2014 年臺灣國際科學展覽會
優勝作品專輯

作品編號　**160036**

參展科別　**物理與天文學**

作品名稱　**The Levitating Ball**

得獎獎項　**二等獎**

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Abstract

This project was inspired by a tournament call the International Young Physicist' Tournament (IYPT). The problem could be broken into two aims: 'Investigate the forces that cause a ball to levitate in a titled airstream' and 'optimize the system for the maximum angle of tilt that results in a supported ball'.

The first stage of the investigation was research and learning. Two fluid mechanics courses online were used to build a basic of knowledge of the subject. Next a force diagram was created to model the forces acting on the ball. The diagram identified a force called the lift force that must be acting on the ball to be supported. There were three contending theories that could explain the lift force: The Bernoulli theory, the Coanda theory and the Magnus theory. A practical investigation was then instigated to differentiate between these three theories. Since the Magnus theory is only applicable if the ball is spinning in the airstream, this theory was isolated by changing the center of mass of the ball but keep everything else constant (this allowed control of how much the ball spun in the airstream). Changing the center of mass didn't impact on the maximum angle of tilt at all, proving that the spinning of the ball isn't producing a significant amount of lift, and therefore the Magnus theory couldn't be a cause for lift. Because further testing couldn't isolate the Coanda and Bernoulli theories, a solution was developed to explain why the two remaining theories might co-exist. Further testing methods have been designed to investigate this possibility in more depth.

To meet the second aim of this project, an investigation was launched to see how parameters affected the maximum angle that the ball could be supported at. The parameters investigated were: Ball radius, ball mass, ball surface, air speed and airstream diameter. A lot of time was spent creating a reliable experimental method. The

method could be used to support a ball in an air stream, slowly tilt the air stream, and then measure the angle of tilt the moment that the ball fell out. After experimentation, a table was created to describe how the listed parameters affect the maximum angle of tilt that a ball can be supported at. Explanations were proposed for why each parameter affected this angle. Future experiments have been devised to build a deeper understanding of the effects of a wider range of parameters.

評語

This project studies the mechanism through which to levitate a ball with a tilted air stream.

The experiment is well controlled, with some innovation to clarify certain physical process.

This is a good work.