Science Magazine Podcast

Transcript, 24 October 2008 show

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Music

Host – Robert Frederick
Hello and welcome to the *Science* Podcast for October 24th, 2008. I'm Robert Frederick. This week: measuring the oscillations of stars hotter than the Sun; how physical warmth promotes psychological warmth; and the wrap-up of *Science*'s pre-election coverage of how U.S. presidential candidates John McCain and Barack Obama view science. All this and more, plus our usual roundup of stories from our free, online daily news site, *Science*NOW.

Promo
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Music ends

Host – Robert Frederick
Stars are the engines of the Universe, making the elements that make up everything else. To get a better understanding of stars, the national space agency of France along with the European Space Agency launched the CoRoT satellite in late 2006. Equipped with a space telescope, among other things, the satellite has been monitoring the light intensity of three stars. And these stars, like the Sun, oscillate at thousands of different frequencies simultaneously. If you transpose these oscillations 18 octaves into our aural range, you can actually hear the difference between stars. For example, here is a star known as HD 49933.

[star sound HD 49933]

And here is the star HD 181906, again transposed 18 octaves.

[star sound HD 181906]

In a paper in this week's *Science*, Eric Michel and colleagues report this oscillation data from the CoRoT satellite and the extent to which these oscillations are similar to those of the Sun. The research will help in refiguring models to make better sense of stars in general, and, in particular, how these stars evolved and how old they are. I spoke with Michel from his office at the University of Paris.

Interviewee – Eric Michel

We are talking about measuring very low variation in the light, quantity of light received from the stars. Such results have been expected by the international community working on thermophysics for more than twenty years, and that they are expected to open a new way to look at the stars. And they offer us the possibility to compare the theoretical prediction and the theoretical models with stars which are different from the Sun, in various aspects, and that this is important to test this model.

Interviewer – Robert Frederick
What are the oscillations that already have been observed in our Sun?

Interviewee – Eric Michel
Variation in the light curve received from the Sun, and they are being used, for instance, to probe the Sun and know how the temperature is increasing inside the Sun, how the rotation, how the Sun is rotating below the surface, things like this. So, the idea now is to do the same with other stars and to see how other stars with different masses, different chemical composition, different temperature, or different rotation behave, to help to improve our understanding of their stellar structure and evolution.

Interviewer – Robert Frederick
So, you were testing the theoretical underpinnings for how the Sun works against these other stars?

Interviewee – Eric Michel
Yes, the point is that all what we know about stars, at the moment, has been according to models, which have been compared with the Sun mostly, and with other stars but through observation of the surface of those stars.

Interviewer – Robert Frederick
And, did you find that these other stars were similar or different?

Interviewee – Eric Michel
In the present case, they are somewhere in between, I would say. Their oscillations, for instance, can be compared to the Sun, and are the same kind of oscillations, working with the same kind of process, but in slightly different conditions. And, at the same time, they are sufficiently different to help to probe the effect of different parameters of light, temperature, or rotation. In this case, the idea is to have stars which are close to the Sun but different enough, to tell us something new.

Interviewer – Robert Frederick
What do you expect to learn from these measurements – the change in how the various oscillations of these other stars work?

Interviewee – Eric Michel
Yes, it's to be seen, but what we expect, we expect results and confirmation or information from the few crucial points, one of them being the evolution, the age of the stars, which means the speed at which they evolve. So, it becomes possible to test this

kind of thing with such observations. If we can reach these goals we could help to fix the determination of the age of the stars much more precisely than it is at the moment. Because at the moment, when you look at the stars, you cannot say – you have an uncertainty factor of about approximately 50%.

Interviewer – Robert Frederick
And knowing the age more precisely will help how exactly?

Interviewee – Eric Michel
Well, then you have to consider stars in the global context, which means that stars are elementary blocks, the elementary units of, surrounding, the universe.

Interviewer – Robert Frederick
Is the CoRoT satellite sensitive enough for long–term study of stars very, very far away, or are we only going to be looking at – with this satellite – stars that are nearby?

Interviewee – Eric Michel
Well, we for observational reasons, in fact, because we are looking at very, very low amplitude oscillations, very low amplitude signal, and so we have to select the brightest stars. It may be possible to have a representative set of stars to look at, but of course the brighter the star the better the information we get. So, we do not select preferentially distant stars.

