

The Lee Rayburn Show
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Lee Rayburn: I'm Lee Rayburn, and you're listening to WPR News. We are just three days away from the 16th Wisconsin Science Festival and who better to help us celebrate science across Wisconsin than our next guest. I'm Lee Rayburn and I'm joined by Bassam Shakhashiri, emeritus professor of chemistry at UW-Madison and the William T. Evjue Distinguished Chair for the Wisconsin Idea. And if you have a question about science in Wisconsin like the Nobel Prize in Physics that was won last week by a UW-Madison professor, or anything else about the science festival coming up, or questions about our universe or ourselves, 1-800-642-1234, that's 800-642-1234, or send an email to talk@wpr.org. Bassam, welcome to the show.

Bassam Shakhashiri: I'm very happy to be with you, Lee, and with our listening audience. Eager to get started.

Lee Rayburn: Let's dive right into the Nobel Prize in Physics given to one of your colleagues, UW-Madison Professor of Physics Francis Halzen. He won the Nobel Prize last week for his efforts to demystify a rare group of neutrinos, tiny cosmic particles that researchers believe somehow will offer us clues to how our universe evolved. Fascinating, but what does this have to do with the South Pole?

Bassam Shakhashiri: It has a lot to do with the South Pole because my colleague and friend Francis Halzen, professor of physics at UW-Madison, had this grand idea about 30 years ago or so to build a detector that will detect the neutrinos. And neutrinos are called ghostly particles. They're tiny, tiny particles and they pass through all matter. Thousands of them are passing through our bodies right now.

But to detect them, he proposed an ingenious proposal to build a detector in the South Pole and it was called the IceCube project, because a kilometer deep into the ice were placed detectors that will pick up the neutrinos without having them interact with anything else before that. And when the neutrino hits the ice, it generates light. And it is the way in which these neutrinos are detected.

And Professor Halzen, as I said already, he was really ingenious in making this proposal. He couldn't believe that anybody would agree with him, but that's the nature of science. You come up with audacious ideas and you try them out. And UW-Madison and the National Science Foundation supported pursuing this idea, and many scientists were involved in doing this. Receiving the Nobel Prize in Physics, my colleague Francis Halzen will receive it

in Stockholm in December, but he's the first solo recipient of the physics award in about three decades, usually shared with one or two other people.

And he was—when he was holding a press conference, the first thing he acknowledged was the collaboration of hundreds of scientists in Madison and Wisconsin across the country, around the world. This is really a tremendous human achievement, Lee. And I'm so happy and proud that UW-Madison and, of course, Professor Halzen are being so recognized.

Long-range ramifications, and the detectors in the observatory, the underground observatory in the South Pole, continue to function, and researchers want to gain more information about the neutrinos and where they came from and how does this help us understand cosmology, cosmic radiation, and all kinds of very fascinating and really challenging concepts are being addressed by people here in Wisconsin in collaboration with others around the world.

Lee Rayburn: Bassam, what are some of the hypotheses when it comes to neutrinos and what we hope to learn or want to test to see if these things hold true?

Bassam Shakhashiri: Well, neutrinos are very tiny. They're electrically neutral particles. As I said already, they rarely interact with matter. And they pass through Earth and human bodies at trillions every second. So the new era of astronomy that Professor Halzen's experiments have opened by putting these thousands of light sensors deep into the polar ice, this observatory will now record faint flashes of light produced when cosmic neutrinos crash into the molecules. And this is going to allow us and all scientists to trace the particles back to the extreme cosmic events such as exploding stars and black holes without relying on any traditional light or radio telescopes, because we cannot rely on those because the neutrinos will not be detected by those.

So this is a fabulous accomplishment. And I really salute the Swedish Academy of Sciences for recognizing what Professor Halzen has pioneered, and he continues to work with others in helping us understand more about the origins of these particles related to all kinds of questions we have about the Big Bang theory, all kinds of questions we have about origins of stars and so on.

And Lee, this is centered right here in Madison, Wisconsin. It's just, you know, I get goosebumps just saying this. So we will gain a lot of knowledge, and with this knowledge, it will be subjected to further explorations. We will learn more about the formation of the galaxies and we'll learn more about—through this new astronomy era that Professor Halzen pioneered.

Lee Rayburn: So the lifespan of a star, the makeup of a black hole, the start of the universe, all could be explored through this what is, I believe, the world's largest telescope at the

bottom of the earth, which largely, you know, Francis Halzen considered the godfather of this IceCube project, and he's UW-Madison Physics Professor and now Nobel Prize winner in physics.

