LOOM MOON

Intro.

EMILY
You’re listening to Device. Your monthly book club with a science-based twist. I am your host, Emily T. Griffiths, and this episode is going to focus on ‘Life As We Knew It’ by Susan Beth Pfeffer.

A collection of journals and loose notes, this novel tells the story of Miranda Evans, a Pennsylvanian 16-year old, as she documents her and her family’s survival through the aftermath of a massive meteor pushing the moon closer to the earth.

We discuss how shifting the moon’s orbit can realistically impact our lives here on Earth, after the break.

SECTION 1

EMILY
Welcome back, you’re listening to Device, and this episode is about ‘Life As We Knew It’ by Susan Beth Pfeffer.

In a rural Pennsylvania town, Miranda Evans recalls her very teenage life with her very teenage concerns with her very teenage journal.

SOUND: WRITING IN HER JOURNAL.

MIRANDA
I wish it was summer already. I can’t wait to get my driver’s license!

EMILY
Sixteen-year-old Miranda lives at home with her Mom.

SOUND: WRITING

MIRANDA
Mom gave me one of her famous You-Shouldn’t-Be-So-Careless lectures.

EMILY
And her baseball enthusiast younger brother, Jonny.

SOUND: WRITING

(CONTINUED)
MIRANDA
There’s money to send Jonny to baseball camp this summer, but not enough money for me to have skating lessons.

EMILY
Her father is remarried and lives elsewhere, and her older brother, Matt, is away at school.

SOUND: WRITING

MIRANDA
Matt’s always been the one to explain things to me.

EMILY
She’s obsessed with an Olympic figure skater that grew up in her home town.

SOUND: WRITING

(RAMBLING A BIT, EMILY WILL CUT OFF.)

MIRANDA
The fan board is still fighting over whether Brandon’ll need two quads to win the Olympics or whether he could win with one. It would be so amazing if Brandon won a gold. I bet we’d have a parade and-

EMILY
That’s enough of that. There is nothing extraordinary about Miranda’s life. In fact, the first few chapters of this novel are filled with eye-roll-worthy moments.

But that’s sort of the point. Miranda’s very teenage life is very typical. It’s boring. As most of our lives are.

Through her, we learn that around 9:30 p.m. on Wednesday, May 18, a meteor is going to hit the moon. A meteor large enough that the impact will be visible from Earth.

There are a few qualifiers there. First off, meteors hit the moon all time, they are just inconsequential. The moon gets hit by about 2800 kg of meteor material per day, which does sound like a lot.

However, if you scaled the size of the moon to the size of the city of San Diego,

that would mean a meteor weighing as much as a 9-volt battery would land every day.

(CONTINUED)
Annoying, could even cause some damage, but it isn’t going to change our daily lives.

A meteor large enough for us to see the impact, however, is a different story. It’s newsworthy. But for Miranda—

**SOUND: WRITING**

**MIRANDA**

They made it sound pretty dramatic, but I still don’t think it’s worth three homework assignments.

**EMILY**

Astronomers filling their airways told Miranda’s family that the density of the meteor wasn’t heavy enough to do any damage to the moon. It was simply an exciting spectacle in the night sky.

**SOUND: WRITING**

**MIRANDA**

Actually, it was kind of interesting. I never really thought about how when I look at the moon it’s the same moon Shakespeare and Marie Antoinette and George Washington and Cleopatra looked at. Not to mention all those zillions of people I’ve never heard of. All those Homo sapiens and Neanderthals looked at the very same moon as me. It waxed and waned in their sky, too.

**EMILY**

So the big night. Telescope and binoculars out. Miranda and her family are out on the street.

**SOUND: SUMMER CASUAL BLOCK PARTY.**

**MIRANDA**

It seemed like everyone on the road was out tonight. Some of the people were on their decks having barbecues. Half moon hanging in the sky.

**EMILY**

A clear night sky. And as it got closer to 9:30—

**MIRANDA**

Things got really quiet.

