Nature Podcast

Introduction

This is a transcript of the 19th April 2018 edition of the weekly *Nature Podcast*. Audio files for the current show and archive episodes can be accessed from the *Nature Podcast* index page (http://www.nature.com/nature/podcast), which also contains details on how to subscribe to the *Nature Podcast* for FREE, and has troubleshooting top-tips. Send us your feedback to podcast@nature.com.

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Interviewer: Adam Levy
Welcome back to the *Nature Podcast*. This week on the show we'll be looking at how tiny sea creatures could have big effects on our oceans. And we'll take a peek at the science of supernova explosions.

Interviewer: Benjamin Thompson
Plus, we'll be hearing about some of the latest science books coming out this spring. This is the *Nature Podcast* for the 19th April 2018. I'm Benjamin Thompson.

Interviewer: Adam Levy
And I'm Adam Levy.

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Interviewer: Adam Levy
The mixing of water in the oceans can have huge impacts on processes like climate change. Now, if you imagine what might drive this ocean mixing, you might think of things like tides, temperatures or winds. But you probably wouldn't think of shrimp. What if the movements of the animals in the oceans was impacting the movement of the ocean itself? It may seem unlikely, but John Dabiri from the University of Stanford in California is used to that kind of scepticism.

Interviewee: John Dabiri
I think the knee-jerk reaction is to rely on your intuition, and your intuition says these animals are tiny and the ocean is enormous, and so how is it possible that such small things could have an effect?

Interviewer: Adam Levy
Undeterred, John and his team set out to see if swimming shrimp really could meddle in marine mixing. Reporter Noah Baker called him up to find out more, and started by asking for a bit of background on how ocean waters mix.

Interviewee: John Dabiri
The conventional wisdom today is that the winds and the tides are the primary drivers of ocean mixing, so the wind blowing at the surface of the ocean, and the tide pulling currents

along the bottom will create eddies that eventually break and lead to mixing throughout the ocean.

Interviewer: Noah Baker
And what kind of impacts are these things having in terms of what's where in the water column?

Interviewee: John Dabiri
Well, mixing is important for the health of the ocean, of course. It helps to bring nutrients to the organisms at the surface, it helps to oxygenate the ocean as well. Perhaps, more important for us on land, is that the ocean is one our largest sinks of carbon emissions, and so understanding these processes that govern the mixing in the ocean can be important for us as well. The role of animals is something that really hasn't been considered.

Interviewer: Noah Baker
But there are a lot of animals in the ocean and they're swimming about a lot, creating, I suppose, their own miniature little currents and eddies behind them.

Interviewee: John Dabiri
That's right, even Walter Munk, who's a famous oceanographer, in a paper about 50 years ago, briefly mentioned the idea of animals in the ocean affecting its motions in the same way that the winds and the tides are known to do. It turns out he was just joking, but others including our lab have pursued this idea over the years. We've for a long time been interested in what are called gelatinous zooplankton, so think jellyfish, organisms that don't have a hard body. And we showed about a decade ago that those individual organisms might be able to lead to a significant mixing. But the larger populations in the ocean are things like krill and copepods, think shrimp-like creatures that swim in huge masses, rising vertically over hundreds of metres in some cases every day. And so, in this work we wanted to better understand what role they might play in ocean mixing.

Interviewer: Noah Baker
And you tried to understand that using essentially laboratory experiments?

Interviewee: John Dabiri
That's correct. One of the challenges we have in the ocean is not knowing exactly where these organisms will appear, but perhaps more importantly we really didn't know what the signature of their mixing would be. Would it be a bunch of tiny eddies? A swirling current the size of the individual animals? Or might there be some interactions that lead to larger-scale effects? And so rather than trying to study this in the ocean, we started with more controlled experiments in the laboratory where we can bring more tools to bear on the problem. The other important step that we took was to use an organism that we could trick into undergoing these vertical migrations dozens of times in a day, rather than once per day. And so, we used brine shrimp – the sea monkeys that you might know from a pet store – which are what we call phototactic, they're very attracted to light. And so, we could use a combination of lasers, or even LED arrays, in order to trick the animals into undergoing these vertical migrations in the laboratory.

