Science AMA Series: We are a group pf researchers that uses the MMO game Eve Online to identify Exoplanets in telescope data, we're Project Discovery: Exoplanets, Ask us Anything!

PD-Exoplanets [1] and r/Science AMAs[1]

[1]Affiliation not available

April 17, 2023

Abstract

We are the team behind Project Discovery - Exoplanets, a joint effort of Wolf Prize Winner Michel Mayor's team at University of Geneva, CCP Games, Massively Multiplayer Online Science (MMOS), and the University of Reykjavik. We successfully integrated a huge set of light data gathered from the CoRoT telescope into the massively multiplayer game EVE Online in order to allow players to help identify possible exoplanets through consensus. EVE players have made over 38.3 million classifications of light data which are being sent back to University of Geneva to be further verified, making the project remains one of the largest and most participated in citizen science efforts, peaking at over 88,000 per hour. This is the second version of Project Discovery, the first of which was a collaboration of the Human Protein Atlas to classify human proteins for scientific research. Joining today are Wayne Gould, Astronomer with a Master's degree in Physics and Astrophysics who has been working at the Geneva Observatory since January and is responsible to prepare and upload all data used in the project Attila Szantner, Founder and CEO of Massively Multiplayer Online Science (http://mmos.ch/) Who founded the company in order to connect scientific research and video games as a seamless gaming experience. Hjalti Leifsson, Software Engineer from CCP Games, part of the team who is involved in integrating the data into EVE Online We'd love to answer questions about our respective areas of expertise, the search for exoplanets, citizen science (leveraging human brain power to tackle data where software falls short), developing a citizen science platform within a video game, how to pick science tasks for citizen science, and more. More information on Project Discovery: Exoplanets https://www.ccpgames.com/news/2017/eve-online-joins-search-for-real-exoplanets-with-project-discovery Video explanation of Project Discovery in EVE: https://www.youtube.com/watch?v=12p-VhlFAG8 EDIT—WRAPPED UP Thanks to all of you for your questions, it has been a great experience hearing from the players side. Once again a big thanks to all of you who have participated in the project and made the effort of preparing all this data worth it. ˜Wayne Thank you all for the interesting questions. It was my first Reddit AMA - was pretty intensive, and I loved it. And thanks for the amazing contributions in Project Discovery. ˜Attila Thanks to the r/science mods and everyone who asked questions and has contributed to Project Discovery with classifications! We're happy we can do this sort of thing FOR SCIENCE ˜Hjalti and the CCP team.

the WINNOWER

REDDIT

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PD-EXOPLANETS R/SCIENCE

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More information on Project Discovery: Exoplanets https://www.ccpgames.com/news/2017/eve-online-joins-search-for-real-exoplanets-with-project-discovery
Video explanation of Project Discovery in EVE: https://www.youtube.com/watch?v=12p-VhlFAG8
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CORRESPONDENCE:

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As an Eve player, I know that many people are "game theorying" Project Discovery and jokingly call it "No Transits Online". How do you sift through inaccurate reporting to get real data?

*Edit: jokingly, not joking

Tanto63

Yes, actually this happened with the Human Atlas Project as well - the infamous Cytoplasm Scam.

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With Project Discovery Exoplanets we have a much harder job. Since the large majority of the lightcurves contain no transits, probably the ones trying to game the system are right - there is a high chance that one player will not see an exoplanet.

Of course we have a system where we benchmark player performance with a gold standard dataset, so if somebody just blindly selects No transit, their score will drop quickly and will not pollute the database. The data is at University of Geneva for deeper analysis and once we find the typical mistakes, we can further improve both the gold standard dataset, both the UI/tutorial part.

And we hope that for the good of science the majority of players will do their best to actually find exoplanets which will counteract those who try to game the system. ~Attila

As an Eve player, have our efforts been useful to you?

How do you filter out the "good" analysts from the folks just mashing buttons to get rewards?

What other games have you been thinking about adding MMOS to?

