**Justine Paradis:** This is Outside/In, a show about the natural world and how we use it. I'm Justine Paradis, and today is kind of a special day because I have the privilege of introducing our new host

[DRUMROLL]

Nate Hegyi. Welcome, Nate.

**Nate Hegyi:** Yes Hello. Thank you. Thanks for having me. I really like the drum roll

**Justine Paradis:** Oh, you're welcome. So, Nate has been a reporter for the Mountain West News Bureau out in the Rocky Mountains. What are a couple of stories you've done recently that you're proud of?

**Nate Hegyi:** Yeah, we just wrapped up a pretty big investigation into jails, tribal jails operated by the federal government and some malfeasance and neglect and misconduct that was happening there.

Um, I also did a really fun story about, um, stopping the plague that was ravaging black footed ferrets by dropping pills in peanut butter pellets from a drone in eastern Montana. That was a really fun one.

**Justine Paradis:** Can you imagine being like a person just like not knowing what was going on and having peanut butter falling from the sky as you want and you're.

**Nate Hegyi:** Like, what is this? You're just getting like hit in the head with peanut butter pellets and you're like, how was that? Oh, sorry. We're trying to we're trying to combat the plague, so just ignore us.

**Justine Paradis:** Indeed.

**Nate Hegyi:** So I've been lucky enough to get to travel a bunch and do a lot of weird, fun stories.

**Justine Paradis:** And you're already working on some stories for us. And we're I'm really excited to hear them. But before that, I think that it's important that we do a lightning round for listeners to get to know you. Five Rapid Fire questions. Are you ready, Nate?

**Nate Hegyi:** I'm ready.

**Justine Paradis:** Okay. What is your favorite tree?

**Nate Hegyi:** Madrone. Or also known as a Madrona or an arbutus tree? They're all the same thing.

**Justine Paradis:** Oh, I've never heard of this.

**Nate Hegyi:** There are these beautiful, beautiful red trees, And I just really like the feel of them it's just really smooth.. And I grew up partially in British Columbia and you would see them on the coast and they give me warm, fuzzy feelings.

**Justine Paradis:** Warm, fuzzy feelings.

Okay this one’s a question I’m gonna steal from Mike Birbiglia: What is a piece of advice that you have received in your life that has actually worked?

**Nate Hegyi:** Wow. That's a tough one. Oh, don't swear. If there's ever a live microphone in your face. Never swear.

**Justine Paradis:** Very apropos for a radio host.

**Nate Hegyi:** Yes, absolutely. So I've I learned that lesson very early on. Never, never say a bad word in front of a microphone.

**Justine Paradis:** What is a piece of outdoor gear like your top piece of outdoor gear that you could not go without?

**Nate Hegyi:** Probably trail running shoes.

**Justine Paradis:** You're not an outdoor barefoot runner.

**Nate Hegyi:** No, I'm not. I'm not like some people who work at Outside/In.

**Justine Paradis:** Well, I gather unnamed people. Unnamed people who who rhyme with Flaylor Flimby.

**Nate Hegyi:** Yeah, exactly. Like a different kind of shoe. No, I like a pretty traditional trail running shoe.

**Justine Paradis:** What is something you're looking forward to?

**Nate Hegyi:** I am looking forward to doing a bunch of weird, crazy, hopefully profound episodes of Outside/In, because I've admired this show for years and I'm still like mind boggled that I get to be the host of it.

**Justine Paradis:** Finally, if you had to pick from the following fruits as the best fruit ever, which one would win the hot pepper, the gourd, the vanilla bean, or the coconut hot pepper?

**Nate Hegyi:** Absolutely hot pepper.

**Justine Paradis:** You know, this is the loaded question, right?

**Nate Hegyi:** Well, what does it mean? What did I did I just answer it wrong?

**Justine Paradis:** Oh no. That's you cited. That's Taylor Quimby is presenting. Oh yeah. This is an Easter egg for long time listeners.