**SOUND: BLOCK PARTY DIES OFF, PERHAPS THE SOUND OF NIGHT TIME BUGS, MIRANDA WRITING SOFTLY.**
CONTINUED: 4.

MIRANDA
You could sense how we were all craning our necks, looking towards the sky.

EMILY
The meteor appears.

SOUND: CELESTIAL PING.

MIRANDA
The biggest shooting star you could imagine. It was a lot smaller than the moon, but bigger than anything else I had ever seen in the sky.

SOUND: CELETIAL CRACKLING AND BURNING.

EMILY
And then... it hits.

SOUND: BLOCK PARTY CHEERING

EMILY
They don’t hear anything from the ground, only their neighbors cheering along the road. Until-

SOUND: CHEERING TURNS INTO PANIC.

EMILY
They saw their moon change.

SOUND: DURING MIRANDA, THE WRITING BECOMES LOUDER AND LOUDER, INCREASING IN TENSION.

MIRANDA
The moon wasn’t a half moon anymore. It was tilted and wrong and a three-quarter moon and it got larger, way larger, large like a moon rising on the horizon only it wasn’t rising. It was smack in the middle of the sky. Way too big. Way too visible.

EMILY
Soon they realized their phones were out of service. The internet was down. And this small rural town in Pennsylvania, which got its news from New York City, lost cable. They only got a local Newsfeed. Miranda, her mother and her brother Jonny watched the news.

SOUND: WRITING

MIRANDA
At first they didn’t seem to know much more than we did. The moon got hit, like we’d been told it would. Only something had been miscalculated.

(CONTINUED)
EMILY
Reports starting coming in that the density of the meteor was greater than models had predicted.

SOUND: BREAK IN BACKGROUND MUSIC
Which stood out to me. I mean, we know the masses of some asteroids in the asteroid belt. That’s roughly 300 million miles away. Every so often the news has a story about a distant planet in a galaxy far far away that has ‘Earth-like’ properties. How could scientists miscalculate the density of a meteor that’s coming so close to earth?

LISA
So getting the mass of an object that doesn’t have anything orbiting it is actually incredibly difficult.

EMILY
This is Dr. Lisa Will.

LISA
(0:58)
A professor of physics and astronomy at San Diego City College. I’m also the resident astronomer at the Fleet Science Center. And the cofounder of astronomy on Tap San Diego.

EMILY
At The Sky Tonight at the Fleet Science Center. Dr. Will takes you through what you can expect to see on a San Diegan clear night every month. Which outside of May Gray and June Gloom, we tend to have a lot of.

LISA
So yeah, a mass can be difficult.

EMILY
I can hear some of you out there shouting ‘mass isn’t the same as density!’ Which is true, but you need the mass of an object to calculate its density. You need to know what an object is made of, and how big it is, to know how dense it is.

LISA
Um, for planets in other solar systems. We get their masses by looking at their gravitational tug on the star that they’re orbiting. Um, and so that allows us to back out the mass but we have a hard time finding out the masses of objects unless we know something in particular about them.
EMILY
Like whether or not they have their own moon.

LISA
Which is why we didn’t really know how low mass Pluto was until its largest moon Charon was discovered in the late 1970s. Uh, so over 40 years after Pluto had been discovered.

EMILY
OK, but still. We know the composition of different meteors during meteor showers. For example, during the Per-see-ids shower in August the night sky can be filled with neon green, purple, pink, orange and white meteors. That’s because the meteors contain magnesium, iron, calcium, sodium, and silicon.

How do we know what passing meteors are made of? Researchers can look at a meteor’s infrared reflectance spectrum.

SHANE
That’s how we identify things out in the cosmos because every atom, every molecule, everything that we look at has a unique spectra.

EMILY
Joining Lisa and I is Professor Shane Haggard.

SHANE
I am a chemistry and analytical chemistry professor at San Diego City College. Um, along with a background in chemistry, I have a background in chemical engineering and emergency medicine with about 15 years experience in the field as a paramedic and uh, looking forward to talking about some science in getting a little geeky today.

EMILY
Scientists can only look at the surface of a passing meteor.