Tangurena

So on MMOS side we are trying to talk to the whole gaming industry and there are very good responses. Also having this success in EVE Online helps a lot to convince other companies to hop on board. The only game project that I can talk about is our cooperation with Gearbox: https://twitter.com/the_MMOS/status/710984806025142272 ~Attila

Your efforts have been very useful to us. We have been overwhelmed at Geneva Observatory by the number of classifications the players have already submitted. We were not expecting these kinds of numbers. Whilst it is too early to say definitively, we are already looking at the results and expect to have many candidates to look at in the future. Hopefully this will lead to many planets being found. ~Wayne

As an eve player, have you ever tried the game?

Also, thank you for bringing it to eve. It's another aspect that just makes this game a bit more unique.

john_dune

Thank you. These kind of feedbacks are very inspiring for us to keep on working on Project Discovery and MMOS. Actually before we started this project I tried EVE once, many years ago, but left quickly - didn't have time for it. Then when we started to work on Project Discovery I had to understand EVE, so for roughly half a year part of my job was to play with EVE. Which was a lot of fun of course. But I still can't call myself a hardcore EVE player. ~Attila

I have played once briefly in my youth but came back to the game when I joined the project. It has been a lot of fun to work on something with such a large community and to be able to see the interactions as people participate in the project and look forward to continue as a player in the future.

I'm glad you are enjoying the addition of the Project Discovery game. We are really excited at the Geneva Observatory by the hugely positive reactions from the EVE community to the project. We have had ongoing discussions about the possibilities this has for the future and how we can continue to engage with such an enthusiastic audience. ~Wayne

This is pretty cool! The computer science guy in me gotta ask, though: Why do you need human

beings to analyze the data, though? According to the video explanation, it's dips in luminosity over a graph of a 28 day time frame. That seems easy enough to detect via an algorithm.

nothis

Human beings are amazing at pattern recognition, thanks to evolution. Which means we are better suited to notice a luminosity dip that is erratic and not always symmetrical, but still periodic. This can happen because the gravitational interactions of multiple planets can create non-periodic transits in the light curve as the orbits are perturbed. Whilst these wobbles in the periodicity are so small that the transits of one planet are still within the transit width of each other, the algorithms are unable to detect them. ~Hjalti

So, how does the data get into the game, how is that data represented and how do players interact with that in a useful fashion?

Sorry if the answers are in the videos, I'm at work! :(

mykkenny

In Geneva we prepare the data from the CoRoT observations into a useful format for EVE players. We then send this to Attila's team at MMOS who puts the data into the specially prepared interface that you use in game. When this has all been done it is put on the server by Hjalti's team at CCP for you to use.

To be useful in interacting mark the light curves honestly as instructed in the tutorial. As more players mark transits a consensus will build up and we will know which light curves to look at. It's as simple as that. ~Wayne

As an EVE player myself, I know we are a devious bunch...

Silly question first. We're a shrewd bunch, and (in-game) a ruthless bunch too. Are you worried that you might get scammed out of accolades or research grants, or worse ganked by someone that wants your glory for themselves?

Serious question second. If there were an Earthlike planet 50-60 light years away that orbited a Sun-like star with a thriving ecosystem but no technological civilizations, similar to Earth a million years ago, what technological innovations or breakthroughs would be required for us to unambiguously detect them?

sirgog

No we aren't worried about being scammed, the data comes back to us to work on and perform the necessary follow ups. Unless you have a telescope capable of observing the targets yourself (you may need a fair few millions of euros at least, for one good enough) we will perform the follow ups from any results you give us that look promising.

To your second question I ask what is your time frame? Voyager is flying out further and further each day so whilst it may take a long time it can reach someone. There is even a gold plated vinyl attached to her with messages from Earth. So as long as any aliens have a gramophone available they can hear us.

There are many exciting projects already going on now. One project proposed I recently read about was to send a small camera weighing a few grams to alpha Centauri by attaching a 'sail' and using high powered lasers to accelerate it to 1/4 the speed of light.

Even radio waves are sufficient though. A civilisation capable of detecting radio waves could identify the complex patterns we have sent out as part of everyday communication and realise these are not noise from natural objects in space.

So less advanced than we currently are would be fine. ~Wayne

Have you found any promising exoplanets yet?