**Nate Hegyi:** That's right.

**Justine Paradis**: Basically, each of us argued why a particular fruit was the best fruit of all time.

**Nate Hegyi:** That's right. I have not listened to that episode. I've seen it up there.

**Justine Paradis:** All right. Well, take it away for this episode. This is our outside inbox.

**Nate Hegyi:** So our episode today is going to be all about space.

**Justine Paradis**: Space.

**Nate Hegyi**: We asked you to send us questions about space. You sent us a bunch in every other week. We answer one of them on our radio broadcast, but we don't want you all podcast listeners to miss out, so we're bringing them all together now for a single episode in our latest installment of the Outside In-box.

**Justine Paradis:** Bah bah dah bah.

**Nate Hegyi**: bah bah dah bah.

[STINGER]

**Justine Paradis:** You know, there's many sounds in that little stinger there from, you know, the earthly natural world. But it does make me wonder if space, space counts as the outdoors, it's like the great, great outdoors.

**Nate Hegyi:** It absolutely counts as the outdoors. It is, as you said, the farthest out of doors you can get. The doors are so far away, they're like thousands of miles away.

**Justine Paradis:** Yeah. If you open the doors, you literally, like, boil to death.

**Nate Hegyi:** Yes, exactly. Or freeze to death or do whatever the heck you do when you're out in space and open doors, which is I mean, we just don't recommend it. I don't recommend opening doors in space. All right. So we're going to bring you this first one that producer Jessica Hunt answered with me, which also happened to be my very first outside inbox. And I remember I was still trying to figure out all my recording equipment. And you made a joke that I sounded like John Mulaney in that that podcast, SNL episode.

**Justine Paradis:** SNL sketch. Yeah.

**Nate Hegyi:** So so apologies if it sounds a little weird.

**<<7 TIPS FOR STARGAZING>>**

**Jessica Hunt:** We've gotten a couple of listener questions about backyard astronomy, how to start, what kind of equipment you need. So, Nate, you're based in Montana, Big Sky Country, right?

**Nate Hegyi:** Oh, yeah. And the stars here are absolutely stunning. I mean, I love going out camping and just staring at them for hours.

**Jessica Hunt:** Well, I can identify Orion's belt, and everyone I talked to said that's a good starting point. But with all the images from the Hubble telescope and now the James Webb Space Telescope, that's not necessarily where everyone even starts.

**Susan Rolke:** When I talk about going outside with some of my younger people, they're like, But the pictures are better than what I can see outside, which to me is is backwards.

**Jessica Hunt:** That's Susan Roque. She teaches high school physics and chemistry in Jaffrey, New Hampshire.

**Susan Rolke:** To me, it's the incredible night sky and just the awe of looking up at the black and all of these beautiful jewels that are twinkling.

**Jessica Hunt:** Susan, by the way, is also what's called an airborne astronomy ambassador, a study program run by Nassau for teachers. And Susan says to get started, you don't necessarily need a fancy telescope.

**Susan Rolke:** Binoculars are great. There's some really great objects that you can see just in the Big Dipper. The bend of the Big Dipper is actually a double star. It's Mazar and Alcor. So if you look at that, you'll suddenly resolve and see two stars.

**Nate Hegyi:** So is the Big Dipper. It has more than just the stars that I'm seeing. When I look at it at the naked eye. That's pretty amazing.

**Jessica Hunt:** I know. And just with binoculars. Here's Jennifer Willis. She's a columnist for Sky and Telescope.

**Susan Rolke:** Binoculars have the advantage of being more portable. They're easier to grab when you have only a few minutes. Binoculars also generally offer a wider field of view than a larger telescope, like having the entire moon in one view as opposed to a closer up slice of it.

**Jessica Hunt:** Other gear. Jennifer recommends bringing along a reference like a guide book and something called a Planet Sphere.

**Susan Rolke:** Basically a star chart on a wheel and you just turn it to match up with the date and the time that you want to stargaze. They're made for different latitudes, so that's something to keep in mind.

**Nate Hegyi:** Okay, but what if you do want to try a telescope?

**Jessica Hunt:** You don't actually have to buy one. Here's Susan Roque.

**Susan Rolke:** Again. So you can go to your local library and you can check out a telescope.

**Jessica Hunt:** You can check out a telescope from the library. Highly recommended as a way of getting started. And Jennifer Willis says, seek out your local astronomy club, for instance.

**Susan Rolke:** If you really have your heart set on Saturn, you can look at Saturn through five different telescopes maybe, and figure out which one is going to suit your purpose.

