

Comment on ‘A new perspective of how to understand entropy in thermodynamics’

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In a recent paper [1], Guobin Wu and Amy Yimin Wu discuss the idea of the KPC (the Karlsruhe Physics Course) about teaching entropy by the colloquial concept of heat.

The KPC is a novel approach to the teaching of physics. The development of the KPC began in 1975. There are many good ideas in the KPC, which are very useful for us to modernize the teaching structure of physics. These ideas have found their way into the mainstream physics textbooks and physics classrooms worldwide.

But in 2013 the author of the KPC received a report from the German Physical Society (DPG), which is an attack against these ideas.

Taking entropy as the quantity of heat is one of these good ideas. At the beginning of the chapter about thermodynamics, the KPC says [2]:

‘What we call ‘quantity of heat’ in everyday language, has a special name in physics. It is called *entropy*.’

And here the objection of the DPG report [3]:

‘It is true that the entropy of a system can be changed by supplying or removing heat. But entropy is by far not the same as heat, and cannot be referred to as such, not even ‘colloquially’. Both have different measurement units, simply for this reason they cannot be identical. Heat is measured in Joule, entropy in J K^{-1} .’

There are physical quantities which have the function to measure the amount of ‘some perception or imagination’: momentum measures the amount of motion we perceive, mass measures

the amount of inertia we perceive, entropy measures the amount of heat we perceive, electric charge measures the amount of electricity we imagine (for we have no sense organ to perceive electricity directly).

Apparently, in ‘amount of heat’, ‘heat’ is not a quantity, but a perception. Of course, a colloquial word heat referring to a perception has no unit. It is neither measured in Joule nor in J K^{-1} .

Now we know that DPG experts confuse two concepts: that of a physical quantity and that of the perception described by the quantity.

Wu and Wu agree with DPG’s view-point that heat is energy. But it is not true that the KPC identifies entropy with heat energy or any other energetic quantity. In the KPC, heat is neither the quantity energy, nor the quantity entropy. However, the quantity of heat is just the quantity entropy.

So, the idea taking entropy as the quantity of heat is convincing and scientifically correct. Thus, the well-known difficult physical quantity entropy become a simple one and can be learned intuitively.

Wu and Wu also provide a new name for entropy as quantity of thermal charge. But what is thermal charge? Their answer to this question is that thermal charge is analogous to electric charge. However, we know that in physics electric charge is a quantity. If thermal charge is also a quantity, then quantity of thermal charge is a quantity of quantity. In physics, there is no such a logic. So,

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a new term is not a new concept, that cannot help us to solve any problem.

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