Interviewer – Robert Frederick
Eric Michel, thank you very much.

Interviewee – Eric Michel
Okay, thank you.

Host – Robert Frederick
Eric Michel is lead author of a paper on the oscillations and granulation in stars hotter than the Sun. Read the paper and a related Perspective in this week's *Science*.

Music

Host – Robert Frederick
Now with a policy update, *Science* deputy editor Barbara Jasny is here with three recent international announcements that reflect important developments in science and technology in the Middle East.

Deputy Editor – Barbara Jasny
First, the Organization of the Islamic Conference, an intergovernmental group of 57 Islamic countries, has decided to create an Islamic Citation Center. The Center will track scientific publications and activity. It will also promote cooperation among Islamic scientists and science and technology institutions. The long–term goal is to improve the quality and impact of research in Islamic countries. Funding for the Center will come

from the government of Iran, and it will be managed by an international committee headed by the Iranian Ministry of Science, Research, and Technology.

Second, the United Arab Emirates is planning to create the Middle East's first international center for telecommunications research and technology. The "Etisalat BT Innovation Centre" is expected to start up in early 2009 at the Abu Dhabi campus of the Khalifa University of Science, Technology, and Research. It will be supported through a joint agreement between Khalifa University and two telecommunications companies – Etisalat and BT.

Finally, the Egyptian government has signed an agreement with the computer technology company IBM to jointly invest roughly 30 million dollars as part of a three–year partnership to create the first North African nanotechnology research center in Cairo. Starting up in January 2009, the center will have a research agenda that will include alternative energy sources, energy recovery, and simulation software. IBM is also involved in a collaboration to build the King Abdullah Institute for Nanotechnology in Saudi Arabia.

Host – Robert Frederick
That was deputy editor Barbara Jasny with a policy update from *Science* and the AAAS Center for Science, Technology, and Congress.

Music

Host – Robert Frederick
The next time you need to make a good first impression with someone, you might want to hand him or her a warm cup of coffee. In a paper in this week's *Science*, Lawrence Williams and John Bargh showed that this kind of "unconscious priming" with a warm object – including, literally, handing someone a cup of coffee – can affect how people think and behave: physically warm objects promote psychological warmth, and likewise, physically cold objects promote psychological coldness. I spoke with Williams from his office at the University of Colorado in Boulder.

Interviewee – Lawrence Williams
What we found is that people are very sensitive to their physical environments, and they're very sensitive to warmth information. And, this paper demonstrates that there's a pretty close association between physical warmth and interpersonal psychological warmth, such that incidentally holding something that's warm or cold to the touch can influence how you feel about other people. It can also influence the type of choices you make, as far as other people are concerned.

Interviewer – Robert Frederick
So, how exactly did you test whether physical warmth promoted psychological warmth towards another person?

Interviewee – Lawrence Williams

So, what we did is we used a priming manipulation, priming technique. What that means is that we exposed people to a stimulus, environmental cue, and in our case, manipulated whether or not that cue was physically warm or physically cold. We had people hold a cup of hot coffee or a cup of iced coffee, and that was the essence of our manipulation. And, in doing this, we could essentially determine whether or not there's an association between physical warmth and psychological warmth by comparing differences in these two groups of people, on our measure, which was taken from a classic paper on social psychology, by Solomon Nash, that was published in 1946, that was the first demonstration of this sort of notion or idea of interpersonal warmth, as far as psychology is concerned. In that measure, we presented participants with a six–word description of an ambiguous person, we called them person A, to keep it – I said 'him' but we wanted to be as gender neutral as possible. And, we just described person A as being industrious, cautious, determined – traits that have nothing to do with the idea of being a warm or a cold person. And then, what we asked participants to do is to rate person A on a series of traits, half of which were related to the idea of being a warm or cold person. We also had them rate person A on traits that are unrelated to the warm/cold dimension. And, what we found was that there was a significant difference between the two groups, and their ratings of person A on the warm traits, such that participants who help the hot coffee cup saw person A as being more generous, more sociable. The people who held the cup of iced coffee saw person A as being less generous, antisocial, selfish. But, we didn't find a difference, between the two groups, on ratings on the traits that were unrelated to the idea of being a warm or cold person – things such as honesty, attractiveness, being strong. So, there wasn't just a global positivity sort of bias that holding something warm makes you feel good, and then you just see more goodness, in general. There was a very specific association between sensations of physical warmth and judgments of interpersonal warmth, in this, again fictional, stranger.