**Nate Hegyi:** What about stargazing apps on your smartphone? I mean, I feel like there's so many of them.

**Jessica Hunt:** Yes. Susan recommends Star Walk, too, and Stellarium. She also has a note of caution for using your phone while stargazing.

**Susan Rolke:** I would put the night mode on my phone so that when you go out, it's showing a darker screen and red light so it doesn't ruin your night vision when you're outside.

**Jessica Hunt:** Very important for stargazing. And I have to admit, even in the daytime, that my vision is terrible. So I'm concerned. What am I going to see if I'm looking at the stars? But Susan says there's a big push to bring astronomy to the visually impaired and even the blind.

**Susan Rolke:** Nasa's actually taken their some of their photos and they've turned them into sonic representations with the different wavelengths being different notes or played by different instruments. There's 3D printed material that you can get so you can see meaning, feel what an asteroid is like or what the supernova remnant Cassiopeia A feels like, which is pretty cool.

**Nate Hegyi:** Yeah, I would say that's amazing.

**Jessica Hunt:** And so simple. We reconnect with the universe by looking up at the sky no matter how we do it. Here's Jennifer Willis.

**Susan Rolke:** There is something very, very reassuring in the enduring skies. Even if everything goes wrong in my life, even if the world ends, it's not the end of everything. And I find such peace and quiet exhilaration in that.

**Nate Hegyi:** That was our producer, Jessica Hunt. And we're going to link to our top tips on getting into stargazing and astronomy and share a link to the music you're hearing right now representing space on the episode post for this on outside in radio dot org.

**Justine Paradis:** I really love that music. It's so cool.

**Nate Hegyi:** Moving on to our next question, producer Felix Poon answered one about the sustainability of space travel.

**<<Sustainability of Space Travel>>**

**Felix Poon:** So continuing our space themed questions, Jasmine Castro Diaz asks, What does the future of space travel look like in terms of environmental sustainability, like fuel effects of launches, etc.?

**Nate Hegyi:** I feel like we never talk about space travel when we talk about the big contributors to climate change. I mean, I imagine that a single rocket launch burns a lot of fuel.

**Felix Poon:** It definitely does. I spoke to Dr. Martin Ross about this. He's a scientist with the Aerospace Corporation, and he says that a typical rocket launch burns about the same amount of fuel that a daylong flight across the globe burns. But Ross says this isn't what concerns him the most.

**Martin Ross:** We don't care about rockets carbon footprint. That's irrelevant. It's the particles. Remember the old saying? It's the particles, stupid.

**Nate Hegyi:** The old saying, of course it's the particle, stupid. Everybody's heard that.

**Felix Poon:** Yeah. So Ross says the emissions don't matter because CO2 emissions from rockets are seven times less than airplanes per kilogram of fuel burned. Plus, there's just way fewer launches than there are flights to begin with. In fact, the rocket industry burns just 1/1000 of 1% of the kerosene that the aviation industry burns. But when it comes to particles, a rocket engine emits hundreds of times more soot particles than a jet engine per kilogram of kerosene burned plus material that re-enters the atmosphere burns up and it turns into even more soot particles that collect in the stratosphere higher up than the kinds of pollution we're used to talking about.

**Martin Ross:** And these particles scatter and absorb sunlight. They change the temperature and circulation of the stratosphere.

**Felix Poon:** Even Ross, who's studying this, says we still don't fully understand the consequences because pollution in the stratosphere is just so new. We don't have the data or the models to predict what could happen.

**Nate Hegyi:** So are there any alternatives that don't pollute?

**Felix Poon:** While Ross says hydrogen could make for good rocket fuel, but the technology isn't quite there yet because of the extremely low temperature that liquid hydrogen has to be kept at, for example. But what if I told you that there actually is a pretty wonky idea that just might work?

**Nate Hegyi:** I'd be interested. I'd be interested

**Felix Poon:** So I'm going to show you a video from a spaceflight company that's trying to get into space without a conventional rocket. And just to be clear, they're not working on getting people up to space. They're doing something to get satellites into space. All right. Let's watch. Okay. So we see this thing that looks like a gigantic fan blade with a small spaceship attached to the end. And this fan blade is inside a chamber that's set up like a 45 degree angle pointing towards the sky. Okay, now the fan blade is beginning to spin.

