Fundamental Constants: The Ultimate Foundation of the SI

Plática Plenaria

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ABSTRACT

The SI, the international system of units, has been the accepted system of units for all measurements for over a century. Its long history has established the public perception that the SI is a static, permanent system. But to the metrology community, with its focus on ultimate accuracy and its stewardship of the SI, the evolution of the SI is more obvious and dynamic. The SI units have changed many times in the last century and have evolved to keep pace with technological and scientific advances while simultaneously striving to maintain the maximum stability and user confidence. Of course these concepts are in conflict; especially now as another change seems imminent.

The fundamental properties of physics, more commonly known as fundamental constants, have their origins with the earliest physical philosophers. But it is wasn't until developments in atomic spectroscopy and quantum mechanical in the early 20th century that fundamental constants became cornerstones in so much of our theoretical understanding of physics. With the subsequent developments of such fields as relativity, superconductivity, quantum electrodynamics and the standard model, fundamental constants have become the consistency test of all of physics and a metric of our scientific progress.

I will review the SI and it present state. I will also outline the fundamental constants and the role of the CODATA Task Group on Fundamental Constants. I will discuss the proposed changes of the SI by exactly fixing some of the fundamental constants and I will outline some of the impacts on the SI.