

AXIOMATIC OF MECHANICS

Johann Marinsek, 2009

marinse@aon.at

What's the use of axiomatic?

The axiomatic presentation of mechanics is based on the undefinable, fundamental notions of which the other notions can be defined.

What is meant by undefined basic concepts? We cannot all concepts define in a logical manner (by words) because this would go to infinity. Some concepts we don't define by using other concepts but we are introducing these primitive concepts by reference:

This is movement, this is force...

Axioms are indemonstrable propositions.

From axioms theorems can be demonstrated.

In order to understand rational mechanics, an axiomatic presentation is necessary.

Gödel's theorem states limits to formalisation, namely that a consistent system sufficiently rich to contain elementary arithmetic cannot prove its own consistency.

Because formalization is not our intention, understanding by an axiomatic presentation is not concerned by Gödel's formal objection.

I - Undefined fundamental notions of mechanics:

- *Space and movement*

- *Force*

- *quantitas materiae A*

or number of H-atoms

(H-quanta): N_H . N_H is identical with the so-called mass number A.

(I argue that H are the building blocks of all elements – Prout's thesis in 1815. See below the appendix:

Prout's idea that an element with mass number A is a specific configuration of A hydrogen atoms

II - Defined notions:

Time is defined since Aristotle: time is the duration of movement. He declares that movement can be faster or slower but time not.

Time as the duration of movement, i.e. a measure, cannot itself be a flux with a velocity.

Time is a relation and not a physical process. Thinking at time dilatation is a category mistake. A measure cannot have a dilatation. Only a clockwork mechanism can change its periodicity due to physical circumstances. See the appendix on Piaget's Genetic Epistemology where he shows that space and movement are conceptually prior to time.

Energy is defined: $E = \int \mathbf{F} \cdot d\mathbf{s}$

Energy is no physical entity or thing; it is a measure, a bookkeeping device when we require that energies of a process must be conserved. Thinking at energy lumps of magnitude hf is a category mistake: energy is not a thing that can be divided and energy is continuous. (h = Planck's constant, f = frequency)

III - Axioms

Natural laws or law-sketches:

$\mathbf{F} \propto m\mathbf{a}$ is not the definition of force but a law-sketch that expresses that the force \mathbf{F} must overcome an aether resistance $m\mathbf{a}$ in order to accelerate (a) a body.

A natural science like mechanics cannot be based on a definition but on natural laws!

The m in the law-sketch $\mathbf{F} \propto m\mathbf{a}$ is erroneously treated as an undefined basic concept. Furthermore the ontological status of *inert mass* m as intrinsic quality of any body, namely to be lazy or capable to resist a force is untenable. Recall that it is assumed that the stage for the body–force interaction is vacuity! Bodies in vacuity cannot produce intrinsic inertial forces $m\mathbf{a}$.

The occurring inertial force $m\mathbf{a}$ (a misnomer) is an *experimentum crucis* for the existence of aether or *vice versa* for the impossibility of a vacuum. This was the argument of Aristotle against the possibility of a vacuum.

IV – Understanding mechanics

The meaning of mass

Inert mass should not be confused with mass as amount of stuff. *Inert* mass (of course a misnomer!) is a measure of the resistance that a medium exerts on a moving particle or atom. This resistance depends on the atomic structure and is not an additive property. Because of the ontological nonsense of *inertia*, we must exactly specify what the measured values of mass m mean.

In many articles (www.marinsek.com) the author demonstrates that Prout in 1819 was right that all atoms are made up of hydrogen. So, the unit of *quantitas materiae* may be hydrogen.

Carbon-12 has 12 hydrogen constituents. During motion through the all-pervasive cosmic medium a force is exerted on the carbon atom (exactly speaking it is the ion C^+). This force is for low velocities proportional to the acceleration \mathbf{a} .

By convenience we set the resistive force for carbon $\mathbf{R} = 12 \mathbf{a}$. Oxygen has 16 hydrogen constituents. Now the resistive force is empirically not $\mathbf{R} = 16 \mathbf{a}$ but $\mathbf{R} \approx 15.999 \mathbf{a}$ because resistance is not additive due to a minute shielding effect.

So we can write

$$\mathbf{R} \approx d_{\text{El-A}} A \mathbf{a},$$

where A means the amount of hydrogen constituents N_{H} or mass number A and $d_{\text{El-A}}$ means drag coefficient for the specific chemical element with mass number A .

Therefore we can express the measured masses m as: $m \equiv d_{\text{El-A}} A$

Because the drag coefficient depends on the number of hydrogen atoms (A) and on the configuration of these atoms, isomers have different drag coefficients.