**Nate Hegyi:** The fan blades going really, really fast.

**Felix Poon:** Super fast. Wow. Whoa. It just launched. It just released the ship into the sky. Now it's in space. So basically it was flung into space using centrifugal force. And only then does an actual rocket on the bottom turn on.

**Nate Hegyi:** A very small rocket ignites to provide the additional velocity to.

**Felix Poon:** Obtain orbit. This is Jonathan Feeney, CEO of Spinlaunch. He says the rocket kicks on after it passes through the stratosphere. They had their first successful test launch last fall, which was just a proof of concept. So it didn't go completely into space yet.

**Nate Hegyi:** But they've actually like gotten to a point where they've they've they've created this thing. It's not just a computer generated image. Yeah, they've built it. That's really cool.

**Felix Poon:** And even if this thing isn't completely net zero, it's still way cheaper per launch and requires way less fuel.

**Nate Hegyi:** But I also feel like there's this thing that happens with technology, like you're going to make a thing more efficient, it's more affordable, sure. But you know when something's more affordable than consumption increases.

**Felix Poon:** Yeah, I just learned that this effect is called Jevons Paradox, but still I think it's a good thing to become more efficient. I mean, launches are dramatically increasing.

**Nate Hegyi:** I mean, yeah, we are entering like a new space age.

**Felix Poon:** Yeah. So if we're going to go into space anyway, we should find better ways of doing that.

**Nate Hegyi:** Right? I think we just need to look at Star Trek and I mean, they beam things and people up all the time. I think that's that's the direction we need to go to. Beam me up, Scotty, kind of stuff.

**Felix Poon:** Someday, Nate. Someday.

**Nate Hegyi:** That was Felix Poon talking about the sustainability of space travel. And, you know, this got cut from the piece. But Felix was telling me about how in 2014 they were able to essentially beam a digital file to a 3D printer in the International Space Station, and it printed out a wrench. So maybe we're not too far off from the Star Trek beam-me-up-Scotty technology, which I think would be really, really cool and a much I don't want to say safer way of of space travel but like if you're really afraid of heights or you just don't like sitting in a.

**Justine Paradis:** Rocket, I don't know. Haven't you seen Star Trek? People got lost in that beam all the time. And that that is not beaming up sending emailing a file to the International Space Station.

**Nate Hegyi:** Dude, that's fair. That's very emailing. Emailing is not beaming people across space.

**Justine Paradis:** No, I don't think we're that close.

**Nate Hegyi:** All right. So we've got two more questions that we've got to get to. But first, we’re working on a really exciting project, and we want you to be involved. We want to hear about your experiences with electric vehicles, EVs. Have you tried to buy an EV? Are you interested in buying one?

No matter what you think about cars, we’re really interested in what people are thinking, so we’ve put together a survey. The link is in the show notes, and it’s on our website at outsideinradio.org. And thanks! We'll be right back after a break.

**<<MIDROLL BREAK>>**

**Nate Hegyi:** Welcome back to Outside In. I'm Nate Hedgi, the new host of Outside In, and I'm here with Justine Paradis.

**Justine Paradis:** We just heard some great tips for getting into stargazing and astronomy and how people are trying to make launches into space more sustainable, potentially. But now I'd like to move on to the question of aliens.

**Nate Hegyi:** Yes, this is what I was hoping for the entire episode.

**Justine Paradis:** You were hoping for aliens.

**Nate Hegyi:** Aliens? Absolutely. Absolutely. That's what I want to know. And I want to know what space is. Aliens.

**Justine Paradis:** Well, I spoke with Taylor Quimby about a question that a listener submitted about the dark forest theory.

**<<Dark Forest Theory>>**

**Taylor Quimby:** Justine, would you do the honors?

**Justine Paradis:** Sure. It is from Francisco on Instagram. And Francisco asked us to look into the dark forest theory. Hmm. So the dark forest theory deals with the possibility of intelligent life beyond planet Earth. And I want to start with this thing called the Drake Equation, which is kind of a theoretical idea that basically attempts to calculate the number of possible advanced civilizations in the galaxy or in the universe.