Interviewer: Noah Baker
Okay, so there are these little brine shrimp swimming along, and they're leaving tiny eddies in the water behind them. But brine shrimp don't live on their own, they live in big groups and so what you were trying to work out was whether or not all those little eddies in a large group can add up to make a large eddy - a big effect?

Interviewee: John Dabiri
That's correct, and so you can imagine yourself as a parcel of water, and one of these small organisms comes by you, and as it's swimming up, it'll kick you backwards by a few centimetres. But what we found, is that in these large aggregations, the next animal will come and kick you a bit further down, and you'll start to pick up some speed in that downward direction. The next animal will come up and kick you again, and so it's almost like an upwards stampede in the ocean is leading to this downward rush of water to depth. And the size of the swirling eddies that are created, then become as large as the whole group itself, which can be tens of metres in the vertical direction, even though the individuals may only be a few millimetres in size. And so, it's that collective effect that we identified in these lab experiments for the first time.

Interviewer: Noah Baker
And how big do you think that effect could get? You know, what kind of impact could it start to have?

Interviewee: John Dabiri
Well, Bill Dewar at Florida State is an oceanographer who has collected some estimates of how much power is associated with these vertical migrations. And he's found that that amount of power is on par with the power of the winds and the power of the tides, something on the order of a trillion watts. The question that had remained is whether all of that power just goes into churning water locally, or whether you could get these larger eddy effects that we've seen here for the first time. So, knowing that these animals exist in climatically important regions, like the Southern Ocean, knowing that the global reservoir of power is quite large, and now knowing that there's a mechanism that exists that can allow these small animals to create this larger scale mixing, we have a lot of pretty strong circumstantial evidence that this is important. And now, the next step will be going into the ocean and seeing this directly by shipboard measurements most likely.

Interviewer: Noah Baker
Up until now, models of ocean systems haven't included this organismal impact that you're discussing in this paper - have they been getting it wrong? Have these models not been churning out results which match with the kind of observations that we can take?

Interviewee: John Dabiri
The data at present, I don't think is sufficient to rule out the possibility that we're missing an important feature in terms of animal effects, but I would also say that it's important that we get definitive field measurements to compliment these laboratory studies, before going to the ocean modellers and telling them to do things differently than what they're doing right now. But the great thing about science is that we can take measurements and find out whether we're right or not.

Interviewer: Adam Levy
That was John Dabiri from the University of Stanford. You can read his paper over at nature.com/nature, but that's not all. If you are dying to see the currents created by his synchronised shrimp swimmers, our YouTube channel has a video which should just about scratch that itch.

Interviewer: Benjamin Thompson
I mean, if that doesn't scratch your itch for synchronised shrimp, I'm not sure what will, to be honest with you. Right then listeners, this week *Nature* has published its Spring Books selection, with contains a number of gripping science reads. To find out more about this season's offering, I spoke to Barb Kiser who is *Nature*'s Books and Arts editor. I began by asking Barb what science books can offer, that news stories can't.

Interviewee: Barb Kiser
Science books are unique in that they're models of multidisciplinarity, and that is a really important thing because it shows the entire context of science - how it is lived, how it is enacted. And so, you get all of the policy issues, you get the history, you get the social sciences that feed into it, you get the cultural impact, you get the human story of the scientists involved, and that, really, often adds up to an exciting package.

Interviewer: Benjamin Thompson
There's a really wide selection of topics in this spring selection, did you maybe have a theme or a thread in mind when you picked them?

Interviewee: Barb Kiser
No, not when I put them together. When I'd chosen them because they were, you know, excellent science books, I realised that they did have some overarching theme, which was the thrill of the scientific chase. I mean, you could argue that that's true of every science book, but in these it's particularly obvious. There's a lot of dynamism in this selection.

