Until the very last years of the nineteenth century, most if not all scientists who believed in the reality of atoms shared the view that these particles cannot be decomposed further, as was eloquently expressed by Maxwell in 1873:

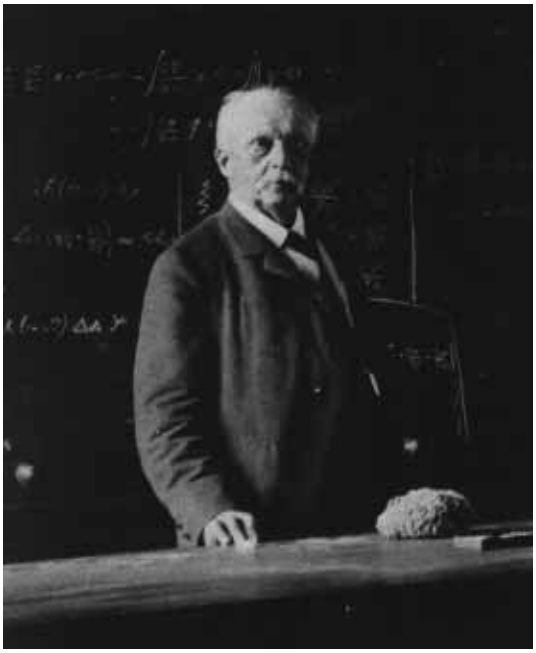
> Though in the course of ages catastrophes have occurred and may yet occur in the heavens, though ancient systems may be dissolved and new systems evolved out of their ruins, the molecules [i.e., atoms!] out of which these systems [the Earth and the whole solar system] are built—the foundation stones of the material universe—remain unbroken and unworn. They continue this day as they were created—perfect in number and measure and weight.[8]

THE ATOMICITY OF CHARGE

ELECTROMAGNETISM BECAME A PART of science in the eighteenth century, largely due to rapid progress in the invention of new instruments: the first condenser (the Leiden jar), the lightning rod, the first battery (the Voltaic pile), the first solenoid. These advances led, in turn, to the formulation of phenomenological laws based on new experiments. Of interest here is the law of electrolysis, formulated in the 1830s by Michael Faraday (1791–1867), one of the great experimentalists of all time, who coined terms of lasting use: electrode, anode, cathode, electrolysis, ion, anion, cation. In modern language, his law can be stated like this:

The amount of electricity deposited at the anode by a gram mole of monovalent ions is a universal constant, the farad (F), given by $F = Ne$, where N, Avogadro's number, is the number of molecules per mole, and e is a universal unit of charge.

What does this e signify? In 1881 Herman von Helmholtz (1821–1894) put it like this in his Faraday lecture: "The most startling result of Faraday's law is perhaps this. If we accept the hypothesis that the elementary substances are composed of atoms, we cannot avoid concluding that electricity also, positive as well as negative, is divided into definite elementary portions, which behave like atoms of electricity."[9] This statement explains why in subsequent years the quantity e was occasionally referred to in the German literature as "das Helmholtzsche Elementarquantum."



Hermann von Helmholtz, who in 1881 speculated on the atomicity of charge. (Courtesy AIP Emilio Segrè Visual Archives)