Take for instance C-14 and N-14 with their respective masses 14.003241988, 14.003074005. Both atoms have 14 hydrogen constituents but their configuration and therefore their drag coefficient is different: $d_{\text{C-14}} \neq d_{\text{N-14}}$

(Misnamed) *inert mass* or $m \equiv d_{\text{El-A}} A$ is just a product of number and a proportionality factor and has therefore no dimension. It depends mainly on the number of hydrogen constituents or mass number A but differs slightly on the atomic configuration that is specified by the chemical element (El).

For carbon C-12 we set $d_{\text{C-12}} \equiv 1$. (Exactly speaking we can only measure the inert mass of the carbon ion.)

Again: Inert mass $m \equiv d_{\text{El-A}} A$ is in reality a force coefficient when a field exerts a force $\mathbf{F} = m\mathbf{a}$ on the atom during motion.

From this it is comprehensible that inert mass is not an intrinsic or innate property of the atom, something like the laziness of the atom. Inert mass is a relational concept.

Haisch/Rueda/Puthoff explained the role of inert mass correctly:

The m in ... $F = ma$ is nothing more than a coupling constant between acceleration and an external electromagnetic force...

To put it simply, the concept of mass may be neither fundamental nor necessary in physics...

The mass spectrograph measures not the *inertia in vacuo* but a repulsive force due to a cosmic drag from a medium. This repulsive force is not additive and depends on the structure of the atom.

No dimension of mass

In classical (inertial) mechanics mass has the dimension $[M]$ because mass was erroneously set as an undefined prime concept. Force was erroneously assumed to be a defined (derived) concept according to $F \equiv ma$.

Therefore the dimension of force in classical mechanics is $F: [ML/T^2]$.

Mass expressed as a product of mass number A and a drag coefficient has no dimension.

Force as undefined concept has dimension $[F]$

VI - Theorems

Conservation laws

Classical mechanics states the maintenance of a body's velocity in the presupposed vacuity. This means that momentum $p = mv$ is conserved. But there is no vacuity but a resisting medium.

Because for higher velocities the aether drag is $\mathbf{F} \propto F(A, v^2)$ and not $\mathbf{F} \propto m\mathbf{a}$ there is **no** conservation of momentum. Maintenance of uniform motion in a resisting medium is impossible. Therefore also angular momentum cannot be conserved.

The only remaining conservation laws are:

Quantitas materiae must be conserved.

Energy must be conserved.

Charge must be conserved.

Charge and energy can neither be created nor annihilated.

Kinetic energy is not an innate property ($mv^2/2$) of a particle moving in the vacuum but the work done to overpower the resistance $\mathbf{F} \propto m\mathbf{a}$ of the all-pervasive electromagnetic medium: $E \approx m \Delta v^2/2$ if the resistance is $\mathbf{R} \propto m\mathbf{a}$.

Mass-energy conversion according to $E = m_0 c^2$ is wrong.

No rest energy $E = mc^2$

If the force is $F = m\gamma^3$ ($\gamma = 1/[1 - (v/c)^2]^{1/2}$), one gets for the energy the relativistic expressions for the masses and energies:

$$E = \int^v ma \gamma^3 ds = \dots = mc^2[\gamma - 1] = mc^2\gamma - mc^2$$

It is a fallacy to derive a rest energy $E = mc^2$ because only the entire expression $E = mc^2\gamma - mc^2$ has a physical meaning. Here, pay attention that the two terms of the result $E = m_0 c^2 \gamma - m_0 c^2$

represent the values for the upper or final (here $v = v$) and lower or initial limit (here $= 0$) of the integral. It is a question of mathematical logic that the terms for $v = v$ and for $v = 0$ have no physical relevance for themselves.

If the result of a definite integral (here it is an energy) is necessarily a difference of terms, then this difference is not a difference of energies but serves only to calculate the energy.

The entire term $\{m_0 c^2 \gamma - m_0 c^2\}$ is the work done by the accelerating force and not energy stored inside of the particle. That would be a potential energy.

So, many authors erroneously claim that the so-called kinetic energy $E = m_0 c^2 \gamma_{(v)}$ is identical with an intrinsic potential energy. In verity there is a partition: the work done by the force F is partly energy of the excited resisting medium, partly potential energy of the “deformed” body. The partition is unknown.

Next step in the conceptually confusing ‘derivation’ is the introduction of the term *rest energy*:

If the initial velocity is $v = 0$, then the term for the initial limit of the finite integral has the value $m_0 c^2$. Because for $v = 0$ there is no kinetic energy the term $m_0 c^2$ was baptized *rest energy*, meaning that it is an energy inside of the body, therefore a potential energy.