**Taylor Quimby:** Which seems just super easy to do.

**Justine Paradis:** I mean, it's super speculative, but basically you take a number of factors like the number of possible planets that could support life, the fraction of those where life actually does take hold, the fraction of those where life becomes advanced enough to make contact. Right. But then another big factor is time. And then theoretically, you get the number of civilizations emitting detectable signals in our galaxy or universe.

**Taylor Quimby:** Okay. So is there is there like an answer, like a number?

**Justine Paradis:** I mean, I feel like it's more of a thought experiment, but what it does find is that the odds that we're alone are really tiny, like vanishingly small. And that brings us to the dark forest theory. So what the dark forest theory says is we should be very glad that we have not encountered alien life because that encounter might not go so well for us. The term comes from a series called The Three-Body Problem by Chinese sci fi author Liu Cixin (and Taylor. Would you mind reading the passage in question in which he lays out this theory?

**Taylor Quimby:** Sure. The universe is a dark forest. Every civilization is an armed hunter, stalking through the trees like a ghost, gently pushing aside branches that block the path and trying to tread without sound. The hunter has to be careful because everywhere in the forest are stealthy hunters like him. If he finds another life, another hunter, angel or a demon, a delicate infant to a tottering old man, a fairy or a demigod, there's only one thing he can do. Open fire and eliminate them. Wow, that is dark. That's super.

**Justine Paradis:** Dark. Dark. And it's saying, like, every other thing that you might encounter is a threat. Right? In fact, many of our sci fi conceptions of what alien life would be are incredibly threatening. So take the movie Alien, in which the alien in question implants its larvae into human bodies.

**Taylor Quimby:** Yeah, definitely qualifies as threatening.

**Justine Paradis:** Does not work out for the human host at all. War of the Worlds H.G. Wells Novel of Martian Invasion adapted many times for radio and cinema, a classic. Summed up by just big screaming.

**Taylor Quimby:** That kind of gives you the gist.

**Justine Paradis:** And in Steven Spielberg's E.T., it's actually humans whose behavior is the scariest.

**Taylor Quimby:** Oh, yeah. The scene where we're dressed in the hazmat suits. We're the.

**Justine Paradis:** Creeps. We're the creeps. And E.T. is just like this gentle being.

**E.T.:** Phone home.

**Justine Paradis:** And even if we don't intend to be threatening, it's also possible that alien life, even if it could be benevolent, might perceive us as dangerous. Like they might hear a radio signal announcing a declaration of war from a hundred years ago or something. But I will say that the dark forest theory, as well as a lot of authors and directors imagining intelligent life beyond this planet. When you do that, you also explore and make assumptions about the human species almost necessarily. Right. And this tension is represented in this scene from the sci fi TV show The Expanse as these two characters try to understand the possible alien life that they've encountered.

**The Expanse 1:** Those things that we're looking for out there, those things might be signals

**The Expanse 2:** or maybe all those other civilizations are gone. Maybe it's the nature of intelligent life to destroy itself.

**The Expanse 1:** Well, I prefer to think that intelligent life can choose not to.

**Justine Paradis:** So what I would ask is what do you prefer to think about intelligent life? And if there is someone else out there, should we be looking for them or should we be trying to hide?

**Nate Hegyi:** I feel like sure. Like there's been a lot of sci fi movies that have had like aliens attacking us like Independence Day and Alien and Aliens and Aliens three and aliens 110, the entire Aliens franchise. But also, like, wasn't it in arrival? Remember that movie Arrival? Weren't the aliens like warning people about something? Like they were actually, like coming to, like, tell us something like, good. Like, Hey, you guys need to change your your behavior. I think there was like definitely some some interaction, some positive interactions. So, like.

**Justine Paradis:** What's a human reaction isn't going to be a singular reaction, right, as we see from like any world event. So that right, that would also be the case here. And so would they have a single mood or purpose in coming here, you know?

**Nate Hegyi:** Right. Right. Yeah. Because I mean, if you if you think of it in terms of like colonization of of Europeans coming over to North America and kind of the different ways different indigenous groups interacted with with colonizing forces, you know, there was a multitude of interactions.

