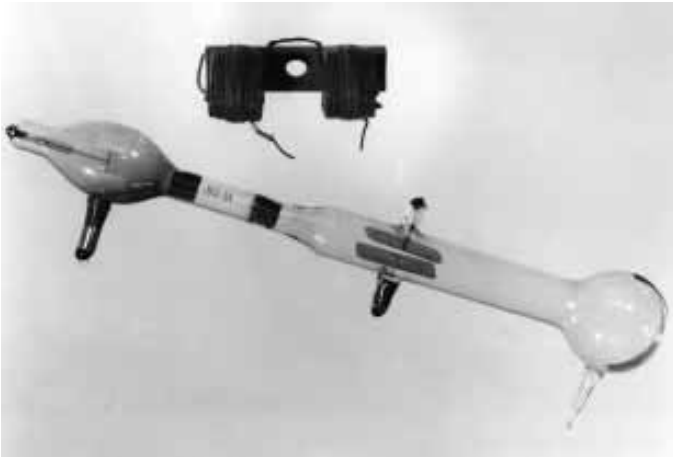

The vacuum tube used by Thomson in his discovery of the electron. (Courtesy Science Museum/Science & Society Picture Library, London)

of a new particle with a very small mass on the atomic scale. However, he was not the first to make that guess. In order to explain, I need to introduce two other players in the field.

The first is Emil Wiechert (1861–1928), then a Privatdozent at the University of Konigsberg. In the course of a lecture before Konigsberg's Physical Economical Society, on January 7, 1897, he stated his conclusion about cathode rays[14] to which his experiments had led him: "It showed that we are not dealing with the atoms known from chemistry, because the mass of the moving particles turned out to be 2000–4000 times smaller than the one of hydrogen atoms, the lightest of the known chemical atoms." It was the first time ever that a subatomic particle is mentioned in print and sensible bounds for its mass are given. However, these conclusions depended crucially on his assumption about the charge. "Als Ladung ist 1 Elektron angenommen" (the charge is assumed to be one electron) he stated, using Stoney's terminology.

The second person is Walter Kaufmann (1871–1947), then Assistent at the University of Berlin, whose cathode-ray experiments had taught him two crucial points.[15] First, e/m for his rays was a *constant*, the same for whatever residual gas remained in his Geissler tube. That greatly puzzled him: "This assumption [of constant e/m] is physically hard to interpret; for if one makes the most plausible assumption that the moving particles are ions [in the electrolytic sense] then e/m should have a different value for each gas." Furthermore there was, as he perceived it, a second difficulty. Assuming e/m to be a constant, his measurements gave him about 10^7 emu/g for the value of e/m, "while for a hydrogen ion [e/m] equals only 10^4." Thus, he stated, "I believe to be justified in concluding that the hypothesis of cathode rays as emitted particles is by itself inadequate for a satisfactory explanation of the regularities I have observed."

Clearly Kaufmann was a fine experimentalist who, however, lacked the chutzpah of Thomson, who on August 7, 1897, submitted his memoir on cathode rays.[16] His first determination of e/m yielded a value 770 times that of hydrogen. He observed (see box