It is a matter of logic that if the first term of the difference is a kinetic energy, then the second also must be a kinetic energy.

See the article Refutation of Rest Energy $E = mc^2$.

Relativistic mechanics conceptually impossible

If one supposes a velocity dependent increase of inert mass, then the formal relativistic derivation according to the vector calculus yields a physical impossible force:

$$\mathbf{F} \equiv d(m\gamma\mathbf{v})/dt \rightarrow \dots \quad m\gamma \mathbf{a} + m\gamma^3 (\mathbf{v} \cdot \mathbf{a}/c^2) \mathbf{v}$$

In classical mechanics acceleration and force vector have identical direction. Not so in relativistic mechanics! Note please that relativistic mechanics treats the second law of Newton as the definition of force: Force \equiv_{def} the time derivative of momentum.

This is an epistemological error: A definition cannot be the foundation of physics.

Lex II is an empirical law. Force is a (logically) undefined basic concept of mechanics.

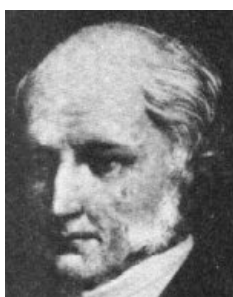
Energy is a defined concept one: $dE \equiv_{\text{def}} \mathbf{F} ds$

Mathematics cannot create physics but is only a tool for physics. For the formal derivation

$$\mathbf{F} \equiv d(m\gamma\mathbf{v})/dt = m\gamma \mathbf{a} + m\gamma^3 (\mathbf{v} \cdot \mathbf{a}/c^2) \mathbf{v}$$

there is no empirical indication...

Appendix I:



Prout's idea that an element with mass number A is a specific configuration of A hydrogen atoms

C-12 consists of 12 hydrogen atoms. This configuration of H's is stable.

C-11 is a configuration of 11 hydrogen atoms. This configuration is not a stable one.

It must undergo a trans-formation that is also a trans-position of the hydrogen building blocks. This transformation occurs not in the void but in a dielectric medium that consists of e^+ and e^- .

The transformation process liberates positrons out of the all-pervading dielectric (the old aether).

The untenable quantum shell model of the atom is the base for the explanation of chemical bonding and the periodic table; therefore quantum physical chemistry is untenable.

Pout's thesis in 1815 that all elements are made up of hydrogen atoms is proved true. The dogmatic exclusion of chemical philosophy and therefore the prevention of a rational metaphysics are the cause for the long sleep of Pout's ingenious idea that the constituents of atoms are hydrogen atoms and that therefore the chemical equivalents in reactions and compounds are expressible by integer numbers.

Stoichiometry shows that for example carbon, oxygen, and the two isotopes of chlorine consist of 12, 16, 35 and 37 hydrogen atoms, respectively. If for convenience carbon has the atomic weight 12, then why the atomic weight of oxygen is not exactly 16? Constituents of all atoms are hydrogen atoms. The number of hydrogen atoms determines a chemical element. Isomers have the same number of hydrogen atoms but different structures.

Mass spectrographs don't measure the number of the constituents of atoms directly but because the shielding effect is relatively small, spectrograph measurements show nearly integer numbers, indicating that the cosmic drag is nearly additive and for instance an atomic weight (a misnomer!) of 15.99... for O refer to an atom which is a construct of 16 H-atoms.

After the discovery of the isotopes it should have been clear that common chlorine is a mixture of ^{37}Cl and ^{35}Cl and that Prout was right. But the misunderstanding of 'atomic weights' (measured by mass spectrographs) as quantity of stuff prevented the insight that stoichiometry calculated the exact chemical ratios long ago.

Constituents of all atoms are hydrogen atoms. The number of hydrogen atoms determines a chemical element. Isomers have the same number of hydrogen atoms but different structures.

Mass spectrographs don't measure the number of the constituents of atoms directly but because the shielding effect is relatively small, spectrograph measurements show nearly integer numbers, indicating that the cosmic drag is nearly additive and for instance an atomic weight (a misnomer!) of 15.99... for O refer to an atom which is a construct of 16 H-atoms.

Chemical equivalents or constituent amounts in reactions or in compounds represent the ratios of the H-constituents of the elements taken into consideration. H_2O is a compound of 18 H-atoms. The exact ratios, the exact moles are the result of *stoichiometry* and not of mass spectroscopy because atomic weights do not represent ratios of 'stuff'!