Interviewer: Benjamin Thompson
Well Barb, you're going to give us a quick overview of a few of the books today, which one should we go for first?

Interviewee: Barb Kiser
Well the first one I'd like to pick out is *The Lost Boys* by Gina Perry.

Interviewer: Benjamin Thompson
Okay then. Well listeners, this one centres on Muzafer Sherif and his social psychology experiments, and the book explores conflict and cooperation. Barb, I must confess, I hadn't heard of Sherif, what can you tell us about him?

Interviewee: Barb Kiser
Sherif was a very interesting character in himself. He was caught between two cultures, he was born in Turkey and spent a great deal of time in the Unites States and became a citizen, and his life was one of definite conflict and cooperation. Apparently, he was caught up in all the restlessness that was occurring post-war because huge populations of people were

moving back and forth. So, I think, that it's not really very surprising that he chose to examine conflict. He chose to examine it through 11 and 12-year-old boys in summer camps across the United States. The boys did not know that they were being observed or investigated and the result was really quite extraordinary.

Interviewer: Benjamin Thompson
Goodness, well, what was he looking to understand?

Interviewee: Barb Kiser
What Sherif was looking to find out, was simply the dynamics of conflict and cooperation. In some of the experiments he divided the boys into groups and they befriended each other inevitably, but then he redivided the groups so that they cut across the friendships. All of this was a way of studying how conflict emerges, how it is expressed, and it was very dramatic. The final results showed that these extremely polite, what you would call well-brought-up**,** boys of the time, became extremely aggressive. But he also worked at reknitting the groups under various manipulations.

Interviewer: Benjamin Thompson
Mm, and it seems there are a lot of ethical issues to unpick there as well. But, for any listeners interested in reading this book, what would they be getting a sense of? Is it the experiments, is it the participants, or Sherif himself?

Interviewee: Barb Kiser
It's about all three. It's as much a psychological portrait of Sherif, as it is a portrait of those times, and of these particular boys and these particular experiments. It's a really fascinating package.

Interviewer: Benjamin Thompson
Well, let's move on to our next book though, and we're going to talk about *Losing the Nobel Prize: A Story of Cosmology, Ambition, and the Perils of Science's Highest Honour* by Brian Keating. Now, I think the title might have given us a bit of a hint, but what can you tell us about this one?

Interviewee: Barb Kiser
Yes, this is a really intriguing two-pronged book. Keating is a cosmologist, and he worked on the well-known BICEP 2 project, but I would say that the bulk of the book is really about the Nobel. So, it's a bit of a manifesto, or say a call for reform of the biggest gong in physics.

Interviewer: Benjamin Thompson
And what suggestions does he offer as to how the prize might be modified?

Interviewee: Barb Kiser
Keating has some very unusual ideas for how the Nobel Prize in Physics should be reformed. Possibly the most surprising, is that he strongly believes that it should be awarded for serendipitous findings, rather than findings that the team set out to seek. He also believed that the Nobel should go to entire teams, which obviously militates against the present

system which is just for three, a maximum. Finally, he believed it should be awarded posthumously, and of course it currently isn't.

Interviewer: Benjamin Thompson
So, is the book then an expansion of these kind of three points, or is there kind of more to it and can you see the benefits and the potential failures?

Interviewee: Barb Kiser
Yeah, there's a great deal of expansion, but I believe that Keating is simply throwing these ideas out there, and I think that he has a realistic sense of how science itself works. And in fact, the reviewer of this piece Ron Cowen, says that the US and European systems for allocating funding and tenure encourage cutthroat competition, so until those engrained systems are modified, we may see no change in the Nobel.

Interviewer: Benjamin Thompson
Alright then Barb, well listen, let's go for one more, and why don't we choose *Chasing Men on Fire: The Story of the Search for a Pain Gene*, and that's by Stephen G. Waxman. What can you tell us about this one?