SHANE
So we could look at this asteroid or they could look at it and say, hey, it’s got this particular spectra, so it’s probably made of carbon are silica or this or that. And not ever really see that maybe the inside is solid iron because they didn’t see that signature fingerprint that you would see for, for iron or something even heavier. So that’s how we can actually go, oh, that star or that Nebula or that or that is made out of this. Because we see that fingerprint, which is very cool science.

(CONTINUED)
EMILY
OK. A density miscalculation is feasible. However...

LISA
So something large enough to actually move the moon probably would have broken up the moon at least somewhat, but you know, for the purpose of the book, just nudging it further. Uh, yeah. That’s good enough.

EMILY
The meteor hitting the moon is only the beginning. Miranda and her family are glued to the local TV News station.

A news anchor, turning pale, double checks what he heard in his earphone.

SOUND: WRITING

MIRANDA
The Newsman cleared his throat, like taking a few extra seconds was going to change what he had to say.

EMILY
There are widespread tsunamis around the world.

SOUND: WRITING

MIRANDA
The tides seemed to have swelled far beyond their normal boundaries.

EMILY
Massive flooding all over the coasts.

SOUND: WRITING

MIRANDA
The Statue of Liberty has been washed out to sea.

EMILY
And the moon, all the while, just hanging there.

MIRANDA
I tried to look at the moon, but it scares me.

EMILY
Unfortunately, the worst was yet to come.

More, after the break.
Section 2

EMILY
Welcome back. You’re listening to Device, and in this episode, we are discussing ‘Life As We Knew It’ by Susan Beth Pfeffer.

SOUND: WRITING

MIRANDA
I feel like it should have been a dream.

EMILY
In this novel, Miranda Evans keeps a diary before and after the moon is pushed closer to the Earth.

SOUND: WRITING

MIRANDA
Like maybe I’m still dreaming and when I wake up none of it will have happened.

EMILY
However, she and her family endure as their physical world transforms around them.

Apocalyptic novels tend to have mankind at the center of how civilization falls into chaos. Pfeffer imagines a world changing by means outside of our influence.

Which, historically, is how the world has changed.

The immediate fallout from the meteor’s impact with the moon is terrifying. Reports come in that tides have washed away much of the coasts.

LISA
The weirdest thing about tides is that you have two high tides and two low tides each day.

EMILY
Dr. Lisa Will again.

LISA
The way tides work is that the tides are due to a difference in gravitational force, felt on two different sides of an object.

If the moon got closer, the tides would become more extreme because the gravitational effect, it would be stronger on both of those points.

(CONTINUED)
EMILY
In this novel, the massive tidal shifts left countless people dead or injured.

SOUND: WRITING

MIRANDA
The tides seem to have pulled back from the East Coast, but now they’re saying the Pacific is being affected also.

EMILY
The effect was worldwide.

SOUND: WRITING

MIRANDA
Somehow I’d forgotten there were other countries, that we shared the moon with.

EMILY
Miranda’s mother snaps into action, and the Evan’s family stocks up on supplies. Canned food, dry goods, candles, powdered milk, juice, water bottles, cat food, seed flats, first aid, toiletries, vitamins, and warm clothes when it was about to be summer.

SOUND: WRITING

MIRANDA
Mom got this scary I-just-had-a-brilliant-idea look and asked if they had any thermal underwear.

I practically died of embarrassment.

EMILY
The days pass and turn into months. Storms continue. The electricity flickers on and off. Miranda’s brother Matt comes back from college, and starts chopping wood in their back yard. Gas is $9 a gallon, and rising.

Near constant earthquakes are reported.

LISA
And so yeah, volcanic activity, geological activity like earthquakes that actually would be very likely if the moon’s tidal effect on the earth got stronger.

Think of it as the ice skater problem.

EMILY
Fitting, as Miranda is an ice skating fan. If a skater wants to increase their speed during a spin, they move their hands closer to their body.

(CONTINUED)
LISA
Uh, the moon and the earth are connected by gravity. So if you think of the moon as being your hand.

EMILY
Your body as the Earth.