Appendix II: Since Aristotle, time is a defined notion

Aristotle's definition of time as the duration of movement concerns the notion of time that we use in science. It is the interval between two events. Of course time has a second meaning: that of temporal order or a succession of events and present time, past, future,

Genetic epistemology shows that the notion of time is based on the undefined notions of movement (that includes speed) and space. Piaget explains the intellectual construction of the concept of time:

So, in sum, genetic epistemology deals with both the formation and the meaning of knowledge.

... The fundamental hypothesis of genetic epistemology is that there is a parallelism between the progress made in the logical and rational organisation of knowledge and the corresponding formative psychological processes... (during the) development of logical structures in children.

...I shall show that the notion of time and the notion of simultaneity are based on the notion of speed, which is a more primitive intuition.

Jean Piaget's *Genetic Epistemology*, Columbia University Press 1970, chapter 1, available under: <http://www.marxists.org/reference/subject/philosophy/works/fr/piaget.htm>

Appendix III:

INERTIA: THE ABSURD RESULT OF A GEDANKENEXPERIMENT

In mechanics the principle of inertia is the result of an erroneous thought experiment (*Gedankenexperiment*) The inventor of this thought experiment was Descartes, Euler perfected it and postulated it as one of the fundamental laws of mechanics.

The essence of the *Gedankenexperiment*:

First assumption:

Only one body is moving *in vacuo*.

Second assumption:

Velocity is a *state* of the body like its shape, its hardness or its colour.

That is to say: velocity is absolute and belongs to the body and is therefore without any relationship to other bodies. In other words: velocity is an intrinsic property of the body.

First conclusion:

The state of velocity \mathbf{v} is persisting: $\mathbf{v} = \text{const.}$ Therefore, the motion continues in the present state of velocity, moving uniformly forward in a straight line. There is no sufficient reason for the body to change its state of velocity or its direction of movement.

Second conclusion:

Only an external force \mathbf{F} can disturb the body persisting in its inert state (or in its laziness) $\mathbf{v} = \text{const.}$, hence change this state. Without an accelerating or decelerating force \mathbf{F} , the velocity and therefore also the momentum $m\mathbf{v}$ of the body is preserved: $m\mathbf{v} = \text{const.}$ (m... mass).

One problem had to be solved by this doctrine: Even the smallest force would accelerate the biggest mass infinitely because the body does not have any support in the vacuum. In order to get rid of this difficulty, a persisting state of velocity or momentum was invented.

One had to pretend that the body resists the external force owing to this capability of persistence. But according to Euler the reaction of the body's disturbed inertial state to the external force can't be a real force because the inanimate matter does not have an internal force reacting „out of“ the body. The so called force of inertia is only the consequence of the disturbance of the state of laziness or *inertia* by the external force.

Conclusion: In classical inertial mechanics the so called force of inertia, namely the product mass times acceleration – $m\mathbf{a}$ – is an *apparent force* (*Scheinkraft*), not a real one.

Recall that Aristotle's argument against the possibility of a vacuum that in the case of vacuity the smallest force would accelerate the biggest body infinitely.

DYNAMICS WITHOUT FORCES?

A strong opposition against force as a primordial concept in physics came from the ideological battle of empiricism against metaphysics and especially against occult qualities.

For example Schrödinger believed that positivism had banished the concept of force, „*the most dangerous remains of animism...*“.

Another method to banish force was to introduce force only as „*auxiliary variable*“

(Kirchhoff, Mach and others) in order to simplify expressions.

IN CLASSICAL MECHANICS FORCE IS A DERIVED CONCEPT

In fact, in physics the term ma was baptized „force“, therefore force is a *derived* concept whereas mass is the *fundamental* concept.

The persistence of this error in the axiomatics of physics is irrefutably proven by the commonly accepted *dimension* of force: $[ML/T_2]$. That means that force has not a fundamental dimension $[F]$ but only a derived one. Inertial mass is the basis of the CGS-System! Starting from the wrong metaphysics of inertia the following fundamental concepts of mechanics were postulated: inertial mass, space and time.

Hence, force is not a fundamental concept and not an *essence* of physics, but force is only a derived concept. As a result of being in the wrong system, force does not have its own *dimension* like time $[T]$, space $[L]$ and mass $[M]$, but force has a dimension according to its definition $\mathbf{F} \equiv m\mathbf{a} : [ML/T_2]$.

The premise for a derived dimension for force is the definition of force in the *nominal* or in the *essential* meaning by the formula $\mathbf{F} \equiv m\mathbf{a}$.

VELOCITY IS A RELATIONSHIP AND NOT AN ABSOLUTE STATE

The physics of modern times turned against occult qualities. The pretended persisting state of velocity, and therefore of the momentum of a body in the vacuum, however, is exemplary of occultism.

