

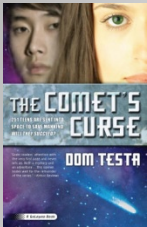
The Science Behind Galahad

Volume 3: Earth-like Planets

Hi, **Dom Testa** again. You're looking at the third entry in a brand new series of articles that I've recently unveiled, and judging by the email and online posts I've seen so far, it's a big success!



You see, as I've spent the past few years writing the **Galahad** book series—which is about the ongoing adventures of 251 teenagers who live aboard a spaceship destined for another world – I've found myself increasingly interested in the *science* that is at the heart of what is technically science fiction. I wonder: How does artificial gravity work? What is the technology that allows Gap Lee to be such a good Airboarder? How does NASA make use of solar sails in space travel, and what *really* happens when the Earth passes through the tail of a comet? And when I deliver presentations at schools or talk with fans out on the road, I've found that they often wonder the very same things.



So, in an effort to satisfy my curiosity and yours, I've decided to explore some of those topics in greater detail. With each volume I'll tackle a scientific phenomenon of some sort and take it apart, bit by bit, until we all understand it a little better. It's the science behind the Galahad series, and I've got a sneaking suspicion that it's going to be a whole lot of fun. Let's dive right in, shall we? This month: Earth-like planets.

Meeting the Neighbors

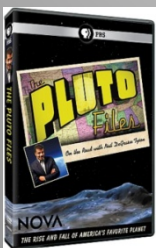
I once packed 251 teenagers aboard a massive space ship and sent them tearing across space toward a cluster of Earth-like planets in a distant solar system, all in an effort to save humanity. What's more, I did all of this from the comfort of my own basement. It started on a Tuesday. I was wearing pajamas.

Okay, perhaps I should clarify: I wrote a *book series* where teens were sent to colonize a new world. I didn't actually, physically shoot a bunch of kids into orbit. I'm pretty sure there are laws against that sort of thing, regardless of how comfy your pajamas are. Nevertheless, I think the idea of visiting some far-away Earth-like planet – whether to preserve the human race or just for a little **vacay** – is pretty cool, and judging by the responses I get from readers each and every week, a lot of you do, too.



The question is: what *is* an Earth-like planet, and are there any out there? Well, before we can get into that, let's take a quick refresher course in Planets 101.

Everybody knows what a planet is, right? Raise your hand if you know what a planet is. Okay, good. There are two main types of planets: *gas giants*, like Saturn and Jupiter, which tend to be giant and gassy, and rocky *terrestrials*, like Earth and Mars, which are, believe it or not, rocky. In our own solar system, we have eight planets. When I was a kid there were nine, but in a sort of cosmic reality show a few years back, Pluto was voted off the proverbial island and is now considered a dwarf planet, which means it isn't really a planet at all. (This is a very interesting story all by itself and we don't have the time or the space to get into it here, but you should ask the internet to find you the NOVA television show called '**The Pluto Files**' and see for yourself what all the hubbub was about. NOVA rocks.)



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So. Eight planets. Of the eight, it turns out that only Earth is very Earth-like. The rest are all doing their own thing – wild fluctuation in temperatures, toxic atmospheres, **anticyclonic storms** – and aren't the sorts of places where humans could survive long enough even to open a **Starbucks**. However, the good news is that with rapid advances in technology we're learning more and more about the planets that exist in other parts of the galaxy. There has to be an Earth-like body out there somewhere, right?



Have Telescopes, Will Travel

As of this writing, astronomers have discovered more than 450 extrasolar planets (meaning planets that orbit a star other than our Sun). As recently as 20 years ago, none had yet been discovered, so you can see how quickly technology is moving. Most of these planets clearly are nothing like Earth; they are gas giants or some other exotic variety of planet. In 2009, scientists discovered a rocky planet with the catchy name of CoRoT-7 b, which is a mere 480 light years from here. It is relatively similar in size to Earth and, even though 480 light years is not exactly a stone's throw away, relatively close. Unfortunately, it is most likely a hot mess of volcanic activity and would not be suitable to human life. Still, it seems like a step in the right direction.

