Citizen Science

a tool for scientific research and public engagement

Giuseppe Cimo’
ASTERICS Project Scientist

JIVE
Joint Institute for VLBI
ERIC

ASTRON

Astronomy ESFRI & Research Infrastructure Cluster

24 partner institutions in astronomy, astrophysics and astroparticle physics

Scope of ASTERICS:

To help solve the **Big Data** challenges of European astronomy

To provide direct interactive access to the best European astronomy data in an international framework

ESFRIs interoperating as an integrated multi-λ, multi-messenger facility

To improve access to data and tools enabling new and interdisciplinary research leading to new insights and innovation for the society at large

Open Science – Science 2.0

Wide access to scientific research, data and dissemination

Open data – open research – open access

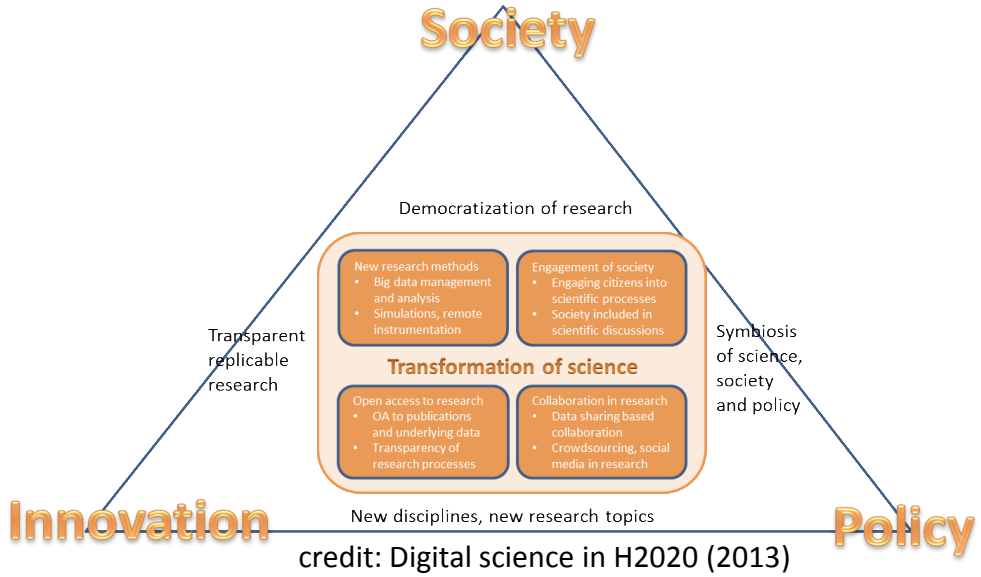
Goal: To open ESFRI facilities to wider stakeholders through citizen science

Audiences: Scientific and technical communities, academia, private industry, other public research centres, SMEs, policy makers and the general public

Means:

- Training in data science tools and training for creating Massive Participation Experiments
- Creating tools and educational guides for citizen interaction with data
- Coordinating citizen science experiments to open ESFRIs to public

CITIZEN SCIENCE IS NOT OUTREACH



credit: Digital science in H2020 (2013)

The case for Crowdsourcing

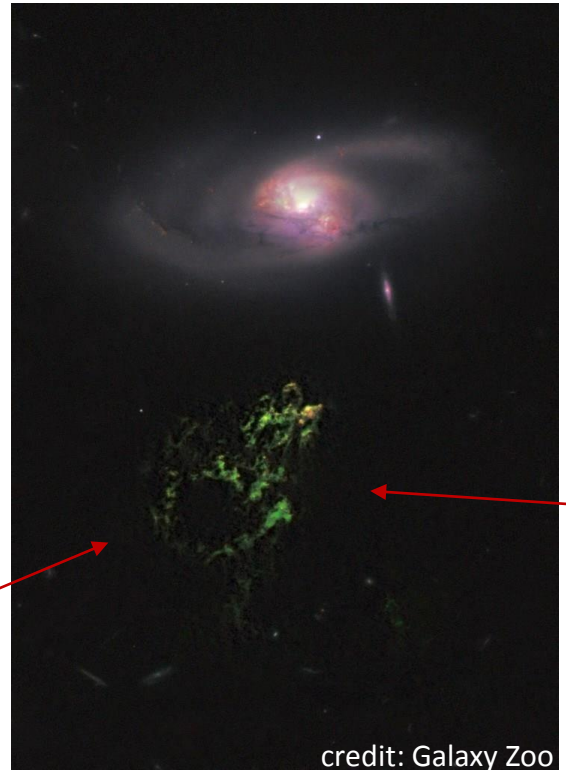
The scale of the problem
what do we do with 50TB a day?

