



Contribution ID: 61

Type: Oral Presentation

Charged liquid droplets in electromagnetic fields - An experiment for developing conceptual understanding during student activity

Friday, 5 October 2018 12:10 (20 minutes)

Introduction

What is the relative impact on learning when the abstraction in lessons changes?

Things that are too small to be seen by the human eye need to be visualized to be well understood. Visualisations can be realized with digital tools but at the cost of introducing a higher level of abstraction. The visualizations could also be made by observing and experimenting with an analog macroscopic object that behaves in a similar way as the object of study, and this is the main idea behind the experiment presented in this work.

We limit our study to scientific questions, whereas social factors affecting learning in the lab is left for future studies.

Research questions

What can students learn about concepts and properties of electric fields, electric charge, electric force, Newton's laws while building their experience on direct observations of charged droplets moving through electric fields?

What kind of teaching, such as direct observations during experiments, pre-recorded videos of experiments or classical theoretical studies with literature and lectures, presents the subject in a way that enables the students to learn efficiently, which we interpret as students having obtained long-term knowledge of the subject matter.

Physical experimental setup

During the study, an experimental setup was used to teach the above mentioned concepts. The experimental set-up consist of: charged macroscopic liquid droplets that fall through an electric field that can be controlled by the observer. This gives the students the opportunity to experience ideas and concepts that otherwise only appear as particle-motion exercises in the Physics textbook. When illuminated by a strong light-diode the 20 microns in diameter droplets are made visible for the human eye. By a simple web-camera we can directly record and observe the motion of the droplet as it moves a curved path in an electric field created.

Students are able to change a number of parameters and simultaneously observe how the changes affects the paths of the droplets. We investigate in this study how work with this experimental system affects the learning of the students.

Design of Study

All students performed a pre-test.

Three groups of students got an equal amount of teaching-time:

Group one: Short introduction to the concepts in the lab while the teacher uses the experimental setup as a teaching tool. Students can interact with the setup.

Group two: Short introduction while the teacher is showing a short video of the experiment. Held in ordinary classroom.

Group three: A theoretical lecture about the concepts in an ordinary classroom.

All three groups then received the same task: "Design an experiment where a charge droplet will move in a circle." This task was conducted in groups of two or three students.

All these lessons were recorded with video cameras.

The post-test was given within two weeks after the lessons.

We will discuss our first results and give suggestions for further studies to improve both the understanding of the teaching situation and the knowledge gained by the students.

Apply to be considered for a student award (Yes / No)?

NO

Level for award (Hons, MSc, PhD, N/A)?

N/A

Primary author: Mr JOHANSSON, Andreas (University of Gothenburg)

Co-authors: Prof. HANSTORP, Dag (University of Gothenburg); Dr BURSJÖÖ, Ingela (University of Gothenburg); Dr ENGER, Jonas (University of Gothenburg)

Presenter: Mr JOHANSSON, Andreas (University of Gothenburg)

Session Classification: Parallel Session 1

Track Classification: Track D - Teaching and Learning of Physics Concepts