**Justine Paradis:** Yeah, true.

You know something that got cut from this was that this is an example of the prisoner's dilemma, which is an example from game theory so imagine you’re one of two prisoners who are in custody being interrogated for a crime. And if you give information and betray the other prisoner, and they don’t betray you, you get to go free and they get 3 years of prison. If you both betray each other, you each get two years in prison. And if neither of you betrays the other, you both only get a year.

That’s just something that goes along with the Dark Forest theory a lot that I found really fascinating.

**Nate Hegyi:** Right, because if you're going around in the dark forest thinking.

**Justine Paradis:** Like if you if you assume violence of the other person, right. You're you're creating a more negative outcome than if both people assumed a good outcome. Right. However, if you assume that they're going to be good and they are violent, then that's also a bad outcome for you.

**Nate Hegyi:** So it's that is definitely a bad outcome for you. Yeah. Maybe that's why humans, we're always just getting ourselves into trouble in wars and things like that because we just assume the worst in each other. And maybe there would be like an alien life form that would just come down and be like, Hey guys, come on. Like, let's just chill out a little bit. This is okay.

**Justine Paradis:** You think that we would, like, come together as a human race with a lesson from an alien species?

**Nate Hegyi:** I know. I think. I think if the pandemic taught us anything, I think I don't have a lot of a lot of a lot of hope in our interactions with aliens.

Okay. For our last question we're bringing to you, Taylor, who answered one about the movie. Don't look up, Justine. Did you watch that movie?

**Justine Paradis:** I did not. It was it was like it's a it's a metaphor for climate change. I get too much of that.

**Nate Hegyi:** But that's fair.

**Justine Paradis:** But I heard that it was good.

**Nate Hegyi:** I did watch it. I did. I enjoyed it a lot. But okay. Here's Taylor talking to Jessica about the question someone had about that movie, Don't Look Up.

**<<Don’t Look Up>>**

**Taylor Quimby:** So this one was posed by John Gage on Twitter. And it has to do with the Netflix movie, Don't Look Up. Have you seen.

**Jessica Hunt:** It? Yes, I watched it on New Year's Eve.

**Taylor Quimby:** So for listeners who have not seen it, I'm going to spoil a couple of plot points in order to answer this question.

**Jessica Hunt:** That's just the way it is.

**Taylor Quimby:** Yeah. So in the film, a PhD student discovers a huge comet hurtling directly towards Earth.

**Leonardo DiCaprio:** There would be miles high tsunamis fanning out all across the globe. If this comet makes impact, it will have the power of a billion Hiroshima bombs.

**Taylor Quimby:** Not good, no. Later in the film, a billionaire tech CEO discovers that the comet is packed with valuable, rare metals used in electronics, and he decides that actually this comet might be a good thing.

**Tech CEO:** Obviously, one giant comet is a major existential threat to our planet, but 30 smaller meteoroids we can handle.

**Taylor Quimby:** So the CEO comes up with a very risky plan to blow the meteor up into smaller pieces and steer them into the ocean so they can be harvested for those rare minerals. Now, I will not say exactly what winds up happening, but John's question is, would the consequences of a large asteroid hit be any less if it were broken up? What do you think.

**Jessica Hunt:** They would burn up? You think so in the atmosphere? Yes. Okay. That's my contention. It is sort of the question, right?

**Susan Rolke:** Can you really do something like that? And as it turns out, I wouldn't recommend it. Oh, well.

**Taylor Quimby:** So to find out the answer to this, I spoke with Amy Mainzer. She is the principal investigator for Wait for It NASA's near-Earth Object Wide Field Infrared Survey mission acronym, NEOWISE.

**Amy Mainzer:** We love our acronyms at NASA.

**Taylor Quimby:** And she's also the technical science adviser for the film. And she told me when it comes to measuring how destructive a comet or asteroid is going to be, there's four things that scientists think about how dense is the object? Is it made of solid iron, or is it like a loose collection of gravelly rock? Also, what angle is it going to hit the planet? Will it skim off the side? Kind of like you're skipping a rock or is it going to just smack into it right at 90 degrees?

