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The State of the Universe

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Forty-five years ago on last Christmas Eve, the Apollo 8 astronauts Frank Borman, Jim Lovell and Bill Anders—the first humans ever to visit another astronomical body—were on their third orbit of the Moon, intently taking pictures of the lunar surface in preparation for the first landing the following year. And then one of them looked up…and saw this:

[Slide 2, Earthrise]

They quickly moved the camera to take a picture—a picture that forever changed humanity's view of its place in the universe, on a small fragile body in the vast blackness of space.

Forty-five years ago also happens to be the first time I took a course in astronomy. I learned that our Sun was encircled by the only planets we knew of in the entire Galaxy. I was intrigued that we could claim to know the age of the universe to *within a factor of two* and that stars had life cycles we could hope to understand. I was amazed that we could see an object 6 billion light years away, and I found it fascinating that black holes might actually exist.

As Meg has indicated, our Society is holding its annual meeting here this week, with over 3100 astronomers from across the country and around the world coming together to discuss research and education in our discipline today. And today is very different from 45 years ago.

[Slides 3 – 23, discussing how our view of the universe has changed so dramatically thanks to decades of amazing discoveries (ad lib remarks).]

All of these discoveries were enabled by an astronomy ecosystem that includes NASA, NSF, and the DOE Office of Science among other agencies, in partnership with our world-leading universities, our national laboratories, and our high tech industries.

Since I began with an anecdote from 45 years ago, I will end with one from that same year, a simple exchange that took place here in the Capitol between Rhode Island Senator John Pastore and Dr. Robert R. Wilson. Dr. Wilson was the founding Director of Fermilab, the premiere particle accelerator in the world for several decades until it was superseded by CERN in Switzerland. In his testimony before the Joint Congressional Committee on Atomic Energy, which was debating authorization for the construction of Fermilab, Senator Pastore (a supporter of the project) asked Dr. Wilson:

"Is there anything connected…[with] this accelerator that in any way involves the security of the country? [the national defense]

Dr. Wilson replied: "No, sir; I do not believe so."

After a brief exchange to establish this concept firmly in the Committee's mind, Dr. Wilson responded:

"...it has nothing to do directly with defending our country, except to help make it worth defending."

A great nation does great things. It seeks to expand human knowledge, because as history has shown, from the Babylonian discovery of how to predict eclipses, to the Iberian application of the compass in the fifteenth and sixteenth centuries, to the industrial revolution of the nineteenth century in Britain, to the microprocessor a few decades ago, expanded knowledge leads to expanded prosperity. The twentieth century was the American century, in large part because of our public investment in scientific research. The creation of knowledge, the generation of excitement, and the development of perspective is what our study of the universe provides. And, as you will hear from our panel, none of whom are now astronomy researchers, the excitement and perspectives of astronomy have led directly to the major contributions to our nation's prosperity each of them each is making today.

First to my right is Blake Bullock. Blake is the Business Development Director for Civil Air and Space with Northrop Grumman Aerospace Systems in Redondo Beach, California.

To her right is Ari Buchalter. Ari is the Chief Operating Officer MediaMath, a leading global advertising technology company that uses cutting-edge algorithms and advanced data analysis to help Fortune 500 companies optimize their advertising strategies.

And to the Ari's right is Peggy Piper. Peggy is an award-winning teacher from the Lincoln-Way Consolidated School District South of Chicago, who has spent her career engaging students in original research alongside research astronomers.

So let's turn now to Blake…