Interviewer – Robert Frederick
So, you found a way to put a warm cup of coffee or a iced cup of coffee into the participant's hand.

Interviewee – Lawrence Williams
Yes. We actually had to be pretty sneaky about how we had participants hold this coffee cup, without really cluing them in to the fact that the coffee cup was the critical aspect of our experiment. So, we had a confederate meet participants on the first floor of the psychology building, and on their way up to the lab, she was holding some textbooks and a clipboard, and also a coffee cup that was either hot or iced. And, you just sort of incidentally briefly innocuously ask participants if they wouldn't mind holding her coffee cup as she jotted down some information – the time, their participation, their name – and then took the coffee cup back while they were on the elevator and then brought them into the lab. So, participants had no idea that holding that cup was the critical aspect of the experiment. They thought that once they came into the lab, filled out their consent forms, and then were given the questionnaire packet where they were evaluating person A that that was essentially the entire experiment.

Interviewer – Robert Frederick

Still, though, were there any concerns that the experimenter who handed off that coffee cup may have influenced the participants in some way?

Interviewee – Lawrence Williams
There were, there were. So, we did have those concerns, and that's essentially why we ran the second study – to eliminate any possible experimenter bias from these results so that we can have a better handle on the extent to which the warm/cold manipulation itself per se led to these significant differences between the two groups.

Interviewer – Robert Frederick
And, what was in the second study? What happened there?

Interviewee – Lawrence Williams
So, in the second study we had participants hold and evaluate either a warm or a cold therapeutic pad, pads that either become instantly hot or instantly cold. And, we had participants retrieve these pads, after they started the experiment, so they didn't have any contact with the experimenter. And afterwards, we didn't want to sort of use the same exact dependent measure, we were influenced by some work that showed that, as far as priming effects are concerned, that they can influence your judgements, they can color your judgements and your feelings, but they can also influence your, like, the self. They can change people's behaviors, so it's not only about perceiving warmth in others, but it can also perhaps lead to an increase of feelings of warmth in oneself. And, in order to do this as our measure, we asked people to make a choice. And, participants weren't aware that this choice, again, was what we were really interested in – they just thought that this was the end of the experiment, after they had evaluated these two therapeutic pads. We didn't particularly care about their evaluations, we just wanted an excuse for participants to actually hold the two therapeutic pads, either the hot pad or the cold pad. But, what we asked participants, at the end of the study, to do was to choose, as a reward for participating, either a gift that they can give to a friend, or we framed it as something that they could take for themselves. What was key for us was the framing of the gift. And what we found, again, consistent with the idea that having this sort of physically warm experience can create a sense of interpersonal warmth in participants. Participants who held the hot therapeutic pad were more likely to choose a gift for a friend; whereas participants who held the cold pad, the icy pad, were more likely to choose a reward for themselves.

Interviewer – Robert Frederick
What accounts for this effect, in which people seem to transfer their feeling of physical warmth with the psychological feeling of interpersonal warmth?

Interviewee – Lawrence Williams
We think that these results reflect a deep association between physical warmth and psychological warmth in people. It's a little bit up to debate in how that association is formed. It could be that this is something that people learn very early in life, through their interactions with a caretaker, so being held. But, these associations are reflected in our mental architecture and the structure of our brains. Recent neuroscience findings

have shown that the same brain area is responsible for processing, or particularly active in processing, information related to temperature, monitoring temperature change, perceiving temperature changes in the environment. And, that same brain area, the insula, also is particularly active in processing information related to sort of interpersonal warmth, how trusting we find others, perceptions of trust in other people, feelings of social exclusion or inclusion.

Interviewer – Robert Frederick
What does your research mean, then, beyond say making sure to hand someone a cup of hot coffee, if you're trying to make a good first impression?

Interviewee – Lawrence Williams
Well, I would say that that's certainly one potential application or implication of this work. For us, the basic finding is that we need to sort of be fully aware of just how sensitive people are to their physical environments, and how subtle cues in the environment are capable of shaping our thoughts and feelings and our decisions and behaviors in the moment. And this research speaks to the importance of the idea that we have to be sensitive to the lessons from development, in terms of our adult decisions. And, human development, the idea that being taken care of, like having close contact with a caretaker, having those experiences of warmth and affection, both physical and then also psychological warmth, are critical for modern day adult judgments and decisions.