Interviewee: Barb Kiser
So, Waxman is one of the prime researches in this area, and thus this book is a laying out of his part in the chase for this pain gene, as well as the work of other scientists that fed into this. The condition at the centre of this book is called erythromelalgia, and it's called 'Man on Fire' syndrome, hence the title of the book. What makes this book special, is that it never loses sight of the fact that there are people at the end of medical and genetic research that are being affected by these conditions. But, it very much puts you right at the centre of that thrill of the chase, again, playing out across many continents as Waxman and his distant colleagues conducted this research.

Interviewer: Benjamin Thompson
How is it set up then Barb, is this like a chronological account, or is it jumping about? How is it laid out?

Interviewee: Barb Kiser
It is chronological, and what makes the book really special and very suitable for both scientists, young scientists starting out in this field, as well as general public, is that 11 original research papers are actually woven into the text. I've never seen a popular science book like this. So, you get that, and you also get extremely well-written context from Waxman, who is just wonderfully able to contextualise and describe the human stories behind this search, as well as of people who live with chronic pain.

Interviewer: Benjamin Thompson
That was Barb Kiser. You can find the reviews to all of the books over at nature.com/news.

Interviewer: Adam Levy

And speaking of news, at the end of the show we'll have the News Chat where we'll be hearing about a deadly tick-borne disease. Plus, a new satellite to keep track of a powerful greenhouse gas. Up next though, it's Ellie Mackay with this week's Research Highlights.

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Interviewer: Ellie Mackay
We all know the early bird catches the worm, but does it ever share? Researchers in the US have identified a hormone in pinyon jay birds which may play a role in sharing behaviour. Mesotocin is the avian form of oxytocin, the molecule linked to maternal behaviour and social bonding in mammals. The scientists found that jays given a dose of mesotocin were more likely to share mealworms with their neighbours, although only provided they had enough food themselves. So, while the hormone might not encourage fully altruistic behaviour, it seems as though it may increase beneficial socialising among our feathered friends. If you'd like to share that story, you can find it in *Biology Letters*.

[Jingle]

Interviewer: Ellie Mackay
An antibody based injection can provide monkeys with long-lived protection against simian HIV, according to new research. The team involved modified two human HIV binding antibodies, to increase the molecules life span, allowing them to remain in the monkeys' bloodstream for up to four times longer than unmodified antibodies. Injections of these modified antibodies protected the monkeys from simian HIV infection for a median of 20 weeks. In the absence of an effective vaccine against human HIV, the researchers hope that these antibodies could form part of a regular prophylactic treatment to prevent infection. Read more on this research over at *Nature Medicine*.

[Jingle]

Interviewer Adam Levy
Everyone loves watching super slow-motion videos, from dogs running along with their ears flapping, to bullets smashing through vases. I'm even partial to a slow-motion shot of someone getting hit in the face with a water balloon – priceless! Well, this week reporter Shamini Bundell has been learning about slow-motion models of a very different kind of explosion. Astronomers and physicists have been slow-motion simulating exploding stars.

Interviewer: Shamini Bundell
From the iron in your blood to the silicon in your computer, the universe is filled with atoms that were made in stars. For the heavier elements, huge amounts of energy were needed to make them, specifically the energy released when some stars die.

Interviewee: Hans-Thomas Janka
Stars live like humans, they don't live endless, they die, and those massive stars at the time of their death create extremely spectacular explosions.

Interviewer: Shamini Bundell

This is Hans-Thomas Janka. He's a physicist working on a decades-old astronomical mystery: why do certain stars end their lives in dramatic supernova explosions? And there's a lot of physics involved in unravelling this mystery.

Interviewee: Hans-Thomas Janka
Nuclear physics, hydrodynamics, general relativity, elementary particle physics…

Interviewer: Shamini Bundell
One elementary particle that's thought to be very important is the neutrino, a tiny particle which interacts with matter only very weakly, but could be vital for driving the supernova explosions. To test this, and to understand the rest of the complex physics involved in the supernova, astrophysicists have turned to simulations. This is a serious computational challenge, as Thomas explained when I gave him a call. So Thomas, how hard is it to create a model supernova?

