Comment on 'Mathematical versus physical meaning ofclassical mechanics quantities' by M. Zabierowski (Apeiron 17, 173, 2010)

Peter Enders
Senzig, Ahornallee 11
15712 Koenigs Wusterhausen, Germany
enders@dekasges.de

The unjustified criticism of my paper 'Precursors of force felds in Newton's 'Principia' (Apeiron 17, 22, 2010) is refuted.

Keywords: Newton's 'Principia', force fields, unity of classical physics

Introduction

In his paper [1], M. Zabierowski makes several unjustified statements about my paper [2], in particular, about the manner of dealing with the words in Newton's 'Principia' [3]. I will show that his criticism is not justified and, perhaps, results from a misunderstanding of the goal of my paper.

Rejection of the criticism in detail

1. "P. Enders ... shows that the anticipation of Faraday's and Maxwell's conception of the field one can find in Newton's Mathematical Principles of Natural Philosophy."

Correct is not "the anticipation," but "an anticipation" or "one anticipation," for Lichtenberg's figures are another anticipation.

2. "He quotes the foundations of classical mechanics in Newton's original version and next translates words into words used today..."

I agree that I should have quoted the modern translation by Cohen and coworkers [4] rather than the 1729 translation by Motte [3], the deficiencies of which are discussed in detail in Ref. [4], p. xi ff. For the paragraphs quoted in my paper, however, these deficiencies play no role as the following comparison of both texts shows.

Definition I:

Motte 1729: "The quantity of matter is the measure of the same, arising from its density and bulk conjunctly."

Cohen 1999: "Quantity of matter is a measure of matter that arises from its density and volume jointly."

Definition II:

Motte 1729: "The quantity of motion is the measure of the same, arising from the velocity and quantity of matter conjunctly."

Cohen 1999: "Quantity of motion is a measure of motion that arises from the velocity and quantity of matter jointly."

Definition VI:

Motte 1729: "The absolute quantity of a centripetal force is the measure of the same proportional to the efficacy of the cause that propagates it from the centre, through the spaces round about."

Cohen 1999: "The absolute quantity of centripetal force is the measure of this force that is greater or less in proportion to the

efficacy of the cause propagating it from a center through the surrounding regions."

Definition VII:

Motte 1729: "The accelerative quantity of a centripetal force is the measure of the same, proportional to the velocity which it generates in a given time."

Cohen 1999: "The accelerative quantity of centripetal force is the measure of this force that is proportional to the velocity which it generates in a given time."

Definition VIII:

Motte 1729: "The motive quantity of a centripetal force is the measure of the same, proportional to the motion which it generates in a given time."

Cohen 1999: "The motive quantity of centripetal force is the measure of this force that is proportional to the motion which it generates in a given time."

Therefore, the conclusions I would have drawn from Cohen's 1999 translation are the same as I have drawn from Motte's 1729 translation.

3. "Enders claims that Newton's definitions serve to supply the empirical (measured) notions with their mathematical interpretation."

I'm not claiming that explicitly. I consider the purpose of the Definitions to provide notions for the subsequent qualitative and quantitative (physical) description of nature. Actually, this claim by Zabierowski is unhistoric: "So, one can say, that the foretelling of the wave-corpuscula dualism appeared firstly in Newton's theory."

4. "Enders writes that Newton did not give "the mechanism for the propagation for the force (field).""

This formulation is incorrect as it suggests that I have criticized Newton for that. My full sentence reads "Notice, that the notion of

field strength does not solve Newton's problem of lacking a physical mechanism for the propagation of the force (field)."

5. "Ref. 3. Our analysis concerns the today form of Newtonian principles. Therefore it is not here necessary to mention that in 1736 L. Euler firstly published Newton's equations in explicit form."

If Zabierowski's concern is "the today form of Newtonian principles," why he has discussed my paper, which explores Newton's original writing?

6. "The inseparability of mathematical intuition and phenomenal abstraction in the language of Newton's Principles of dynamics allows to answer the question raised in Enders' article."

I'm not aware of having risen a question. Anyway, Zabierowski should study Euler's work on the foundations of mechanics. This would prevent him to make premature claims about what is 'necessary', or 'the only way'. Euler's principles of mechanics are much more general than Newton's one, because only the state conservation is axiomatically fixed, but not the change of state. Unfortunately, Zabierowski discards the central notion of state. I guess that the rational content of his thoughts would significantly benefit from including it.

7. "According to our interpretation we can assume that this is the reason why Newton wrote on centripetal forces as follows: "For I here design only to give a mathematical notion of those forces, without considering their physical causes and seats."... This statement is fully explained only in our presented approach, whereas the Enders' comments are of purely lingual nature and do not touch the essence of Newton's physics."

First, Zabierowski has not really explained, why Newton has stressed that his theory of forces is a purely mathematical one. He has claimed that wave motion is the only possible form of propagation.

But wave motion does not say anything about the "physical causes and seats" of forces.

Second, the goal of my paper was not to explore "the essence of Newton's physics." I was just going to demonstrate in detail, that Newton's 'Principia' contains thoughts about the force of gravity which facilitate the unified derivation of Newton's and Coulomb's force laws given in [5].

8. "He presents extensive quotations from Newton's "Principia" and makes translation of original Newton's words (of XVIIth) into modern language in physics."

See Point 2 above for the reasoning that this criticism is unsubstantiated.

9. "The example is Enders' suggestion that the above quoted Newton's statement entitles to conclude that: "It thus is incorrect to connect the physical meaning of 'action-at-distance' with Newton" [7]."

This is just wrong. Correct is the following. After a quotation from the 'Principia', I have written: "This is one of the several places in the 'Principia'..., where Newton urges the reader to consider his description of forces to be purely mathematical. It thus is incorrect to connect the physical meaning of 'action-at-distance' with Newton."

10. "Such one-statement declaration could not replace the complex chain of deduction in physics."

Of course not. My sentence is a notice within the paper. It is thus incorrect to treat it like a central conclusion.

Summary

In summary, M. Zabierowski has written a methodological paper about the nowadays understanding of Newton's three "Laws of motion." In contrast, I had written a paper about the germs of force

fields in the original "Definitions" in the 'Principia'. In view of this fact, *viz.*, that these two papers have little in common, it may even not be surprising, that Zabierowski's criticism of my paper is unsubstantiated. His incorrect quotations from my paper indicate that he has largely misunderstood it.

References

[1] M. Zabierowski, *Mathematical versus physical meaning of classical mechanics quantities*, Apeiron **17** (2010) 173-182

[2] P. Enders, *Precursors of force fields in Newton's 'Principia'*, Apeiron **17** (2010) 22-27

[3] I. Newton, *Mathematical Principles of Natural Philosophy*, London 1729; http://gravitee.tripod.com/definitions.htm

[4] I. Newton, *The Principia. Mathematical Principles of Natural Philosophy*. A New Translation by I. Bernhard Cohen and Anne Whitman assisted by Julia Buden, Preceded by A Guide to Newton's Principia by I. Bernhard Cohen, Berkeley etc.: Univ. Calif. Press 1999

[5] P. Enders, *Towards the Unity of Classical Physics*, Apeiron **16** (2009) 22-44