LISA
And your arm being gravity. If the moon comes closer, the earth should spin up.

EMILY
Increasing the spin increases the gravitational force on the earth. Hence, more earthquakes.

LISA
We would also have a expect to change in the length of the day if the moon was closer.

EMILY
However, the earthquakes don’t directly impact Miranda in Pennisvanya. She and her family are more concerned with making their food storage stretch and catching diseases from mosquitoes.

One hot summer morning, Miranda wakes up and the sky was an odd color of gray.

SOUND: WRITING

MIRANDA
From what we heard on the radio, there are dormant volcanos erupting everywhere. It’s been going on for a few days now and there’s no guarantee it’s ever going to stop.

EMILY
While there are no dormant volcanos in Pennisvanya, one did go off in Canada nearby.

Miranda’s world grows cold and dark due to the volcanic ash lingering in the sky.

LISA
I always think back of the reports about a, when Krakatoa erupted in the 1800s, there were reports of vivid sunsets, so red that, firetrucks were called or fire departments were called, I think even in New York. So there’s a, you can do extreme changes to the atmosphere with one large volcanic eruption.
EMILY
Krakatoa is on Java in Indonesia. 10 thousand miles away from New York. Krakatoa’s 1883 eruption lasted roughly 2 months and impacted the entire world. Atmospheric temperatures in the Northern hemisphere dropped 2.2 degrees F. San Diego and the rest of Southern California received a record-breaking amount of rain.

In Miranda’s world, multiple volcanos are erupting globally, and they show no signs of stopping.

SOUND: WRITING

MIRANDA
The earthquakes haven’t. The floods haven’t. The eruptions may not, either.

EMILY
By August, there is frost cold enough to kill their mother’s small garden, and their food storage is getting thinner and thinner. The family skips meals and start fasting on Sundays to make it stretch. They are all losing weight.

School starts, but they more just hand out textbooks and tell kids to stay at home.

SOUND: WRITING

MIRANDA
I picked up my textbooks. Either textbooks are a lot heavier than they used to be, or I don’t have as much strength as I did three months ago.

EMILY
Miranda tries to fill her time by skating on the local pond.

SOUND: WRITING

MIRANDA
I noticed how the woods were quiet. No birds. No insects. No squirrels rustling around. No animals scurrying away at the sound of me crunching in the leaves.

EMILY
But the air is filled with ash.

SOUND: WRITING

(CONTINUED)
CONTINUED:  12.

MIRANDA
The air is so bad, I’d skate for a few minutes and then start coughing.

EMILY
And it keeps getting colder.

SOUND: WRITING

MIRANDA
I had on my long johns. Sometimes I remember how upset I was when Mom bought them last spring, and now I thank her over and over, at least in my mind.

EMILY
As heavy as this all is, Miranda and her family persevere because they make decisions together. They fight and make mistakes, like all families do, but they make sure they all have enough.

And then...

MIRANDA
They’re sick.

EMILY
Flu immobilizes Miranda’s mom and two brothers.

SOUND: WRITING

MIRANDA
The nurse says it’s like 1918, the kind that will kill you any way. And that, like them, I must be resistant to the strain.

EMILY
It is January by this point, and it’s below zero outside. Miranda had stopped noticing wildlife months earlier.

But, can a virus survive without animals to carry it?

SHANE
Definitely, because we still see that even today.

EMILY
Shane Haggard.

SHANE
In the winters and you know, the extreme north and so forth where it is much colder in this here in San Diego and you still see disease being spread even though there–, there are no bugs or everything is in (MORE)

(CONTINUED)
CONTINUED:

SHANE (cont’d)
hibernation or so. There’s no animals there to spread it. We still see disease get spread. Um, it’s very interesting that disease is, um, like the virus, the flu virus and so forth. They are very resilient. They are, you can resist a lot of extreme conditions. All right? They can go dormant and just stayed dormant until the right time for it to come out again.

EMILY
Ok. That checks out. As does the volcanic activity, the shift in tides, and the miscalculation of how dense the meteor was.