Expand_your_dong

Unfortunately no, it is too early to tell. We have begun the process of looking at all the classifications you have sent us and will work hard to get these results. Sadly the life of an astronomer is rarely a fast one when it comes to confirming planets. Whilst you may have found the planet in a few seconds of looking at light curve it takes time to perform follow up observations and confirm them. We will endeavour to keep the community informed when we begin getting results. So be patient and we hope to bring you great news. Especially if you were one of the players who spotted it. ~Wayne

As EVE Online player I appreciate your project. I wonder why you chose a gaming platform over a vastly more popular platform like Facebook or even Reddit. Are gamers more interested in "space" or just self-selected nerdy enough to enjoy a rather complicated and math-based puzzle?

splatus

Very interesting point. So when we first came up with the concept we had videogames in our mind to partner with. I think there the acceptance of the grinding aspect, doing something repetitive and enjoying it, because amazing game designers know how to make the experience engaging and entertaining was key. And of course the sheer numbers. But since then, we realized that we can apply this same approach in many different ways. Basically what we are doing is approaching already existing communities and somehow smuggling some kind of real life activity in their online life. Actually since then we started ayaru.ch together with the University of Geneva, which is the application of the same principles in higher education, in MOOCs. (First MOOC on exoplanets will be out soon :) ~Attila

I know a very large issue with the Project Discovery is that the players will attempt to get through the process as quickly as possible to maximize profits. I assume a lot of good data is lost or corrupted because of this. I read that there are some checks that are run on the players to sort out this behavior, but it most definitely doesn't get it all. What are the steps you take after the process of the game to weed out inconsistencies or people who rush through the process?

gthomas4

Check out our answer here to a similar question.

Hi and thanks for joining us today!

I'm fascinated by the potential for MMO games to simulate disease spread within a population.

The Corrupted Blood incident though a glitch certainly enticed many epidemiologists to look at the potential for gaming for model development. And with indie games like Ancient Cities being developed I also believe the potential to further scientific knowledge and be entertained is there.

My question, I suppose, is how can we further develop exciting features like this in games?

PHealthy

I do believe too that games in general can help to solve real life issues - be it solving scientific puzzles, social issues or education. I love http://www.ndemiccreations.com/en/22-plague-inc when by trying to wipe out the whole population of the Earth, you actually learn a lot about virus or bacteria. I loved it also, when I saw a copy of La Historia at a newsstand in Paris about the Victorian Age with all images coming from Assassins's Creed. So yes, I think there are many clever ways to use games to address serious issues in a way that doesn't ruin our gaming experience in any ways, but rather adds to it. ~Attila

Hey guys,

Not really about the Project, sorry, but I want to ask you a question about becoming an astronomer. I am 16 years old and from South East Melbourne, Australia, and have always wanted to become an astronomer, I have loved space my entire life. Do you have any advice for me? What's the best pathway I can follow to become an astronomy researcher?

Rndomguytf

In this instance I think we can forgive the off topic nature. I in fact work with a few people from ANU (Australian National University) in the field of Exoplanets. Melbourne natives included.

At 16 you will be looking at what route to take into Higher Education. Make sure you study Science (Physics of course) and Mathematics and pursue an Astrophysics degree to a Masters level at University. Most importantly though is your research experience. Look for a university that offers plenty of opportunities to engage in research. Your whole degree is important but the research projects, especially your Masters is crucial to take you to the next level of pursuing a PhD and beginning your academic career as an astronomer.

If you know what area of space science you want to go into (Stars, Galaxies, Planets, Nebulae, etc) look for researchers at potential universities who are working in your areas of interest and try to do research with them.

Don’t be afraid to engage and communicate with them either. Even now. If your passionate about your interests they will engage with you, if they don’t then they won’t make great supervisors anyways. Through your entire career communication and collaboration will be important.

There are possible downsides depending on your attitude. You will have to be open to moving in your early career and nights on telescopes can be long and uneventful. In my opinion they aren’t though.

Ultimately, work hard and engage with as much as possible in your fields of interest.

