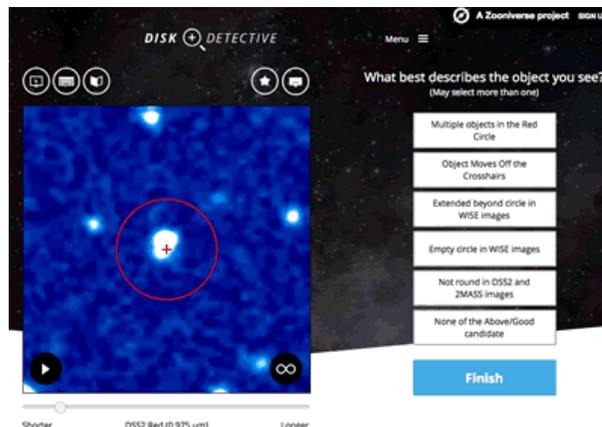


Disk Detective: Crowdsourcing New Planets

Case Study Overview

Planets form from vast, swirling disks of gas, dust and rock. We can find out where planets are forming by searching for stars surrounded by these swirling disks; we can also discover newly formed planets by finding other disks containing the leftovers of planet formation, such as asteroids. At [Disk Detective](#), participants help identify stars with disks. Sponsored by the National Aeronautics and Space Administration, *Disk Detective* is part of the Zooniverse community of citizen science projects.



Project Description

Participants examine data from NASA's Wide-field Infrared Survey Explorer and other surveys. WISE surveyed the entire sky in four infrared bands, imaging 747 million sources. There are a few thousand new disks to find among those 747 million sources.



Looking through all that data is tricky, because computer algorithms often confuse the disks with other astronomical objects, such as galaxies and interstellar dust. So NASA decided to harness the image-processing power of the human eye by creating the Disk Detective project. The goal of this project is to find new disks.

Participants examine animated images of the same source at 10 different wavelengths and click on-screen buttons to sort these sources into categories. Advanced users participate in a variety of side projects, such as researching targets for follow-up observation with ground-based telescopes and analyzing the data from these telescopes.

Challenges

NASA panels for reviewing funding for science research rejected initial proposals to fund the project. Before the project was funded, competitors made many interesting discoveries that NASA citizen scientists could have made with the same data.

When funding became available, the NASA Goddard Space Flight Center had no programmers who knew the required Web development and database languages (such as Java and Ruby). This forced project leader Marc Kuchner to outsource the site development.

Then, before the Disk Detective website could be launched, large amounts of data needed to be downloaded and processed, and NASA data servers could not handle the load. Also, the assigned NASA science writer was tapped for other projects, making it a challenge to coordinate the website launch with a NASA press release.

Long after the launch, colleagues in the international astronomy community continued to express misconceptions about the project. Some regarded it as an education or outreach project that could unfairly take research dollars away from professional scientists.



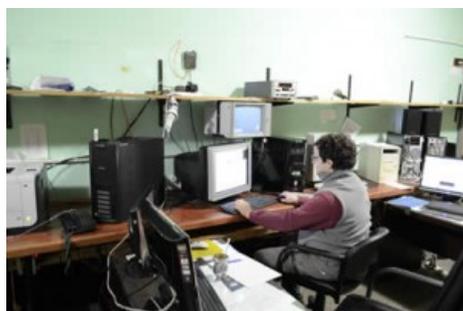
Benefits and Outcomes

About 30,000 participants are working to identify stars that have disks, helping scientists understand how the solar system formed and where to find extrasolar planets. By the end of the project's first year, this work had already yielded hundreds of interesting disk candidates that the science team is re-observing with telescopes in Chile, Argentina, California, Arizona, Hawaii and New Mexico.

In particular, Disk Detective is adept at finding unique disks that are roughly twice the mass of the sun; young stars that are not part of known stellar clusters or associations; and disks around older, evolved stars such as white dwarfs. The disks and planetary systems found by Disk Detective will likely be targets for NASA's upcoming James Webb Space Telescope mission. Disk Detective is currently on schedule to be complete when the space telescope launches in 2018.

Tips

The Disk Detective case study illustrates the following steps in the Federal Citizen Science and Crowdsourcing Toolkit:



- **Design a Project — Plan Project Management**

It takes a great deal of scientist time to work with 30,000 participants. At first, the project greatly underestimated the amount of time required. The Disk Detective project chose to award a grant to the Citizen Science Alliance to include the project on the group's Zooniverse Web portal, which hosts a

range of citizen science projects. Zooniverse projects have a social network called “TALK” that allows citizen scientists to communicate with each other, which is wonderful; but it can also allow users to spread misinformation. So the Zooniverse team encouraged project coordinators at NASA to stay active on TALK for 24 hours a day for the first week after launch to correct any misconceptions and educate the citizen scientists. Now, after a year and a half, communicating with participants still takes roughly one day per week of a scientist’s time writing blog posts, composing tweets and newsletters, and answering emails. It is extremely rewarding but also time consuming. Citizen science project managers should work to receive the proper authorizations and approvals within their agencies for the anticipated level of employee resources required.

- **Build a Community — Engage Your Community**

Working with Zooniverse lets NASA take advantage of Zooniverse’s email list, with over 1 million members. This email list has proven the single most effective tool for marketing the Disk Detective project. The effectiveness of this email list suggests that the people who have previously participated in a citizen science project are most likely to try a new one. Working with Zooniverse has also taught NASA that another important way to market citizen science projects is through celebrity endorsements. Television star Brian Cox typically selects one Zooniverse citizen science project each year to highlight on his Stargazing Live show on BBC television, and that project typically receives an overwhelming participation rate. Disk Detective has not yet received any comparable endorsements but is seeking them.

- **Sustain and Improve — Adapt to Cycles of Participation**

Although Disk Detective has about 30,000 participants, about half of the online work has been done by a group of about 30 particularly enthusiastic “superusers.” The project really took off when the organizers got to know this group. Now the project has a superuser email list, with traffic of a few emails per day, and superusers participate in weekly NASA science team telecons through Google+ hangouts. Many of the superusers have science degrees, and all of them were interested in additional side projects. The superusers have translated the site into 11 different languages; made their own video tutorials for Disk Detective; helped research targets for observing runs; and driven for many hours to participate in observing runs. For example, the photos above show participant Hugo Dutantini Luca observing Disk Detective targets at the CASLEO telescope in Argentina. Citizen science project managers should know and abide by all legal requirements regarding the use of participants.

Learn More

- Website: [Disk Detective](#)

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