EMILY (IN INTERVIEW)
But that level of miscalculation?

LISA
Okay. Probably not.

(LAUGHING)
Okay. There is, there is a possible chance.

EMILY
Within reason, of course. Between Lisa, Shane and I, we could not find one blatant scientific fabrication. Exaggeration, maybe, but this is more than one typically expects from a young adult novel.

Yeah, if the teenager-writing-a-diary plot device wasn’t a dead giveaway, this book is YA.

Conclusion

LISA
So I have to admit when I, when I read books, I try to not, I try to allow myself to just enjoy the magic as opposed to pick out to many of the nitpicky scientific details.

What I actually did appreciate about this one is that every event, whether or not there was some dramatic spin to it or not, was something plausible? Can something hit the moon? Yes. Could the moon going into a different orbit disrupt the tides? Yes. Could that drive volcanism geological activity? Yes. Uh, so the extremes maybe not, but we tend not to write about boring things. We tend not to read about things that don’t have dramatic tension. So what I liked about it was that just the, the spin forward from these events I actually thought was a reasonable overall. Um, I, I, I don’t think author, I think the author has even admitted they didn’t do much research. They didn’t try to get that.

(CONTINUED)
EMILY (IN INTERVIEW)

Oh really?

LISA

Yeah. They didn’t want to get that bogged down by the scientific details when they wanted to tell the story of what was happening to this family and I can understand that they did, they did, they did a scientific setup and then went with the how horrible it was and how difficult it could be to survive and the beauty of trying to survive.

EMILY

My feelings exactly. There are so many, too many, post-apocalyptic stories about zombies or pestilence or nuclear war or whatever. They try to hard. They take such unrealistic leaps into technology or plague that it can feel too, well, pulpy. So few of them talk about the daily reality of starvation. Of skipping a meal because your younger brother needs it more, and making sure your mother doesn’t skip too many for the same reason.

Life As We Knew It has one catastrophe after another, but it stays within the bounds of logic because of it doesn’t dive too deep. That structure fosters a story about Miranda Evans growing up and learning to make tough, bittersweet decisions. She and her family are stronger, together. She knows what she has, and what she had.

SOUND: WRITING

MIRANDA

It’s funny how sorry I feel for Jon these days. I’m 2 1/2 years older than him and I feel like I got those extra 2 1/2 years to go to school and swim and have friends and he got cheated out of them. And maybe he’ll live 2 1/2 years longer than me, or 20 years, or 50, but he’ll still never have those 2 1/2 years of normal life.

EMILY

It’ll break your heart in the best way possible.

Credits.

EMILY

Device is co-produced by myself and Derrick Ascota. It is recorded at KPBS and Mega64 Studios in San Diego, California. John Wanser is our audio engineer, with additional music by the Bicycats.
EMILY (cont’d)
The voice actor for this episode was Crystal Waters.

At KPBS Emily Jankowski is Technical Director,
Kinsee Morlan Podcast Coordinator,
Lisa Jane Morrisette is Operations Manager,
and John Decker is Director of Programming.

You can get our monthly episodes of Device on your preferred podcast app.

Many thanks to Dr. Lisa Will and Prof. Shane Haggard for coming in and getting nerdy with us. One of the best ways to learn more about astronomy, the best time to see the various meteor showers in San Diego,

and how to recognize constellations is checking out The Sky Tonight show at the Fleet’s Planetarium. And in July they always have a ComicCon Theme.

LISA
The sky tonight show at the fleet science center in July usually has a bit of a science fiction, a twist. Sometimes we do the science of Star Wars. We’ve done the science of Star Trek.

But we always welcome people in costume for the July sky tonight show.

EMILY
This year they’ll be looking at the Universe of Comics. If you’d like a taste of what that show is like, listen to the rest of our conversation with Shane for this episode on Device Interviews, wherever you get your podcasts.

Next episode we’ll be discussing The Poisonwood Bible by Barbara Kingsolver and the truth about army ants. So get reading, it’s a long one.

Device is made possible by the KPBS Explore program.

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Thanks for listening.