I wish you the very best of luck. Perhaps we will meet someday in the future at a telescope in the middle of nowhere (as all the best ones are usually located). ~Wayne

As a non-EVE player, this is incredibly fascinating and interesting. Is there a way for me to help in a similar fashion, outside of Eve?

c0d3M0nk3y

There are many citizen science projects on the web that you can participate in. Check https://www.zooniverse.org/ or https://eyewire.org/explore as great examples. Those are not connected to EVE Online of course. ~Attila

Wait Eve uses real planetary data?

SaidTheHypocrite

Yes, all the data you use in Project Discovery is real data taken by astronomers. Your participation will help us look for real planets. For the non-real-world planets in EVE's game universe, they tell me they were generated along with the rest of the universe using the number 42 as the randomizing seed. ~Wayne

Are there any particular factions that have higher participation than others?

trustanni

We haven't been tracking this at all actually. We probably COULD find this out given some database queries, but would rather operate under the assumption that all factions are equal in the eyes of science.

We're wary of doing faction leaderboards or things like that because it might encourage gaming the system too much. ~Hjalti

How does this differ from doing a FFT on the data points to look for frequency spikes? Are these mostly samples where the automated methods were inconclusive?

Have you given any thought to how you'll communicate the results back to the players? I've been involved in a few citizen science things in the past and usually there's almost no sense of connection between the user and the science that comes out the other end. Most people don't keep up to date on publications or even news inside certain science circles, but they still want to hear about what they helped discover even if they only played a small part. Like a quick rundown on the properties of each planet discovered delivered through the ingame news, for example.

BadRandolf

For the previous Project Discovery iteration, we have released blog posts along the way and are planning a follow up blog in a few months. Rest assured, we will make some noise if/when we find an exoplanet from this project. ~Hjalti

We have had several discussions at Geneva about how we will communicate with players when a planet is successfully found. We know which light curves you have looked at, so rest assured you will know if you helped find one. ~Wayne

I find this fascinating, but I find eve online a bit annoying - there's lots about the game that amazes me, perhaps particularly because when I grew up, a huge, floor-standing machine that could play Pacman was state-of-the-art - but I find the people often the problem.

Anyway, is there any way for me to help without getting involved with eve?

ButterflyAttack

There is no need for you to play the core EVE game itself. Simply logging on through a free account, going through a quick character creator and launching the Project Discovery game on the left task bar of the UI is all you need to do in EVE to participate. Assuming helping science is sufficient reward in

itself for you. Hint: it should be. ~Wayne

What about this data analysis makes it a good candidate for crowd sourcing rather than, say machine learning or statistical analysis?

dipique

In a way we are in a luxury situation because it wasn't us who invented citizen science itself and there are many citizen science projects out there, so we can easily check what problems are a good candidate for crowd sourcing. Also we talk a lot with the researchers when we set up a project and they have quite precise knowledge on how machine learning is performing on their data and whether they see a possibility that humans can increase quality.

Also it is worth to mention here that the analysis of the data is one outcome for researchers, but the science outreach is sometimes as important for them as the data analysis itself. In this aspect this approach is a unique opportunity to talk to large player communities about different research topics. And what better way there is to understand their research than to work on the data ourselves. ~Attila

What prerequisite was used for determining that you wanted to use eve rather than build your own or jump into another game like elite dangerous or star citizen?

vessel_for_the_soul

First of all EVE is a natural fit to this idea for may many reasons. And also it was an important thing that Andie Nordgren (aka. CCP Seagull) wanted to make this happen after we first talked. And where there is a will... At Gearbox, founder and president Randy Pitchford has the same very enthusisastic and supportive stance towards the project from the beginning. And in the meantime we are working hard to talk to other people in the gaming industry - in the last three years or so I am going to several gaming events and conferences, giving talks, networking etc., and now I can say that when I start to talk to someone at least they heard about the project, which is great and makes our work so much easier. The games you mentioned seem to be a good fit, but back that time they were working hard to publish their first version of the game, so it wouldn't have been the ideal moment. ~Attila

Can the Project Discovery be used for other things besides exoplanets? Were there other options/ideas y'all had or were exoplanets the only focus?

mantooth09

I think there are many possible research projects that would be a good fit for EVE. Of course some citizen science projects that would contradict the EVE lore would be a no go - I have a hard time imagining analyzing images from the Serengeti National Park, marking zebras while docked up in Jita. But taking this problem as an example: I can imagine those images appear in Zoo Tycoon. So it is more of a question to find the perfect match in each individual case. ~Attila

I sort of skimmed through the information of how EVE Online achieves this..., Extremely interesting!!!

