Calculation of (Minor Planet) Rotational Period Using Light Curves

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Abstract

Lightweight oil is sprayed through an atomizer. As the droplets are forced through the nozzle they gain a small amount of charge due to friction. The drops will quickly reach terminal velocity in the absence of any electric field and will travel at a constant velocity. By placing the drops between two electrodes the electric field created by them will cause the droplets to accelerate up and down. By measuring the terminal velocity and acceleration of droplets in a known electric field, the fundamental unit of charge (e) calculated and reported here is (?).

I. INTRODUCTION

With the discovery of charged subatomic particles in the early 20th century by J.J. Thomson in 1897 and Neils Bohr, whose combined theories began to describe the internal workings of the atom, there was the question of how much charge these particles carried. Most of what was known about electricity and magnetism before these this discovery could be explained by treating charge as an essentially continuous variable. However the introduction of quantization by Niels Bohr transformed the way that the atomic structure was explained. As such the question arose as to the magnitude of the charge which the charged subatomic particles carried– might the charge by quantized like the orbitals potentials in the Bohr model or was it arbitrary? At the time Robert A. Millikan, with significant input from Harvey Fletcher, perfected their oil drop experiment to measure this charge. The experiment involved measuring the force on oil droplets in a glass chamber sandwiched between two electrodes, one above and one below. With the electrical field calculated, one could measure the droplet's charge. In the end Millikan's measurement of the fundamental charge was exceptional, and the method of measurement was an elegant hands on representation of the quantized world of atoms. The straightforward nature of the measurements and the obvious conclusions that came from them became a foundation for Bohr's model of the atom and the standard model that would eventually follow. It convinced even the most stubborn skeptics; prior to Millikan's work Thomas Edison strongly believed that electric charge existed on an unbroken continuum. However, after he examined the method and results of Millikan's experiment he was swayed from his position.

The work done in this experiment looks to measure the fundamental charge as Millikan did by manipulating charged oil drops with electric fields.

II. CONCLUSION

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[1] Richard P. Feynman, Robert B. Leighton, and Matthew Sands, *The Feynman Lectures on Physics, Vol. 1* (Addison-Wesley, 1964), p. 3-10.

[2] J. Wheatley, T. Hofler, G. W. Swift, and A. Migliori, "Understanding some simple phenomena in thermoacoustics with applications to acoustical heat engines? Am. J. Phys. 53, 147–162 (1985).

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[4] *AIP Style Manual*, 4th edition (American Institute of Physics, New York, 1990). Available online at <http://www.aip.org/pubservs/style/4thed/toc.html>. Although parts of it have been made out of date by advancing technology, most of this manual is still as useful as ever. Just be sure to follow AJP's specific rules whenever they conflict with those in the manual.