CALIFORNIA STATE SCIENCE FAIR
2015 PROJECT SUMMARY

Name(s)

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Project Number

S0908

Project Title

Investigating Futuristic Ways of Frictionless Transportation: Is Quantum Levitation a Solution?

Abstract

Objectives/Goals

Even a few decades, the possibility of frictionless vehicles seemed impossible, but today the new invention of floating maglev trains is more common all around the world. By constructing a symmetrical car model out of styrofoam, and supercooling it with liquid nitrogen (LN2), we predicted that the object will undergo levitation and suspension for 2 minutes, and will be able to carry approximately 15-20 grams, while traveling a total of 16 meters. In addition, our levitator will be able to be suspend for 1.5 minutes. In order to test our hypothesis, we created a neodymium magnet track and a small automobile model to float on a small superconductor cooled with liquid nitrogen and to record different variables: speed, carrying weight capacity, distance traveled, etc.

Methods/Materials

Neodymium (NdFeB) block magnets (150) attached to a stainless steel strip - creating a neodymium track. Levitator (YBCO superconductor with thermal insulation) is supercooled/soaked in liquid nitrogen with help of a Dewar, thermal gloves, ladle, plastic tweezers, and metal tongs. For additional experimentation we used a timer, sphere weights, a camera, styrofoam containers, and base structure we designed to demonstrate suspension and quantum locking of the levitator.

Results

By conducting four different experiments, we were able to prove our hypothesis and test the various factors of the levitator, such as its weight carrying capacity, speed, traveling distance per certain amount of time, ability to experience suspension, and the levitation time length.The superconductor was able to levitate for a highest average of 2:08.2 after being soaked in LN2 for 10 seconds. For second experiment, although the superconductor levitator was suspended for only 1:57.8, it was able to carry an average of 31.17 grams. During suspension, the time levitation averaged out to 1:17.91. On the horizontal track, the levitator traveled an average of 1545.2 cm/min. Using proportions, we conducted that a superconductor average-sized car can travel 156.96 km/hour.

Conclusions/Discussion

While experiencing frictionless levitation, we explored the idea of creating a superconductor levitating vehicle. Thanks to it properties of zero electrical resistance and the expulsion of the magnetic field, the superconductor can be considered as the world's next efficient solution of incredibly fast frictionless transportation and reducing the emissions of CO(2).

Summary Statement

Experiencing frictionless motion in both levitation and suspension while levitating a superconductor levitator above maglev neodymium track and stainless steel base structure.

Help Received

Materials ordered from Amir Saraf (Physics from Tel Aviv University, Israel); liquid nitrogen from Air Gas Company; levitation/suspension base structure - created by Andrew Turchyn; supervision of Karen Reynosa during experimentation.