The most exciting development in this field is the **Kepler Telescope**, which is on the hunt for Earth-like planets, big time. Kepler – named for **Johannes Kepler**, an early and revolutionary German astronomer – was launched into space by NASA in early 2009, and by the following January already had scientists abuzz with anticipation over its progress. One prominent NASA researcher told the Associated Press that he “would certainly expect in the next four or five years we'd have an Earth-size planet in the habitable zone.”

Which brings up some interesting questions: what exactly is a “habitable zone”? And what sorts of things should we be looking for in these Earth-like planets?

To start with, it should be rocky rather than gassy. Also, it needs to be juuusstttt the right distance from whatever star it orbits. If it's too close, that can lead to problems like extremely high temperatures and, in some cases, extremely high levels of radiation. Too far away and you get an opposite set of problems, like freezing temperatures. Another key consideration is the atmosphere. Earth's atmosphere consists primarily of nitrogen and oxygen, allowing its inhabitants (like you and me) to do some very convenient sorts of things, like live on land, and breathe. So for an extrasolar planet to be considered habitable, it would need (at the very least) to be a rocky planet, the right distance from its star, and have a non-toxic atmosphere. Of course there is a much longer list of desirable qualities – Gravity! Stable weather! **Water slides!** – but this little trifecta is a good start.

So have we discovered any habitable Earth-like planets? And if so, where are they? The answer is... not quite yet. But indications are that we seem to be getting closer.





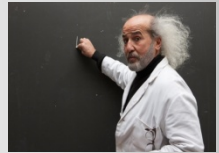
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In 2008, the Spitzer Space Telescope identified a dust cloud forming around a nearby star, which is how most planets are thought to form in the first place. So, if the information from Spitzer is correct, then this particular dust cloud would evolve at just about the right distance, meaning that it could build an atmosphere, collect liquid water, and perhaps even support life. The catch? It's going to take several million years for all of that to happen. Unless you and I hit the gym and stop consuming all these empty calories (I'm looking at you, **Girl Scout Cookies**), then we probably won't be around to see it come to fruition.

The Kepler telescope, meanwhile, has discovered (and confirmed) no fewer than eight new planets during its first year in space. Each has varying degrees of similarity to Earth, but none so far is anywhere close to having the right atmosphere or climate. Still, optimism is high for several reasons. One is the dizzying pace at which planets are being identified – in addition to the eight confirmed extrasolar planets, Kepler has come across many more objects that have yet to be categorized, and it can take up to three years to categorize a planet's orbital path. Another reason for optimism is the sheer volume of available stars and our newfound access to see and study them. Kepler alone is scanning more than 100,000 stars, and while that's just a small fraction of the available nighttime sky, it's still a big number. Moreover, leading experts at the American Astronomical Society speculate that about 70% of all stars have rocky planets within their orbit. If true, that ups the odds of finding an Earth-like planet considerably.

The Final Frontier



If the **experts** are to be believed – and it seems safe to assume that they are – then we could very well be on the verge of seeing at least one Earth-like planet come to light during our lifetimes. That's pretty exciting, no? At such extreme distances, however, some major advances in space travel would need to take place in order for any of us ever to set foot on such a planet. Nevertheless, the search for Earth-like planets could prove to be invaluable to future generations... and not just because we may someday have to evacuate the premises here on our own planet.

One of the most overlooked benefits of the space program is the HUGE number of advances it brings to our everyday lives. Do you like having a **cell phone**, or cable TV, or insoles for your shoes, or water filters which remove harmful chemicals from your drinking supply? Well you can thank the space program for all of those advances. But it isn't just new technologies. We learn a lot about our own planet, and about things like physics and weather patterns and all sorts of other useful information by studying the cosmos. Imagine what we might learn if astronomers find planets with similar properties to our own spinning around in some far away solar system. Imagine all that could be learned and applied to our own lives here on Earth!



In the Galahad book series, the comet Bhaktul forces an emergency evacuation from planet Earth for 251 teenagers. And the truth is – which you already know if you read the last SBG article on comets – that sort of thing, be it a comet or some other natural disaster, could plausibly happen. Who knows, right? And even if it doesn't, the Earth isn't going to be around forever anyway. So yes, having a back-up planet available, if such a thing is possible, in order to save the future of the human race is a good idea. But even if we never managed to *colonize* another world, there is still so much to gain by simply finding one. Heck, there's a lot to gain by simply *looking* for one. Sometimes – in space science as in life – the journey *is* the destination.