Interviewee: Hans-Thomas Janka
So if we wanted to have the answer of how a star explodes, and we had only a desktop computer available, we would have to calculate 8000 years. So we have to go to massively parallel supercomputers, and to get the answer for one star – whether it explodes, how it explodes, when it explodes – we still need to compute for at least half a year, sometimes even longer.

Interviewer: Shamini Bundell
So it's almost like you're watching a star explode in very, very slow-motion.

Interviewee: Hans-Thomas Janka
Exactly, extreme slow-motion. All the physics which leads to explosion takes one second, essentially.

Interviewer: Shamini Bundell
So, for decades when people have been trying to model supernova explosions, there just wasn't the computer power available to model it in a detailed manner, and you needed to be able to model the neutrino physics going on inside the star as well, which is thought to be an important part of why they explode, so these recent models must be a pretty big deal, even if they do take half a year to run.

Interviewee: Hans-Thomas Janka
The big breakthrough which was possible a couple of years ago, some five years ago from now, was that we for the first time could do these simulations in three dimension. And with the first generation of models that we started in that of this new generation of three-dimensional models, we did not find explosions, at least not for the first models we tried. And that led to the conclusion that either we explored the wrong stars, that we don't look at the right conditions, or what maybe also the problem is that we are missing some crucial ingredient still in the modelling.

Interviewer: Shamini Bundell

So people were really expecting that now these new models would be able to reveal the inner working there, and I guess the fact that they then didn't explode is sort of missing the key element of what makes a supernova a supernova.

Interviewee: Hans-Thomas Janka
Absolutely. Not obtaining explosions of course was a big disappointment, and created some desperation and people already thought maybe the neutrino-driven mechanism is not the right explanation at all.

Interviewer: Shamini Bundell
And it must be quite frustrating to have to wait so long between each experiment to see if the latest one is going to work, but you and other teams did manage to reach a point where your simulations did explode. You tweaked some of the neutrino physics and the model stars did go supernova. Does that mean that the physics is now accurate, you've kind of solved it all and these simulations represent reality?

Interviewee: Hans-Thomas Janka
Well, I think at the moment, I personally would be willing to only draw one conclusion from these simulations. Namely, that I think they support the idea of the ordinary supernova explosions, the majority of supernova explosions, being driven by deposition, that is what we call the neutrino-driven explosion mechanism. Still, we have not been able to produce many explosions, there's a handful or maybe let's say in total around the globe, so far, roughly let's say a dozen of three-dimensional simulations with good or very good neutrino transport, which shows explosions. So in order to really arrive at the point of saying that the models are now converged, everybody agrees we need more models, and we need the comparisons of modelling efforts by different groups.

Interviewer: Shamini Bundell
And are there still things you can learn from astronomy, and observations of actual supernovae in space?

Interviewee: Hans-Thomas Janka
Of course we can, I mean that is the crucial test for our models, we need to compare the model predictions to observations.

Interviewer: Shamini Bundell
And I know that a lot of astronomers are hoping to be able to observe a supernova in our galaxy, or one that's close enough to get way more information on than we get from the many, many, very distant supernovae that we observe. What impact would that have on your models?

Interviewee: Hans-Thomas Janka
So that is, really, I would say a dream for an astronomer and for NASA physicists such as myself working on supernovae, that we have a galactic supernova. I mean, in this case of course, we would not only have one just in front of our door, probably observable from the very first moment, we would also get signals that we have not had so far. Gravitational waves, because of these turbulent and mixing processes in the supernova core, gravitational

wave emission will take place. And also of course we hope we will get, we are sure, we are confident, that we will get a neutrino signal which is measured with high precision, which comes directly from the core of the supernova, so direct evidence of what is going on in the supernova core when the explosion begins.

Interviewer: Adam Levy
That was Hans-Thomas Janka of the Max Planck Institute of Physics in Garching, talking to Shamini Bundell. Over on nature.com/news we've got a feature all about this work. We've also got a short film which explains some of the physics inside the new model supernovae. It's a sight to behold, so, to see it for yourself head to youtube.com/naturevideochannel.