Is the Corot Telescope out of commission? If so, how much data is there still available to analyze from the mission?

I wish Mass Effect 2 had a mini game like this where instead of scanning planets for endless hours,

you can sift through actual scientific data and then obtain your minerals! I would have felt a great sense of accomplishment.

patanwilson

The CoRoT space observatory mission ended in 2012. There are approximately 175,000 stars observed. A lot of initial work has been done to identify targets we easily can by computer. We believe there are more planets in all of this data though. To find these is where we need your help.

I'm a big Mass Effect fan so I would have loved something like that too. ~Wayne

Say a community consensus is reached on a transit period, then what? How is this data then used to confirm/disprove the potential existence of an exoplanet?

skyarth

When a consensus is reached we will look at the light curve more carefully. If it looks promising we will perform a more detailed follow up of the target itself with a telescope. We will try to confirm if it is in fact a planet and not from another source. ~Wayne

does pineapple go on pizza?

Sony22sony22

Nope. Raw ham and ruccola go on pizza. ~Attila

does pineapple go on pizza?

Sony22sony22

Absolutely frigging not. ~Hjalti

does pineapple go on pizza?

Sony22sony22

Yes. ~Wayne

Have you ever considered using Elite Dangerous to similar effects?

gamealias

Yes, this is absolutely on my list of games to talk to. ~Attila

Can I have a copy of your data?

PrinceParadox

Most of the data that we use in the project is open data. And the results that yield valuable scientific information will be part of open databases too (for example if EVE players find a new exoplanet) At this

moment we haven't thought of releasing the raw dataset as open data, but that might happen in the future. ~Attila

The data is freely available to download but I am afraid we can't give you the results from Project Discovery. You will have to sift through the 175,000 stars yourself. Best of luck, if you are successful you can submit a a proposal to ESO (deadlines next week). ~Wayne

Do you guys have a plan for sifting out a large number of quick click no transits that are being spammed for credit/isk? If not you might want to include analyst time in your metrics. I know the accuracy thing is there but I have been tempted to spam no transits after being screwed by a particularly bs testing image.

EVEOpalDragon

We have had some difficulty at the beginning with very difficult transits and we have removed almost all of these so that your scores aren't ruined, though that doesn't mean tricky ones aren't in there still, we don't want you to find it too easy.

When you click no transit we record that information too so this does cause a problem. However, the most important information is from those of you who take the time to mark transits on difficult light curves you aren't ranked on. It is the light curves that have strong consensus' for transits that we will be looking at closely. ~Wayne

How is it that when an exoplanet comes between their star and us we see a noticeable dip in brightness? When the last eclipse happened, in my location the sun was blocked by more than 50% but any dip in brightness wasn't noticeable to me. Someone said even in the path of totality it's still pretty bright up until 100%

Any thoughts?

Chance_Wylt

Good question, it's an issue of distance and size.

Relative to ourselves, the moon is about a quarter of our size and close to us compared to the sun. So when it comes between us it easily blocks out the light from where an observer is. In your case it wasn't perfectly aligned so you only got a fraction of the moon in your path.

A star (not the sun) is much further away and whilst the planets transiting are much larger than earth they are close to a sun that is much bigger in size to the planet and far away from us. So when a planet transits in front of it's parent star the drop in light is only a few percent.

The basic principles are the same but on very different scales. ~Wayne

Is the data is some way or another simplified or are the graphs we see the raw data collected from the telescopes? And what makes the eclipsing binary, pulsating star, eruptive variable and rotating star so important/outstanding that one can classify the slides as such?

Zokto

The data is as it has been taken by the telescope, if an astronomer were to look at the data live as it were recorded with telescope this is how it would appear. Unfortunately however, we do not have the wonderful graphics and user interface that has been developed for you in the game.