And you mentioned the funding before and the support this received for what would have seemed maybe perhaps decades ago a very odd, outside-the-box idea. But I have to ask: the National Science Foundation continues to be in the news. Last week there was this story about current budgets being severely cut. And I also know that you served for years as Assistant Director of the National Science Foundation. So what is happening from your perspective, Bassam, and how might this affect works like Professor Halzen's?

Bassam Shakhashiri: Well, I sincerely hope that the effects will be positive. There's a lot going on at the National Science Foundation now in Washington D.C. There's more emphasis on technology, which I'm for, but the fundamental basic research requires really continued support, financial support. It requires really support from all of us who eventually benefit from it. The immediate benefit may not be there. So the use of taxpayers' money to fund projects like IceCube and to fund other projects, to fund projects that support what is referred to as curiosity-driven research—we're curious about different things. We're all curious about a lot of different things, but scientists need further sustained support from the American public. And the American public has been very generous in supporting fundamental research and later on its applications. So it's important that this be sustained.

It's important that our elected officials hear from us about the importance and significance of sustaining research—fundamental basic research as well as applied research. So there are many people who are affected, as you said, there's been a withholding of some of the funds. This will affect educational processes, it'll affect research processes. We need to make sure that these are not disrupted. We need to support our elected officials so that they continue to make wise decisions in allocating funding for the research and for the educational processes that have made us in America what we are right now.

So I urge everyone—especially, we'll have a midterm election coming up. I urge everyone to vote in that election. And I also ask—I'm going to ask you Lee as well as everyone else that's listening to get five people to vote who have not voted before. You think you might do that?

Lee Rayburn: I don't know if I could find five people that haven't voted before. I think I'd have to get them right when they turn 18, because folks I know understand the importance and the connection between what we expect as a community and the organized extension

of community that we call government—that it is part of, it is an important part of our world, and it decides a lot, including what we’re going to pitch in and spend our money on.

And the idea that there is questions about the value of science, you know, I would challenge that, because where would we be without science? You know, Bassam, it doesn’t—and there are just projects like Professor Halzen's that we would not be able to have if we were not to collectively agree to pitch in and pay for something like the Nobel Prize in Physics this year.

Bassam Shakhshiri is our guest, emeritus professor of chemistry at UW-Madison, William Evjue Distinguished Chair for the Wisconsin Idea, and we welcome you to our conversation at 1-800-642-1234 or email talk@wpr.org. Let’s go to Vic in Amherst Junction. Junction, pardon me. Vic, hi.

Vic (Caller): Hi, no problem. So, yeah, so I just wanted to use Bassam's springboard of mentioning the importance of the technology and that he’s absolutely for that. And as a scientist, that is important. I don’t want to give a lesson here, but you know, you get the technology, you got to do the research. And politically, I think they’re missing that. They’re saying they want the technologies. I’m doing a broad scope statement here, but you know, you listen to some of the rhetoric, so to speak, that, oh, you know, this and that about science. But we need that piece. We need the research, as evidenced by the Nobel Prizes last week, to get that technology forward so that we can use technology to do the science, too, but also to do the other parts of our society that are important. So anyway, that’s more of a statement, but it’s just a springboard of what—

Lee Rayburn: I appreciate it immensely, Vic, that there is a direct connection between our scientific study and the technological outcomes. Thank you, Vic.

Bassam Shakhshiri: Thank you very much for what you said, and thank you, Lee, for what you’re saying, too. Indeed, the technology follows scientific discoveries. A long time ago, our ancestors were very good at technology. A long time ago, they built pyramids, they built canals, built cities. They didn’t know enough science, but they were able to do that. But today, in the past century or so, science is what drives our economy. But science drives our economy because of new discoveries.

Take diagnostic MRI. The nuclear magnetic resonance effect was discovered in the 1940s. And it took people who discovered it—they had no idea whatsoever that all human bodies would be put through a machine like that without being invasive. So this is why basic research needs to be supported properly. This is why young people who are considering careers in science need to be encouraged and supported and enabled. This is why the rest of us who are not scientists need to express ourselves and express our desire to be

supportive of free inquiry. This is what distinguishes scientific research from other research: the ability to think freely and to try ideas that may not be immediately popular or acceptable.

So it's all related to the attitudes that we have about ourselves, about learning, about the beauty of nature, and understanding who we are and what we can do in developing new technologies to serve us. I gave you the MRI example. There are many other examples that we can talk about. I would like to invite our listening audience, as I have in the past, to visit my website scifun.org—S-C-I-F-U-N.org—where I will post some additional examples and post information about neutrinos and about Professor Halzen.

I'd like to say one more thing related to what Vic said—

Lee Rayburn: Go ahead.