Measurable accuracy
wisdom of the crowd

Machine learning
creating partnership between human and machine

Education – engaging the public in research
People are doing science, not just learning about it

Serendipity
finding the "unknown unknowns"


credit: Galaxy Zoo

Motivations for Citizen Scientists

How much am I learning?
How easy is it?
How beautiful is it?
How important is it?
How famous could I get?
Hanny's Voorwerp

Even small exposure to science education dramatically changes a person's lifelong civic scientific literacy, impacting on the society at large

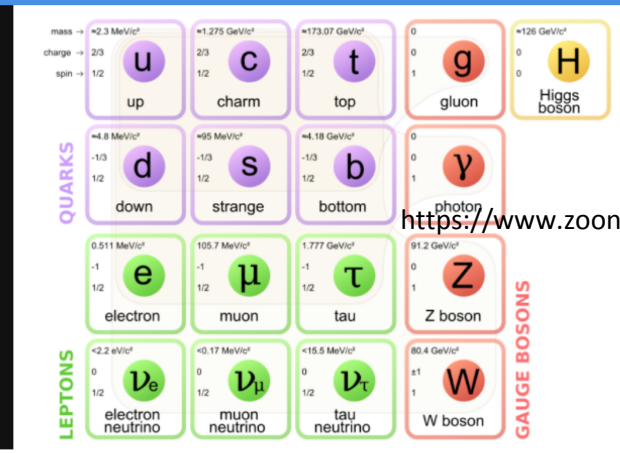
Do you want to find out more?

We hope you're enjoying working on Muon H
occasionally during your classifications to giv

If an occasional pop up does not interest you
course.

Enjoy...

Do not show mini-course in the future



https://www.zooniverse.org/projects/zooniverse/muon-hunter

The 'standard model' of particle physics. The electron and muon can be found in green boxes halfway down the diagram.

So what is a muon?

A muon is a type of subatomic particle, which is very similar to an electron – for instance, they both have the same negative electric charge. The main difference between a muon and an electron is their mass. A muon is 207 times more massive than an electron! For comparison, you might have known that the mass of a proton (the nucleus of a hydrogen atom), is about 1,800 times that of an electron. However, unlike the proton, which has substructure and is composed of other particles, the muon is a fundamental particle in its own right.

If you think the existence of the muon is strange, you're in good company. The world-famous physicist I. I. Rabi, when first told of the discovery of the muon, said in response, "Who ordered that?" There's good reason why the muon is such an unfamiliar particle: muons are radioactive; they decay with a mean lifetime of 2.2 microseconds. That's 2.2×10^{-6} seconds, or 2.2 millionths of a second. Muons don't stick around long enough to become part of the matter we encounter day to day.

However, there are lots and lots of muons all around us, created in interactions we don't usually think of...

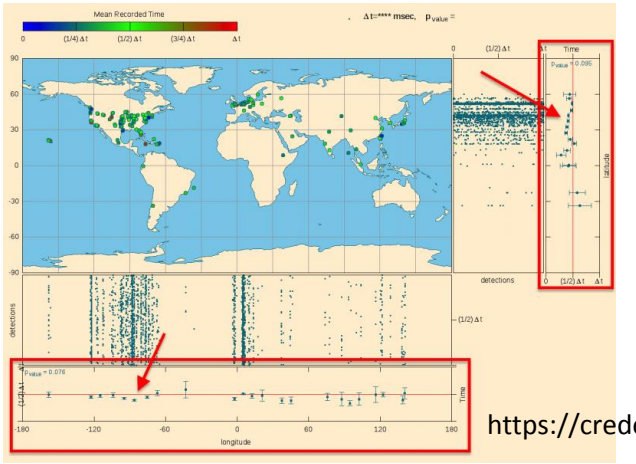
Developing new Massive Participation experiments

Euclid Strong Gravitational Lenses

- Lead: Andrew Davies
- Science objective: find strong gravitational lens events in simulated data
- Activity: “Tinder”-like swiping left and right to accept or reject candidate gravitational lenses

CREDO Dark Universe Welcome

- Lead: Piotr Homola
- Science objective: detect ultra-high-energy charged particles with a whole-Earth Cherenkov detector
- Activity: use mobile phones as charged particle detectors