Whilst the classification of stellar activity is less important to the science goals of this project they are none the less very useful to us. Variability is a big source of interference in being able to detect transits, so the more we can classify stars the better. Similarly this information may be useful to us in the future as science goals are always evolving. ~Wayne

Can you play EVE just for this purpose and not have to worry about PVP?

Malak77

Yes, you can play EVE (for free) and as soon as you create your character you can certainly stay docked in station and only do Project Discovery if that's your thing. ~Hjalti

Have us players found any likely orbits that you had not found? If so how many?

homnom1

We have only just begun analyzing the data as we need results from players first, so we have no news just yet to report. We are extremely confident however that players will provide us at Geneva Observatory with plenty of targets to follow up. Thanks to everyone for all your work on the project. ~Wayne

Have you looked into Elite Dangerous?

MrSenseOfReason

It's on my list of games to talk to ~Attila

This seems like a simple problem to solve via data analysis algorithms. What are the benefits of project Eve vs traditional algorithmical or machine learning analysis?

kerloom

Hopefully this answers your question?

How viable do you think that this system will be in the future? Will scientists and gamers unite more? (pardon the romanticism)

Ayhon

There is a lot of overlap already. Nice story from EVE Vegas when we showcased Project Discovery 1 a guy came to give it a test ride and told us that he really likes the project and btw he is analyzing the same kind of images in the lab as his day-job.

As for the long term vision, I think these kind of features will be important in games and will yield nice and important results for science and will be an invaluable tool in science outreach as well. ~Attila

How do you ensure the sample size of results is statistically significant? From what I've seen very few players make it past the tutorial.

chanrahan1

We've had over 38.3 million classifications since the Exoplanets effort launched so I think we're on our way there ;) ~Hjalti

This might be a silly question, but let's say an exoplanet is found using project discovery that could harbor life. Is the fact that it was discovered by Project Discovery documented?

(now for the silly part) if this were to occur, how could we as the player base petition to have it be named "New Eden"?

ChrisTheGuy

I don't know what the internationally agreed rules are for naming a new world found to harbinger life but I'm sorry to say that this project won't tell us if life exists on a planet. That is still a very young field in the already young field of finding planets.

If someday we find the planet I am sure historians will look for all information and find that it was indeed the players of EVE Online who first helped find the planet. ~Wayne

Wouldn't an AI work way better at this?

SteadyDan99

Hopefully this answers your question.

Uh, practical question and sort of on the side of things: The data is just observed from one angle (ours) in the universe, so we're just lucky that some planet pass in our plane/viewing angle between us and the stars?

Or is this within this galaxy so we're all more or less in the galaxy plane due to the disc form?

snoozieboi

You are indeed correct. Transiting planets have to been in our plane of vision for us to be able to detect them. So many stars aren't viable but we don't know which ones. The initial stages of any detection of planets is to look at thousands of stars and try to find the characteristic dip in the light curve that you are searching for.

The targets are within our galaxy, even in our own the light drop is only a few percent on a good observation. Whilst the stars rotate around the galactic centre this doesn't mean that the planets orbit around the stars at the same angle. ~Wayne

While playing the project discovery game many players report a transit for a single data point that drops in luminosity slightly below average.

I'm to lazy to count, so what is the average time step for data points? Could complete a transit in that time frame if it were sufficiently close to the star? I feel like most stars would have consumed the planet by that point or broken it up by tidal forces.

Also, what kind of filtering has the data gone through? Have clearly erroneous datapoints been taken out or is this mostly raw data?

VooDooZulu

A single data point is unlikely to be a transit, it requires several data points. The time frame for a single data point is approximately 20 minutes.

