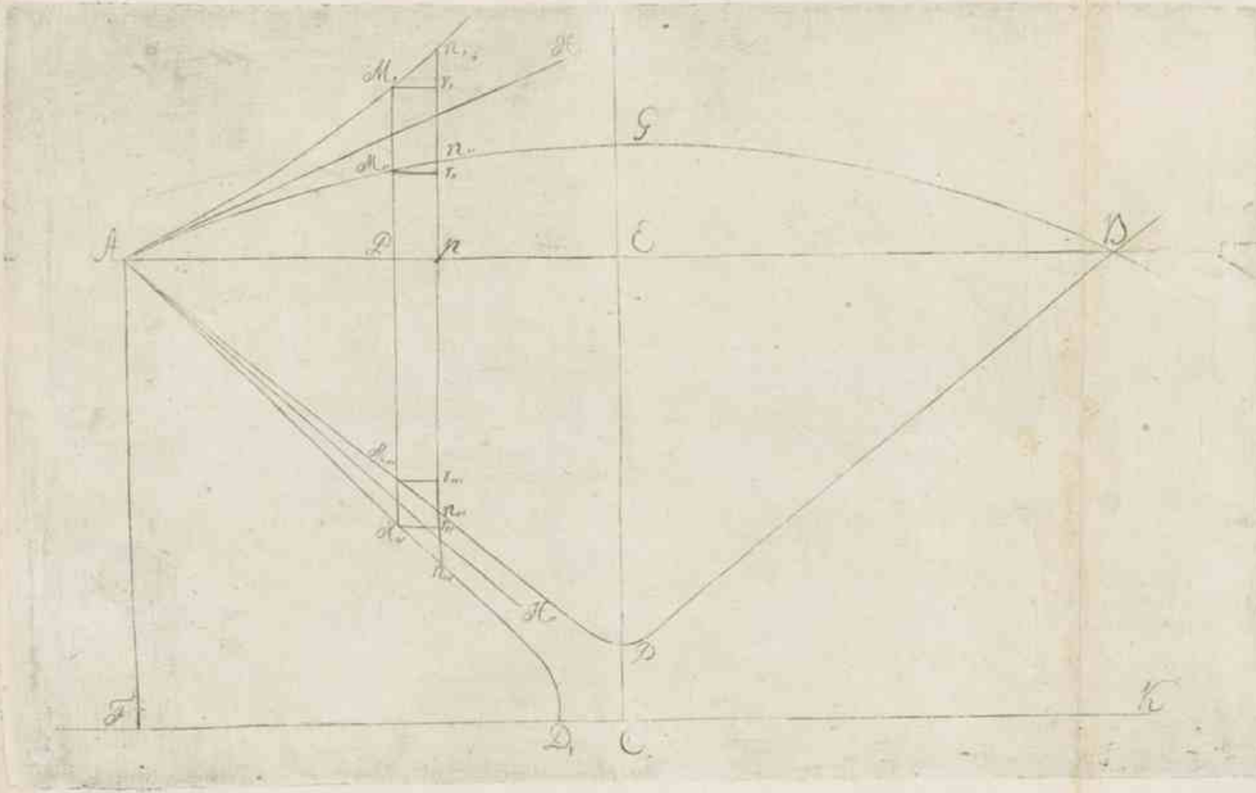

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Usu quidem invaluit, Amplissime vir, fautor Aestumatissime, à defensoribus dissertationis alicujus ventilandae benevolentiam et faciles aures praemissa oratione expetere; Cum vero Constitutiones Academicae Capite decimo 8vo, §o 3tio mom. 5to expresse praecipiant, ut Opponens a Praeside invitatus statim sine praefatione oppositionem aggrediatur, huic legi tanto libentior obedio, quo magis mihi est perspectum, Tuam, Celeberrime vir benevolentiam mihi semper amica ita nunc etiam ultro mihi praestito fuerant, ~~quoque minus convenit~~ Tuam Clarissime Dne Candidate, amicitiam hac occasione in dubium vocare.—