https://credo.science

Zooniverse is not limited to astronomy
It is a multi-disciplinary platform

Citizen Science and Education

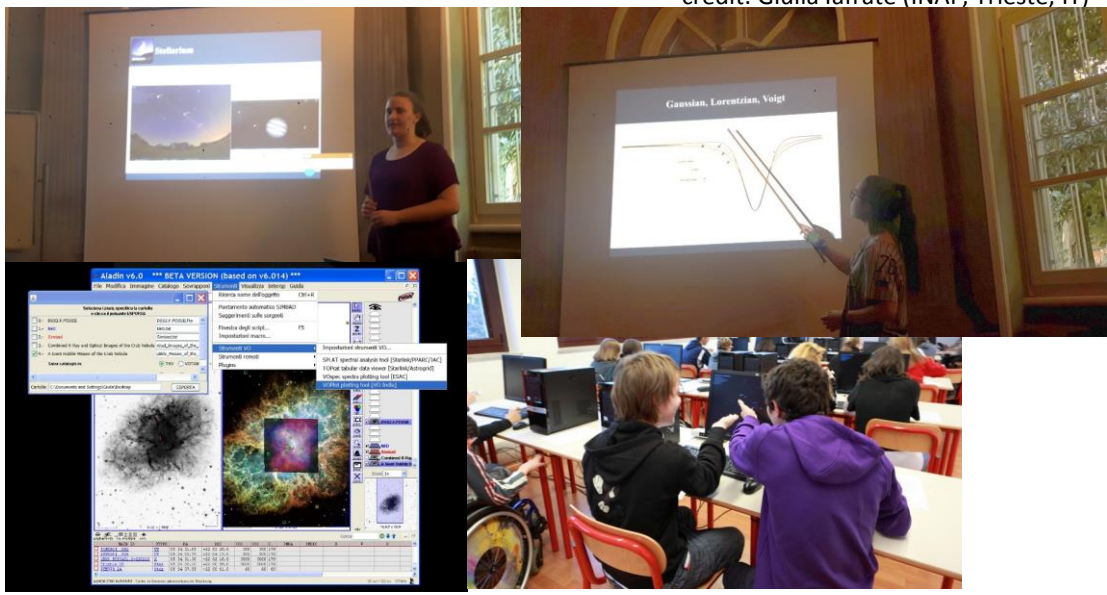
- Alternative to traditional science education
  Bringing science to students and get them engaged
  Creating an environment in the classroom that encourages students participation in science

- Beneficial to both parties, students and scientists
  Combining education, outreach and citizen science

- Make them realize they could become scientists
  students learn analyzing data and interpreting their own observations

- Give students a glimpse of the professional world of scientists, including a perception of the infrastructure

credit: Giulia Iafrate (INAF, Trieste, IT)



Each school-year in Trieste
- about 500-600 students (ages 13-18)
- selected lectures on basic astronomy
- Virtual Observatory tools and measures in astronomy
- Muon hunting!

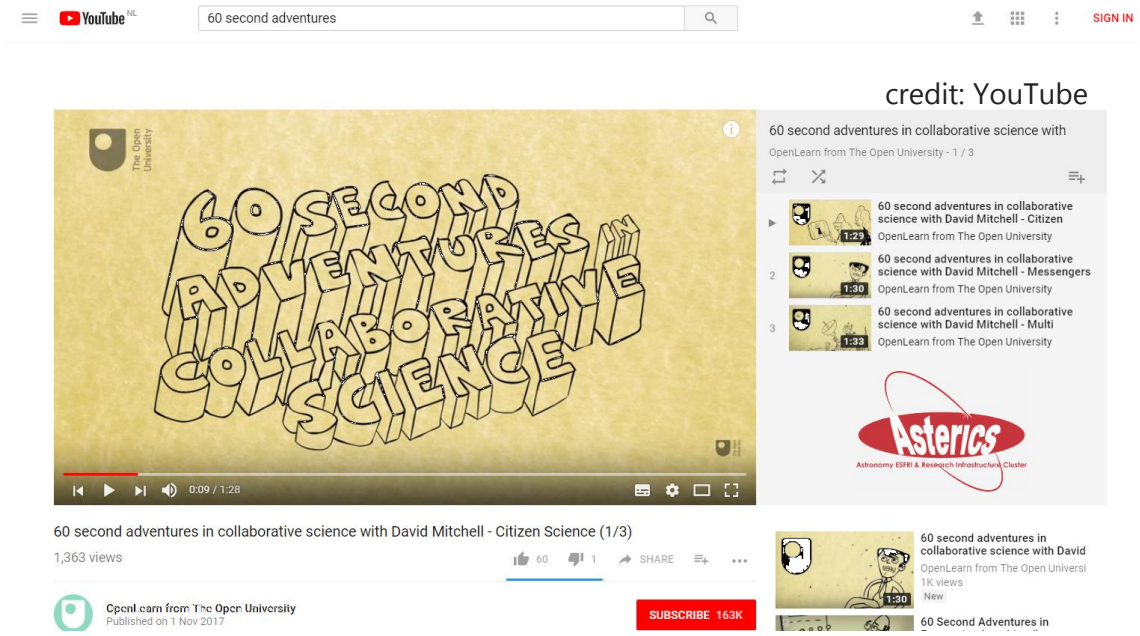
Citizen Science and Research Infrastructures

Citizens become scientific tools that help research infrastructures to deal with challenges (i.e. Big Data)

Identification Open Science and open tools to engage the public in creating cross-disciplinary experiments

Development of new tools and technique to answer to the “unknown unknowns” discovered by citizens

Use of the infrastructure data by mean of Massive Participation experiments



credit: YouTube

Public engagement, outreach and dissemination of results as byproducts

60 second adventures with David Mitchell