Interviewer: Benjamin Thompson
Now it's time for the News Chat, and I'm joined in the studio by Richard Van Noorden, Features Editor here at *Nature*. Hi Richard.

Interviewee: Richard Van Noorden
Hi Ben.

Interviewer: Benjamin Thompson
Well let's head over to East Asia for our first story today then, and it's one where healthcare professionals are getting ready for the upcoming annual wave of a particular virus. What can you tell us about this one?

Interviewee: Richard Van Noorden
This is a tick-borne virus, and it causes a disease with a very long name, it's called severe fever with thrombocytopenia syndrome. It's just called SFTS for short, and thrombocytopenia syndrome is when you have very low levels of thrombocytes or platelets in your blood. So, if you catch this, it's very nasty, you get a high fever, you have a very low platelet count that can cause bleeding and bruising, you can have gastrointestinal problems, and quite worryingly, quite a large proportion of people who catch this virus actually die, it's lethal in many cases.

Interviewer: Benjamin Thompson
Hence why the kind of the health care folk are getting ready then?

Interviewee: Richard Van Noorden
Yeah, so in March this year, Japan launched the very first clinical trial of a drug to try and treat this disease, there's no way to treat it, and some researchers say that governments in East Asia should devote many more resources to raising awareness and studying the virus. What's causing concern is that the disease is rising in incidents, and that signs that the virus can spread more easily than previously thought. So, just to run through the numbers, it was first reported in China in 2009, where it killed 30% of those infected that year.

Interviewer: Benjamin Thompson
Oh my goodness.

Interviewee: Richard Van Noorden

Yeah, and in Japan and South Korea in 2013, more than a third of those infected in Japan died that year, and nearly half of those in South Korea died that year. But, that sounds a little bit more concerning that it really, because as cases that we know about have gone up, the lethality appears to have gone down, which is probably just an effect of much wider surveillance, where we're recognising the mild cases as well as the more severe cases. So, In China only around 3% of people infected died in 2016. So, your chances of surviving it appear to have gone up as we learn more about this virus.

Interviewer: Benjamin Thompson
Well, only 3% there, and listeners, heavy air quotes there from me for 'only', who is at risk of this virus then?

Interviewee: Richard Van Noorden
Well, just to be cautious, again, this virus is not expected to evolve into a rapidly transmitted disease like Ebola, the real problem areas are generally limited to people like farmers, or hunters, who come in to contact with the animals that carry the tick that harbours the virus.

Interviewer: Benjamin Thompson
Yeah, I guess a lot of tick-borne diseases are what are known as zoonosis, I guess they come from an animal reservoir and sort of spill over into humans. Do we have any idea in this case what the reservoir for this particular tick-borne virus is?

Interviewee: Richard Van Noorden
Well goats, cattle, sheep and deer all expose humans to the ticks, and they're often infected without showing any symptoms. But, slightly worryingly, there were two reports from Japan last year, where one woman was likely fatally infected through a cat bite, and another report was that a man had been infected by his dog. That suggests that we have to add new warnings to the risk of touching sick domestic animals, as well as animals that hunters and farmers might come into contact with. So, why have the numbers gone up? Well, is it heightened awareness, is it growth in the number of ticks in the animals that carry them, or are humans encroaching on the areas where the disease is endemic? So, it's not entirely clear, but researchers say that they have lots of questions about how the virus spreads and why it's going up. And right now we're in the period where warm weather is returning to East Asia and people are flocking outdoors where they come in contact with the ticks, so the season is just beginning for this year's edition of the virus.

Interviewer: Benjamin Thompson
Mm, so a bit of watch this space then.

Interviewee: Richard Van Noorden
Exactly. Japan's clinical trial is with in an influenza drug, that was very effective against Ebola during the West Africa outbreak. And interestingly, Ebola and SFTS, these viruses share similar molecular structure, so there's hope that the drug will be effective. But as of now there's no particular way of treating the virus beyond generalised treatment for fever and recognise the condition early.