Interviewer – Robert Frederick
Well, Lawrence Williams, thank you very much.

Interviewee – Lawrence Williams
Thank you.

Host – Robert Frederick
Lawrence Williams is lead author of a paper on how experiencing physical warmth promotes interpersonal warmth. Read the paper in this week's *Science*.

Music

Host – Robert Frederick
Many scientific issues are never discussed during presidential campaigns. After all, there are more pressing things for voters to think about besides, say, whether the next big space mission should go to Jupiter or Saturn. But that decision, along with many decisions that will be made by the next president concern scientific issues. In this week's *Science*, deputy news editor Jeffrey Mervis has compiled two sets of those issues – one set that the candidates are both talking about now and one set whoever is elected will have to think about once he gets into office.

Interviewee – Jeffrey Mervis

What we wanted to do is let people know about some issues that haven't gotten any attention on the campaign trail, for perfectly understandable reasons, but that the next president is going to have to face sometime in his first term. In other words, he hasn't talked about them on the stump, but you're going to hear them in the news sometime after he takes office.

Interviewer – Robert Frederick
So we're not talking about issues like the economy or energy or space or health – we're talking about issues that are scientifically important, but maybe not hitting the mainstream media.

Interviewee – Jeffrey Mervis
Right, well they are issues that sort of take a side seat -- I won't say a backseat -- to those issues. So, you'll hear them talk about energy independence and reducing greenhouse gases, but you won't hear them talk about whether you can regulate carbon dioxide emissions using the Clean Air Act. But, they're going to have to deal with that. Likewise, you'll hear them talk about terrorism, you may even hear them mention bioterrorism, but you won't hear them talk about reducing the chances of having the research being misused and what the guidelines should be, so that scientists can stay on the right side of that line.

Interviewer – Robert Frederick
So, this spread in the magazine is on one side a report card, and on the other a description. Tell me about the report card, first.

Interviewee – Jeffrey Mervis
Right. Well, we decided to put together what you could call "bumper stickers" on some three dozen issues. These range from basic research to immigration to space and health. They're things that they've talked about; they're things that they've issued white papers; they have science advisors in some cases; they've had debates; and, we try to summarize them. It's very succinct, and some readers may feel that we've oversimplified, and we apologize. But, we thought it would be a helpful scorecard for people to look at before they go to the polls, if they haven't made up their mind, or just to confirm what they think, where each candidate stands. We've also made the comparison with the current administration because we wanted to give people a baseline. Too often candidates say they will do more, or they will do less, and we wanted to make it easy for readers to understand where we are now.

Interviewer – Robert Frederick
So, page two of this spread.

Interviewee – Jeffrey Mervis
Right. So, page two of this spread picks ten issues that haven't gotten attention, but that one way or another, the new president and his administration is going to have to tackle. Some of them have to do with regulation; some of them have to do with abiding by laws that Congress has passed; some of them have to do with decisions that involve the

president's vision. For example, picking a long–term mission to an outer planet is something that NASA is going to have to do fairly early in the new administration. You don't hear them talk about it on the campaign trail, but they are going to have to "get up to speed" and either, with their new NASA administrator or other advisors, decide what course they want to take for that next step.

Interviewer – Robert Frederick
How about the Office of Science, itself? I understand that President Bush had moved that office essentially across the street. Is that something that either candidate has weighed in on?

Interviewee – Jeffrey Mervis
Well, both candidates have separated themselves from President Bush, and have promised to restore the integrity of the process by which decisions are made that use science as a basis. But, that's easy to say, the harder part is giving that advisor, and those administrators, an important role to actually make decisions. A lot of scientists feel that the current title of the Science Advisor doesn't give him an equal seat at the table, and they have urged each candidate to upgrade that position to Assistant to the President for Science and Technology. Senator Obama has recently said that he would do that. Senator McCain has not been explicit. But, in either case, the important thing is what happens after they name that person to the position, and give him his responsibilities.

Interviewer – Robert Frederick
Well, that addresses how the president potentially will view the office of science, how about the position of U.S. as a science global player with other countries?