Bassam Shakhshiri: We do not do research to win prizes. We do research to satisfy the curiosity that we have and to fulfill our obligation to improve society. That's why we do research. This is why it is important to continue the fabulous support that the American people have provided to our universities and research institutions. We need federal support, we need private support, we need a healthy attitude towards learning. When we learn, then we have chances to develop technologies based on knowledge that we have learned. And we always have to be wise in making decisions. So knowledge is not wisdom. Yes, wisdom is related to what we learn when we make intelligent choices.

And so I wanted to say also, Lee, about the beauty of the foliage that we are experiencing now. It's just a fabulous, it's a dazzling display of color that is happening. It happens every fall. It's because the green leaves stop being green. How does that happen? Chlorophyll is a pigment that's green. It's generated in warm weather. But when the temperature drops down, and when the humidity goes down, and when the amount of daylight goes down—all these three factors—these giant chlorophyll factories shut down. And the other chemicals that are already in there begin to show their color. And we don't see them in the summer because the green pigment of chlorophyll masks the coloration. I'll post something about that on the website, too.

Lee Rayburn: Scifun.org. And I love the idea that the rainbow of fall colors is there all the time, you just don't see it because the chlorophyll machine is operating at full tilt.

Before we run out of time, Bassam, we've got the 16th annual Wisconsin Science Festival beginning this week and going on for the next 10 days. And there are hundreds of events all over the state for folks to participate in.

Bassam Shakhashiri: I wish everyone in the listening audience will partake in these events. There are hundreds all over the state. This is the 16th annual Wisconsin Science Festival. It begins on October the 15th and goes on for 10 days. And I invite everyone to visit the website for the science festival. You'll see all the displays and invitations to participate. So just go to WisconsinScienceFest.org. WisconsinScienceFest.org. I'll post this on my website, too.

Lee Rayburn: And if I'm not mistaken, you were there at the outset, right? When this fest was first launched in 2011, you had something to do with getting this off the ground in the first place.

Bassam Shakhashiri: I made a suggestion that we should have a Wisconsin Science Festival. I made that suggestion back in 2009 in an article I wrote for the publication of the Wisconsin Academy. And within two years, it became a reality. I'm so pleased and happy to see this. It's all over the state now in so many different counties, so many different locations. And it's for people of all ages. It's for youngsters, for adolescents, it's for adults. It's—I don't have time to list them here—

Lee Rayburn: No, it's also connected to the Wisconsin Book Festival.

Bassam Shakhashiri: That's right. So all kinds of connections. Let us all enjoy the rich offerings that the Wisconsin Science Festival is making by participating and by also making suggestions for future science festivals, so we all benefit from this. We all develop a healthy attitude toward learning and toward responsible action.

Lee Rayburn: WisconsinScienceFest.org, and there's actually an interactive map. So wherever you are, you can find the closest events happening to you, and I am just blown away at how many events there are. Like 650 at last count, but there seem to be more than that even. Is there anything on your radar, Bassam, that you're excited for? And as you mentioned, it's everywhere and all ages.

Bassam Shakhashiri: I wish I could go to all of them, but we have to be selective and we have to allow enough time to interact with the people who are putting on these different activities, and to learn and to think, and to always take responsible action after that.

Lee Rayburn: I, with a minute or so that we have left, I want to acknowledge the scientific method, because I find it brilliant, Bassam. And I don't know that more people outside of scientists shouldn't employ the scientific method—the idea of hypothesizing and testing, collecting data, analyzing results. That when you employ the scientific method, I think some people can be critical because you never prove anything, you can only support your hypothesis, but you can certainly disprove something. And that scientific method has brought to you, as Vic mentioned, the technology that we have today, our understanding of

the world and our place in it—that that scientific method has been foolproof, even though it's been challenged by plenty of fools.

Bassam Shakhashiri: Well, it's good to challenge it. We make progress by asking questions. Yes, you know, I like to refer to it as a scientific process. It's okay to say method, but the scientific process where we're curious about something, we ask questions, we learn how to formulate the question, we check it out, we do experiments. Some of the experiments don't work the way we thought they're going to work, but we learn from that. We learn from failure. This is part of the scientific process.

And this is not only partially satisfying, it's collectively helpful to all of us, because this is how discoveries are made, and eventually technologies are developed based on these inquiries and these findings. And once in a while, a distinguished colleague gets a highly prestigious award.

Lee Rayburn: Because they tested something, and there's no failure in this process. There's just a deeper understanding of the direction or the questions you can ask in that curiosity-driven research.

The Wisconsin Science Festival begins on Thursday, runs through 10 days. You can find more from Bassam online at scifun.org, and more about the Wisconsin Science Fest at WisconsinScienceFest.org. Bassam Shakhashiri, the Distinguished Chair of the Wisconsin Idea and Emeritus Professor of Chemistry at UW-Madison.