Interviewer: Benjamin Thompson

Well Richard, with a lot of emerging diseases, and it seems like this one fits in that particular envelope pretty well, climate change can be involved, you know altering animal population distributions and things like that. For our next story, let's talk about a greenhouse gas very much involved in climate change, and that's methane, and about a new satellite. What are we looking at in particular?

Interviewee: Richard Van Noorden
We're looking at potentially the first satellite from an environmental group. This is the Environmental Defence Fund which wants to launch a satellite to track emissions of methane. It's been awarded tens of millions of dollars to start doing this, funded by something called The Audacious Project.

Interviewer: Benjamin Thompson
It's an amazing name.

Interviewee: Richard Van Noorden
It's a brilliant name. It's partly funded by the Bill and Melinda Gates Foundation, partly by the non-profit group TED of TED Talks, so kind of exciting new way of funding a space mission run by an environmental group, not by a government. And the idea here is that this satellite, planned to be called MethaneSAT, could launch as early as 2020.

Interviewer: Benjamin Thompson
Right, so MethaneSAT there, I mean, 8they've given it the name to describe what it does, I suppose, is a satellite looking at methane, what in particular is it going to be looking at though?

Interviewee: Richard Van Noorden
The EDF wants to look at methane emissions from oil and gas facilities. It's already pointed out that methane leaking from the wellhead, all the way to where oil is distributed, that amount of methane could be up to 50% higher than official estimates of how much of this gas is leaking. And that's a real problem, because methane is a very potent greenhouse gas, it traps heat much more effectively than carbon dioxide does. And according to some estimates, it could be up to 9% of US greenhouse gas emissions in total. And, at the moment we don't actually know that much about where the methane is leaking from. The problem is that we do have a satellite in space measuring methane, it's coming from a sensor aboard the European Space Agency's Sentinel spacecraft. Now, that looks at the Earth at a resolution of nearly 50 square kilometres. So that's not really enough to capture the individual leaks of methane from oil and gas fields, you can just see it mixing at this coarse resolution. Commercial firms who actually produce the oil and gas, they've got their own sensors that look in a very detailed fashion at individual oil wells, and they can be placed aboard very cheap, sort of ten-centimetre-sided CubeSats. Unfortunately, those data are a) propriety to the company, and b) you can't easily scale up those individual measurements to the level of an entire oil and gas field. So what MethaneSAT is doing, is providing precise measurements at about 1 square kilometre resolution, with global coverage at least once a week, and the idea is to plug that all in together to calculate cumulative leaks and emissions across larger areas.

Interviewer: Benjamin Thompson
You say there that oil companies maybe like to keep hold of their own data, will the data from this satellite be shared in a different way?

Interviewee: Richard Van Noorden
Yeah, the EDF publishes all its data, so it definitely intends to make everything public. One of the issues with this satellite, which sounds like a great idea, is its cost.

Interviewer: Benjamin Thompson
Yes, what's the magic number?

Interviewee: Richard Van Noorden
So our story says: 'The EDF declined to provide a cost estimate for its satellite because the design remains in flux.' But it says it's likely to be in tens of millions of dollars, so it's needing extra support from philanthropists to operate the satellite once it's in orbit. So, the EDF's chief scientist Steven Hamburg, he says we're going to be the first of this new model for funding these targeted space missions, but he thinks that as it becomes cheaper to launch satellites into space, we're going to see this approach be used by others as well.

Interviewer: Benjamin Thompson
Thanks Richard. For more on the latest science news, head over to nature.com/news.

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Interviewer: Adam Levy
That's it for this week's show. And listeners if you'd like to get in touch, you can do so via Twitter, we're @NaturePodcast. Or if you'd prefer, you can drop us an email: podcast@nature.com. I'm Adam Levy.

Interviewer: Benjamin Thompson
And I'm Benjamin Thompson. Thanks for listening everyone.

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