Interviewee – Jeffrey Mervis
That's an important issue, and a lot of people think that the United States isn't keeping up its end of the deal. International projects are more and more common because of the rising cost of any particular scientific facility. And, the United States is involved in several of them. The one that's currently being built, an international fusion reactor, called ITER, is being paid for by several countries, although it's located in France. Last year the U.S. decided not to put up its share of its contribution for that year. The next president is going to have to not only decide whether to keep the U.S. in the project but also convince our partners that we are reliable, and can be counted on, for years to come.

Interviewer – Robert Frederick
Jeffrey Mervis, thank you very much.

Interviewee – Jeffrey Mervis
Thank you, Rob.

Host — Robert Frederick
Science deputy news editor Jeff Mervis, on science and the U.S. presidential elections. Find the article, as well as other election 2008 coverage, at www.sciencemag.org/hottopics/election08.

Music

Host — Robert Frederick
Finally today, Erik Stokstad, managing editor of *Science*'s free, online daily news site, *Science*NOW, joins us to talk about the latest science news. Hi, Erik.

Interviewee – Erik Stokstad
Hi, Rob. Good to be here. We've got three things to talk about today. First, it's going to be why women get more cavities then men; then we're going to talk about a neat transitional fish fossil, some new insights there; and finally, wrap up with a surprising discovery about supermassive black holes.

Interviewer – Robert Frederick
Okay, so why do women get more cavities then men?

Interviewee – Erik Stokstad
It's actually not a new phenomenon. People have known that this was true, ever since pretty much people invented agriculture, that women get more cavities then men.

Interviewer – Robert Frederick
So, what's new here, then?

Interviewee – Erik Stokstad
What this anthropologist did was look at many published studies of tooth decay, in tens of thousands of teeth, both from prehistoric humans and modern humans, all around the world from about 12,000 years ago to 800 years ago. And, he found, as people had thought, that women consistently had more cavities in their teeth than men did and do. The idea here that's new is that it might have something to do with fertility because the transition to agriculture not only made more food available, and more sugar–rich food, but it also made women more fertile, and there the connection is that pregnancy leads to a couple of changes that impact teeth.

Interviewer – Robert Frederick
Like what?

Interviewee – Erik Stokstad
Well, in addition to the boost in female sex hormones, pregnancy reduces the amount of saliva, and saliva has antimicrobial properties, and as everybody knows, pregnancy also increases the urge to eat, and to eat energy-rich food like Snickers bars or other things that might impact your teeth.

Interviewer – Robert Frederick
So, does this suggest a new study, say of how much being pregnant contributes to cavities, in general, not just with the ancient women's teeth but with women today?

Interviewee – Erik Stokstad
Well, one thing you could look at is whether the rate of cavities changes when fertility changes, and whether you see a difference there with men and with women. So, that might be one way of testing the idea. So, one thing they'd like to figure out is how much of this difference in cavities is due to biology – pregnancy – and how much of it is due just to culture, to what people like to eat.

Interviewer – Robert Frederick
Well, from fossilized teeth to fossilized fish – tell me about this transitional fish fossil. Is this a missing link kind of fossil?

Interviewee – Erik Stokstad
It is one of those fabulous missing links. And, just like Archaeopteryx shed a whole lot of light on the transition from dinosaurs into birds, this fish, called Tiktaalik, tells us a whole lot about how fish evolved into tetrapods, into four-limbed animals. When Tiktaalik came to light, a couple of years ago, and that told us a whole lot about this transition. It showed, for example, that Tiktaalik is a fish, it has fins, and it has scales, but it also had a lot of characteristics of tetrapods, of the animals that conquered the land, such as the presence of a neck, the lack of a boney covering of its gill. So, Tiktaalik was right there, in the middle, kind of doing both things. What they couldn't tell, back then, was what was going on inside the skull, and that's because the inside of the skull was still covered by rock, and so preparators had to spend pretty much a whole year just carefully picking away at this rock to remove all of the covering and expose what the bones looked like, on the inside.

Interviewer – Robert Frederick
And what did they find?