A transit would not eat up the star, they are likely in stable orbits passing infant of the star from our point of view but far away enough. ~Wayne

How does the incentivization scheme prevent people from just flipping through lightcurves rapidly without bothering to even look for transits?

spacex_vehicles

We track players accuracy and it is affected by control samples. If the accuracy gets below a certain value, we stop giving them rewards until they get their accuracy back up. New players have a more volatile accuracy, so if a player starts immediately submitting bogus answers, we will know and they will tank their accuracy and get nothing. ~Hjalti

Is it conceivable that beyond the scope of this project, that the data set containing EVE user responses could form the basis of a machine learning approach by which computer analysis of the telescope's data could be improved? (I love that there's still things humans do better, though.)

jermleeds

Absolutely. I think machine learning and citizen science are complementing each other to create a hybrid computation engine so to say. Machine learning requires large and good quality training sets, and players can provide that.

Of course this doesn't mean that players don't have a chance to find an exoplanet in this case without machine learning. ~Attila

As an eve player, how can you sleep at night knowing the countless of hours of sleep you've made me miss because of "Just .... one... more.... slide!!!!!"?

ccheuer1

Sweet dreams! :) ~Attila

I spent a great deal of time classifying exoplanets as part of the zooniverse.org exoplanet explorers project. One of my classifications was later confirmed as exoplanet k2-111b but I haven't been able to find out whether my classification contributed to its discovery or whether it was already being investigated when I classified the light curve on Zooniverse.

My question is do you plan to notify users who contributed to the discovery of an exoplanet? It would certainly help encourage people to contribute if they knew they would be notified.

Thanks!

DeepStatic

We definitely are saving the IDs of users who contribute to each sample. So we totally can, and probably will, acknowledge them in the case of a discovery. Them being EVE players is beneficial in

this regard since there are a lot of things we can do in way of acknowledgement. ~Hjalti

I can't believe that I payed a game for fun and might have helped science. That is so cool.

PhreakerX

You're welcome and we are grateful for all your work (play?) in helping us. ~Wayne

Thank you! These kind of responses are really motivating for us. ~Attila

Since the galaxy appears to be symmetrical, there are ten thousand stars per every picture taken. And that pattern continues everywhere else. Do you think that that means that another planet Earth is on the opposite end of the galaxy from where we are located?

So, because we are 25k light-years from the center and close to one of the arms. Would it mean that the other planet, that harbors complex life like Humans, would be on the other end, 25k light years from the center? So, they would be 50k light years from us?

Is that possible? Or do you believe complex life is closer to us than that?

toomanynames1998

If I understand this correctly I think it is likely you are finding Eclipsing Binary systems (two stars orbiting one another) rather than multiple objects in the same orbit. When you fan out your period in the game, if all the transits line up and they are a similar depth (after detrending), then they are likely from a single object. If the dips alternate in depth between deep-shallow-deep-shallow-deep-… relative to one another, it is likely an Eclipsing Binary. ~Wayne

What alliance does it better in the game?

NazAlGhul

That question is a trap.

So, can you guys explain why you're doing this, but in laymen terms, maybe I'm just high, but I don't get what you're trying to do. Discover planets? If yes, how?

RolledUpMaxipad

Yes, trying to discover exoplanets! I suggest you check out this amazing presentation by Michel Mayor at Fanfest: https://www.youtube.com/watch?v=fthdEetUGY0 ~Attila

What benfits will this have for real science and more importantly how would you you correct an incorrect consensus

Nomadola

The benefits for the field will be important. How groundbreaking will they be? I can't say until we know what these planets are. However, every planet we discover adds to the information we have, so far the number only stands in the thousands. The more we know about distribution and types of planets the

more we can understand important questions such as: the probabilities of Earth like worlds, how common planets are and what is typical of formation processes in a extrasolar systems early life to give some examples.

Any interesting targets will be followed up by us in Geneva so we will check that a consensus is correct. We won't be declaring any planets as found without being sure on our side. ~Wayne

Hi,

Sorry but could you explain like I'm 5 how EVE online is helping you gather data? I used to play EVE a lot but I haven't been on it for years.

LesPaulSteve

For the data we have given to Project Discovery there are approximately 175,000 stars in there. We can do general runs through the data and look for repeating patterns but it is much more difficult for us to find irregular patterns in the data. No observatory can afford to employ enough people for long enough to look at these kinds of numbers one by one.