Therefore, enlightenment against the darkness of erroneous metaphysics is necessary:

Firstly, thought experiments *in vacuo* (*nothing* by definition) cannot be carried out. Without nature no natural laws can be established. In the vacuum not even velocity is determined because there is no frame of reference.

Secondly, velocity is a relationship:

- relative velocity between bodies;
- relative velocity of the body with respect to the universe, this is the *real* velocity.

The expression *absolute velocity*, meaning the velocity with respect to the universe is misleading because every velocity is *relative*. But as *façon de parler* „absolute velocity“ may be tolerated.

The universe is *absolute*. The universe as a whole is *immobile*. *Internal* motion is an essential quality of the universe. A body as part of the universe does not move uniformly on a straight line.

Natural motion occurs on continuous curves with continuously changing velocity.

Motion is always relative, not absolute and belonging to the body. Thus, velocity cannot be an (absolute) *state* of *one* body. Therefore, the principle of inertia is based on a category mistake.

Thus, neither velocity nor momentum and kinetic energy are *states* or properties of *one* moving body.

The alleged natural law for the conservation of momentum in the absence of

forces, $mv = \text{const.}$, is *science fiction* based on a *Gedankenexperiment*.
In a *plenum* of anisotropic force-fields neither conservation of momentum nor acceleration on a straight line are possible.

VI – Category mistakes in mechanics

The danger of hypostatizing concepts:

To hypostatize: to conceive a relation as an existing being;

Hypostasis of a concept means a concretization, the erroneous assignment of qualities of things to relations.

Example: time is not a physical process with a flux-velocity but only a relation.

To say that time has a flux with variable velocity is a category mistake.

Only clockworks can change its periodicity. The rotational speed of our globe decreases but this is not time dilatation!

Energy is by definition not a thing with a flux but a relation, a measure. Therefore Planck's energy lumps are a category mistake.

Space is a relation and not a thing that can undergo deformation or expansion.

Velocity is a relation and not a state of a body.

Also momentum $p \equiv mv$ is not a physical state of a body that is persisting.

Relativistic mechanics is science fiction because time and space are treated as things that have velocity or are deformable, respectively.

Relativistic mechanics treats the famous *lex II* of Newton's mechanics: $F = ma$ not as axiom but as the definition of force $F \equiv d(m(v))/dt$. The derivation with the assumed mass increase gets physical nonsense.

VII – References

[ara] Aristotle, *Physics*

[des] Descartes, R., *Princ. Philos.*, II, 37. 39. Heimann, Berlin 1870.

[dij] Dijksterhuis, E., *Die Mechanisierung des Weltbildes*, Berlin 1956

[eul] Euler, L., *Briefe an eine deutsche Prinzessin*, Kröber ed. Leipzig 1983

[ive] Ives, H.E., *Deriv. of the mass-energy relation*. *J.Opt.Soc. of Am*, pp 540-543 (1952)

[Jan] Janich, P., *die Protophysik der Zeit*, Mannheim 1969

[Kir] Kirchhoff, G., *Vorlesungen über math, Physik. Mechanik*, Leipzig 1876]

[mai] Maier, A., *Studien zur Naturphilosophie der Spätscholastik*, Roma 1949-55

[maa] Marinsek, J., *Rationale Physik oder Wissenschaftliche Science fiction?* Graz 1989.
Erratum: erroneous theory concerning mass and gravitation.

[mab] Descartes, the Inventor of the Principle of Inertia, *Convegno a Perugia* 19..

[mac] Marinsek, J., *Inertia, the Error-Virus Not Killed till Now*. In: *Physics as a Science*, Galezcki, Marquardt, Wesley, ed. Hadronic Press. Palm Harbor 1998

[New] Newton, I., *Mathematische Prinzipien der naturlehre*, Wolfers ed. Darmstadt 1963

[pro] Prout, W., On the Relation between the Specific Gravities of Bodies in their Gaseous State and the Weights of their Atoms, Ann. Philosophy, 6, p. 321, 1815,

Also in: Knight, D. M., ed., Classical Scientific Papers – Chemistry, 2. ser., 1970, N.Y.

Prout, W., Correction of a Mistake in, Ann. Phil. 7, p 111, 1816

[rob] Roboz, J., Introduction to Mass Spectrography, N. Y.... 1968

[rp] Haisch/Rueda/Puthoff, Beyond $E = mc^2$, The Sciences, vol. 34, no. 6, pp.26-31, 1994

[Sro] Schrödinger, E., Die Natur und die Griechen, Wien 1955