Interviewee – Erik Stokstad
A lot of really neat stuff, Rob. For example, they could tell how the bones of the skull connected to each other. Now, in fish, these have a lot of flexibility, and that has to do with how fish eat, and how fish breathe, and they distort the shape of their skull to, for example, suck prey in, to create a vacuum. So, they need a lot of flexibility in their head. Tiktaalik had much less of that flexibility – the head appeared to be more rigid.

Interviewer – Robert Frederick
…suggesting that it didn't need this flexibility and got its prey some other way?

Interviewee – Erik Stokstad
Well, one idea is that if you are moving out onto land, and you don't have water bearing the weight of your body, you might want to have a more rigid skull so it doesn't deform, under the weight of gravity. It also suggests the Tiktaalik was moving more towards air breathing, rather than moving water across its gills. And, another neat feature of the skull that they discovered was a bone called the hyomandibular bone. Now, in fish this is a crucial bone that helps orchestrate the motions of the skull, the gill skeleton, coordinates feeding and breathing and respiration. Now, in Tiktaalik this bone has started to reduce,

and it's loss some of those connections, suggesting that it is on its way towards, what we do in tetrapods. The hyomandibular bone in you, me, and all other tetrapods has become one of the middle ear bones, the stapes. So, Tiktaalik here is, again, a really transitional form there.

Interviewer – Robert Frederick
So, the real exciting part is that we found this fish. We knew these things happened, but we now actually have physical evidence for it.

Interviewee – Erik Stokstad
Absolutely, Rob. We have fish, we know what they're like; we know what tetrapods are like. What really excites paleontologists about this is it shows how this happened. And, what it really illustrates is how a series of small steps can take us from one kind of animal to a totally different kind of animal.

Interviewer – Robert Frederick
Well, from the evolution of the fish to tetrapod – to the evolution of our galaxy and the universe. In describing this surprising finding about supermassive black holes, remind us what a supermassive black hole is, in the first place.

Interviewee – Erik Stokstad
Right, well, all black holes, as you know, are places where the gravity is so intense that they pretty much pull everything in, and not even light can escape it; hence they're black. The really big black holes, these supermassive black holes, what's astonishing about them is just the sheer scale in what we're talking about. They have mass equivalent to a million suns that are crammed into a space smaller than, than our solar system. So, they're really big. And they were thought to take a long time to form, to pull all this matter in. And that's what's surprising about this. When this team of astronomers was looking at a far-away galaxy, one that's about 12 billion light years away, so back in the fairly early days of the universe, they were checking out this galaxy that was emitting a lot of radio waves. And, the really astonishing thing was that they found not one supermassive black hole there, but actually two, so there were two galaxies in the process of merging, and they each had a supermassive black hole.

Interviewer – Robert Frederick
Suggesting that there were a lot more than previously thought, and that they formed in a relatively short time, right? Twelve billion years ago was only two billion years or so after the universe formed.

Interviewee – Erik Stokstad
That's right, Rob. So these supermassive black holes appear to be far more common than people had thought, for the relatively early days of the universe. And consequently, they must have been forming more rapidly than people thought, as well.

Interviewer – Robert Frederick

So, this will sort of put the modelers into a tizzy about how to reform and rethink about how the universe became what it is today.

Interviewee – Erik Stokstad
Right. I see a lot of gnawed pencil heads out there – or, more likely, pretty involved computer simulations.

Interviewer – Robert Frederick
Okay, well thanks, Erik.

Interviewee – Erik Stokstad
My pleasure, Rob.

Interviewer – Robert Frederick
So what other stories are you looking into for *Science*NOW?

Interviewee – Erik Stokstad
We've got some news about stem cells regenerating the prostate; erasing memories in mice; and finally, heat-seeking beetles. So be sure to check out the site.

Host — Robert Frederick
Erik Stokstad is the managing editor of *Science*NOW, the free, online daily news site of *Science*. You can catch up on the latest science news at sciencenow.sciencemag.org.

Music

Host — Robert Frederick
And that wraps up the October 24th, 2008, *Science* Podcast. If you have any comments or suggestions for the show, please write us at sciencepodcast@aaas.org. The show is a production of *Science* Magazine and of AAAS, the Science Society. The content is provided by the news and editorial staff of *Science*, and Jeffrey Cook composed the music. I'm Robert Frederick. On behalf of *Science* Magazine and its publisher, the American Association for the Advancement of Science, thanks for joining us.

Music ends