

Development of a “Turn-Key” Cloud Chamber in Collaboration with Non-Academic Science Enthusiasts

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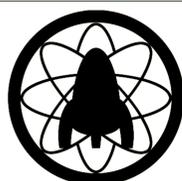


INTRODUCTION

Science Hack Day (<http://sciencehackday.com/>) is an event that brings together scientists and science enthusiasts for 24 hours to “hack” a science project. These events serve two purposes. The first is to provide a structured environment for science outreach. Academics and researchers have the opportunity for “boots-on-the-ground” interactions with the general public. The second purpose, is to enable science enthusiasts to donate their skills so that they are able to push back to educators and researchers in a fashion that benefits their work. The motivation behind this project was to educate attendees about radiation and particle physics, while also benefitting from the experience and knowledge of the attendees in constructing the device.

SCIENCE HACK DAY

Hack Day is a 48-hour event that brings together many different people in the same physical space to collaborate and create cool things. Science Hack Days are events that give scientists and science enthusiasts the opportunity to work together on



Ariel Waldmann, co-founder of Science Hack Day. Picture by Matt Biddulph.

different projects and allows them to contribute their strengths to the completion of the project. The whole event brings people who are interested in science together to do cool things with science. Science Hack Day was launched in 2010 and came to the California Academy of Sciences in San Francisco on September 28-29, 2013.

OTHER CITIZEN SCIENCE PROJECTS

Citizen Science Projects attempts to get the general population involved in real science. These projects make it possible to have science enthusiasts contribute in some way to real science or the creation of tools for outreach.



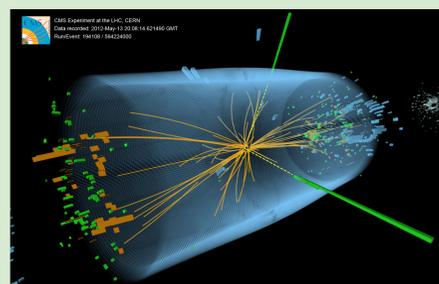
Galaxy Zoo is one of the bigger projects. It relies on science enthusiasts to help classify images of galaxies from the Hubble Space Telescope.

Foldit attempts to find the best structure for proteins, by taking advantage of humans’ ability to identify certain structures more efficiently than computers.

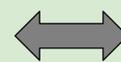


Eterna is another game in which players have to design a strand of RNA that folds in a particular way.

Can we use small, portable, cloud chambers to help explain and motivate large-scale experiments like CMS and the Large Hadron Collider?



<http://cms.web.cern.ch/news/observation-new-particle-mass-125-gev>



Picture by Meghan Harrington

CLOUD CHAMBER

We got the idea for a portable cloud chamber that uses Peltier coolers from Instructables (<http://www.instructables.com/>).

A Peltier cooler is a solid-state heat pump that pushes heat from one side of the cooler to the other. Dry ice is usually used to obtain the cold conditions needed for a cloud chamber, but dry ice needs to be purchased each time you want to “run” the device and it can get messy. This was a project that a colleague of ours was working on all summer and though he put a lot of time and effort into it, he could not get it working. We hoped that by bringing it into a collaborative environment like Science Hack Day we would be able to make more progress.

TEC Cloud Chamber

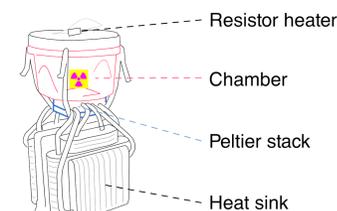
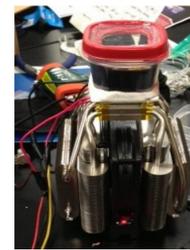


Diagram from Nathan Bergey, science enthusiast.



Picture by Matt Biddulph

We engaged science enthusiasts with a range of ages and experience to work with us and after 24 hours of intense hacking, we had a working version!



Picture by Meghan Harrington

EDUCATION AWARD

Awards were given out at the event for achievements such as “Best Use of Data” or “Best Hardware”. Our project won the “Education Award” at this year’s SF Science Hack Day.



Picture by Matt Biddulph

OUTREACH

One of the science enthusiasts that helped us build the working cloud chamber was a high school student. In less than 36 hours she learned about particle physics, solid-state physics, radiation and we even had time to teach her how to solder. Upon returning to Siena, we brought the device to Albany High School for a demonstration.



Picture by Matt Biddulph

It was the first time these students were able to *see* radiation - a topic they learn about frequently in their studies. The performance of the device was good enough that they could even see different particles emitted such as alpha and beta particles. We would like to continue to bring the cloud chamber around to other schools. There is only so much you can learn from a textbook and nothing beats being able to see what you are learning about!

Scan the QR code for a video of the cloud chamber in action at Science Hack Day.



FUTURE DIRECTIONS

At Siena, students will continue to improve the portability and performance of the cloud chamber. It will be used for education and outreach efforts in the local community.

We plan on continuing to take advantage of the unique environment that Science Hack Day provides to directly engage with post-K-12 science enthusiasts.

ACKNOWLEDGEMENTS

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Hack Day Pictures from: <http://www.flickr.com/photos/mbiddulph/sets/72157636103957716/>

Additional links:

Instructables instructions on Peltier cloud chamber: <http://goo.gl/I5CEwR>
Citizen Science Links: <http://www.galaxyzoo.org/> <http://eterna.cmu.edu/web/>
<https://fold.it/portal/>