**Amy Mainzer:** But the two parameters that are the most important are the mass of the object as well as its speed.

**Jessica Hunt:** Okay. The speed and the size right now.

**Taylor Quimby:** Jessica, have you seen a shooting star before?

**Jessica Hunt:** Yes, I have.

**Taylor Quimby:** So if you had to guess what size object was making a shooting star, would you say maybe the size of an apple, the size of a car, or like the size of a house?

**Jessica Hunt:** Okay, I'm going to go with the middle one size of a car.

**Taylor Quimby:** So this was a trick question designed to blow your mind.

**Amy Mainzer:** When you see a shooting star in the.

**Susan Rolke:** Night sky, you're typically looking at something that's maybe the size of a sand grain or or a grain of rice at most.

**Taylor Quimby:** What I. Know.

**Jessica Hunt:** What

**Amy Mainzer:** just doesn't seem possible until. We figure out the velocities. These things move at speeds of somewhere. In the neighborhood of maybe 20 kilometers per second. That's 40,000 miles an hour.

**Taylor Quimby:** My point is, if a grain of rice can make that bright flash in the sky, the comet in the movie Don't Look Up is nine kilometers wide, five and a half miles wide. The tech CEO character says he's going to break that into 30 pieces. Each one would still be about two kilometers across.

**Amy Mainzer:** Do the math on that. Each one. Of those chunks is still very large and even on its own, maybe capable of causing global impact.

**Taylor Quimby:** Effects. Global impact effects is a euphemism for really, really, really bad. So some scientists at Purdue University, they actually put together an impact calculator that I strongly recommend. You can plug in the density angle, speed and size of a potential asteroid or comet and see what kind of damage it would do if it hit anywhere on Earth. Cool. Yeah.

**Jessica Hunt:** cool. Really cool.

**Taylor Quimby:** It is! It is cool!

**Jessica Hunt:** What am I saying?

**Taylor Quimby:** No, it is cool. So I plugged in the info for one of these 30 smaller pieces and if one of them hit New York City, it would leave a crater the width of Manhattan. It would ignite clothing from Virginia Beach to Canada, and it would shatter glass in buildings in Cuba.

**Jessica Hunt:** That's nuts.

**Taylor Quimby:** 30 pieces that size hitting the planet. At the same time, I don't know if it would have the same amount of damage as the original meteor, but I think from the perspective of life on Earth, it wouldn't really matter because we'd all be dead.

**Jessica Hunt:** I think. I think they should have said this in the movie.

**Nate Hegyi:** That was producer Taylor Quimby with Jessica Hunt on whether that scheme and don't look up would actually work.

**Nate Hegyi:** Justine. Do you have a favorite, like, End of the World movie?

**Justine Paradis:** Oh, great question. I love, like all good millennials. I love an apocalypse movie.

**Nate Hegyi:** Absolutely. I feel like we were raised on disaster movies.

**Justine Paradis:** You know, one that I really remember is Children of Men. Yes. It's that one's about.

**Nate Hegyi:** I was one of my favorites.

**Justine Paradis:** Yeah. It's an idea that we have collectively lost our ability to reproduce. So no more new humans, no more babies. And what does that do to the human psyche to to know that there is no future and the way that it is filmed is just really stunning. It's a good one.

**Nate Hegyi:** Yeah, that's a beautiful movie.

**Justine Paradis:** And it ends on Hope, too. It doesn't end.

**Nate Hegyi:** Hopelessly. I think if people haven't seen that movie, they should definitely check it out. Good suggestion.

**Justine Paradis:** This is just a movie recommendation edition of Outside in Box.

**Nate Hegyi:** Yeah, we're just coming up with cool movies that you guys should all see.

That's it for today's episode all about obviously space. Special thanks to everyone who has written or called in with questions. If you've got a question about the natural world or just thoughts that you'd like to share about the show, you too can call our hotline. It is 844-GO-OTTER. You can also send a voice memo to our email and that's outsidein@nhpr.org. Or write to us on Twitter or Instagram. Our handle is outside and radio.

This episode of Outside In was produced and mixed by Felix Poon, Taylor Quimby, Justine Paradis and Jessica Hunt. It was edited by Taylor Quimby with additional editing from Justine Paradis and Cory Ansell. Rebecca Lavoie is our executive producer.

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Our theme music is by Breakmaster cylinder.

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