However, if you can get tens of thousands of players in a game to look at a few each and reward them for it, suddenly it becomes possible. We fully expect to find confirmed planets in the data and acknowledge them for their efforts.

From all in Geneva we offer our thanks for your participation in this. ~Wayne

What made you think of using a mmo and more specifically, eve online?

Jonatc87

Hopefully this answer will give you some insight.

What caused you to choose EVE online over something like No Man's Sky?

DankMemes2016

Actually back 3 years No Man's Sky was still not out. I used a screenshot from that game too in my TEDx Lausanne talk though, to illustrate how I can imagine this kind of integration of science and games. ~Attila

As someone who does not play Eve:

I'm baffled by the idea that a video game can have real life affect on identifying planets. As someone who is clearly an expert on this, can you explain the term exoplanet in your own words and explain how a video game MMO can do such a thing?

jbcarrot

An exoplanet is a planet that exists outside of our solar system. Scientists have gathered a lot of data by looking at the sky in the search for these planets. EVE Online players can help the scientists by combing through the data and looking for the appropriate signals. In return, the players get valuable rewards in the game, therefore incentivizing them to submit as accurate a result as they can. ~Hjalti

So, as a game developer (and obviously gamer), the first thing I would implement is an incentive. I see you have this already. However, do you track which player submitted each analysis, and keep that data paired all the way through the process after submission? I'm fishing for, will the player actually be credited with assistance in the discovery of a new exoplanet, should it happen?

Rhames

Yes, we know which light curves you have used and we will track them as we look at the results. How you will be credited has not yet been decided. We have had multiple discussions about this however at Geneva Observatory and are keen to make sure you have that incentive. ~Wayne

What do you think are the odds a race of intelligent beings on another planet have seen light emitted from our star and theorized that it could have a planet that holds life?

ZachJGood

I like to believe they are just waiting for us to develop Warp Drive so they can make First Contact. ~Wayne

Yay for space exploration

radeon23

Agreed! ~Wayne

As an eve online player whats the point? I really get the whole using gamers to do science but why in-game and not a seperate app?

pm_me_lingerieboobs

To be successful we need a lot of users to join. Zooniverse did an exoplanet citizen science project much like you suggest. For us we felt the community in EVE online would be able to engage with this kind of project as they are used to going out and finding new worlds in the game. ~Wayne

Our original concept in MMOS was to solve the long term engagement and activity problems that citizen science struggles with. Our answer was to this problem is to create a seamlessly integrated experience where the problem is in the game world and so players are as motivated to solve these tasks as any other in game. Creating outside apps were done by many other projects, but building an active community around it is a challenge that small citizen science projects with very limited resources simply can't tackle. We are very happy to see that our original idea seemed to work out quite nicely. ~Attila

What do you think of the Elite Dangerous simulation? Is it more complete or accurate than eve or less?

m1k3tv

Unfortunately I haven't played Elite Dangerous so I cannot comment. ~Wayne

Do you think there is a future for games being used for scientific and research purposes?

Subtle_Omega

If you play Project Discovery (or tried its previous iteration with the Human Protein Atlas) you are doing it already but there is definitely a future as the success of this Project has shown. ~Wayne

Can't this classification be done algorithmically? It seems like a completely obvious candidate unless I am missing something.

demonachizer

Hopefully this answers your question.

This is amazing and makes me want to give Eve a shot. Any chance you could integrate this with Elite: Dangerous since it aims to offer us a 1:1 recreation of the Milky Way?

mrsegraves

Elite: Dangerous is absolutely on my list of games to talk to. ~Attila

What are the kind of ratios you see between retrograde and prograde rotation among each set of exoplanets?

anandmallaya

For the CoRoT data this isn't something we could tell you. ~Wayne

Are black holes actually worm holes?

phillip708

Not necessarily. ~Attila

Black Holes may be the doorways to Black Holes in another Universe connected via a wormhole. That's just a working hypothesis though. ~Wayne

How do you use a scifi game to identify exoplanets.

--RickyBobbyInc

Check out the above AMA description and links and jump right in and play Project Discovery! ~Wayne

Hey, I saw your GDC talk! Very interesting!

Coloneljesus

Thanks! ~Attila