

'Space Warps' and other citizen science projects reap major dividends for astrophysics

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Thanks to the Internet, amateur volunteers known as "citizen scientists" can readily donate their time and effort to science—in fields ranging from medicine to zoology to astrophysics. The astrophysics project Space Warps offers a compelling example of why citizen science has become such a popular tool and how valuable it can be.

Late last year, in a pair of research papers, Space Warps announced the discovery of 29 new gravitational lenses. These arced or blobby features, seen in images of deep space, are actually distant galaxies whose light has been bent by the mass of foreground galaxies. Scientists prize these rare, cosmic phenomena because they offer tantalizing glimpses of objects too distant and dim to be otherwise seen.

This haul of lenses was obtained over an 8-month period by about 37,000 Space Warps volunteers who reviewed 430,000 digital images in a massive, online photo library. Automated computer programs have identified most of the approximately 500 gravitational lenses discovered to date. However, computers failed to flag the 29 lenses the Space Warps volunteers spotted.

"Human beings are very good at pattern recognition. The dynamic range that our eyes and our brains offer is much greater than a computer algorithm," said Anupreet More, a project researcher at the Kavli Institute for the Physics and Mathematics of the Universe (Kavli IPMU)

at the University of Tokyo and a co-principal investigator for Space Warps. More was one of the three astrophysicists who participated in a roundtable discussion, hosted by The Kavli Foundation, about the growing role that citizen scientists are playing in astrophysics.

More and her colleagues designed Space Warps to take advantage of these human abilities. So far, besides the 29 new gravitational lens candidates, Space Warpers have also turned up a never-before-seen lensing scenario that looks like a red ring in the project's image archive. Researchers are still working out the source of this red ring, which they suspect is the warped features of a background galaxy containing a [supermassive black hole](#) as well as regions of new star formation.

Discovering such strange, new phenomena is a hallmark of citizen science. Among the most famous examples is Hanny's Voorwerp, a galaxy-size gas cloud discovered in 2007 in a project called Galaxy Zoo, one of the earliest astronomy projects.

"Citizen scientists... have really enabled us to produce important findings. They've inspired us with their dedication and productivity," said Aprajita Verma, a senior researcher in the department of physics at the University of Oxford and also a co-principal investigator for Space Warps. "We've learned from our analysis that basically anyone who joins Space Warps has an impact on the results."

As astronomical datasets continue to increase in size, there will be no shortage of opportunities for eager citizen scientists. For instance, the Large Synoptic Survey Telescope, opening in 2022, will collect 30 terabytes of data nightly as it observes the whole sky every few days from the vantage of the Southern Hemisphere. Computerized object-recognition programs will certainly play an important role in analyzing these data, but human volunteers are likely to remain integral.

"I think there will be citizen involvement for a long while and it will become more interesting as we use machines to do more of the routine work and filter the data," said Chris Lintott, a professor of astrophysics and the citizen science lead at the University of Oxford. "The tasks for citizen scientists will involve more varied things—more of the unusual, Hanny's Voorwerp-type of discoveries."

Lintott, who is also a co-founder of Galaxy Zoo and the principal investigator for the Zooniverse [citizen science](#) web portal, added: "Plus, a lot of unusual discoveries will need to be followed up, and I'd like to see [citizen scientists](#) get further into the process of analysis. Without them, I think we're going to end up with a pile of interesting objects which professional scientists just don't have time to deal with."

More information: Read the full conversation with astrophysicists Anupreeta More, Aprajita Verma and Chris Lintott on The Kavli Foundation website: [www.kavlifoundation.org/scienc ... re-driving-discovery](http://www.kavlifoundation.org/scienc...re-driving-discovery)

Provided by The Kavli Foundation

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