Panel 2: “For en bedre forståelse af hvordan vores univers fungerer” Schiller Instituttets internationale videokonference den 25. april 2020

Talere på panel 2: Jason Ross, ordstyrer, LaRouches videnskabelige Team; Megan Beets, LaRouches videnskabelige Team; Ben Denniston, LaRouches videnskabelige Team; Jean-Pierre Luminet, ph.d., astrofysiker, forsker emeritus ved National Center for Scientific Research; Michel Tognini, astronaut, Association of Space Explorers, stiftende medlem; Walt Cunningham, Apollo Astronaut; Marie Korsaga, ph.d., astrofysiker, Burkina Faso; senator Joe Pennacchio, New Jersey State, sponsor af Fusion Energy Resolutionen; Will Happer, ph.d., professor emeritus i fysik, Princeton University; Guangxi Li, M.D., ph.d., Chinese Academy of Medical Sciences, Beijing

Videoarkiv af Panel 2, se https://www.youtube.com/watch?v=xQlZ-2CcXiY.

Panel 2 i Schiller Instituttets historiske konferences bar titlen: “For en bedre forståelse af hvordan vores univers fungerer”. Det var en vidtrækkende international drøftelse om anvendelse af menneskelig kreativitet, videnskab og teknologi til forbedring af menneskehedens vilkår gennem samarbejde mellem nationer. Ordstyrer Jason Ross åbnede med at sige, at spørgsmålet om at skabe et globalt sundhedssystem, som grundlægger af Schiller Instituttet, Helga Zepp-LaRouche, har opfordret til, burde overvejes mere bredt som en del af et strategisk forsvar for menneskeslægten. Ross optrådte sammen med sine kolleger fra LaRouche PAC's Videnskabelige Team, Megan Beets og Benjamin Deniston, der uddybede Lyndon LaRouches perspektiv for, hvordan man udfører denne målsætning.

Deniston henviste til det russiske forslag fra 2011 om et 'strategisk forsvar af jorden' (SDJ), hvilket var en åbenlys reference til det forslag, som præsident Ronald Reagan fremsatte i 1983, kaldet Strategic Defense Initiative (SDI). Lyndon LaRouche er kendt for at være ophavsmanden til denne Reagan-politik og for at have foretaget 'bagdørsforhandlinger' med Sovjetunionen for at opnå en aftale. Men andre mennesker kæmpede også for deres egen version af SDI – ofte for at undergrave LaRouches forslag. Deniston definerede LaRouches SDI som et videnskabs-drivende program, ligesom John F. Kennedys Apollo-projekt, der skulle hjælpe med at udvikle begge nationers svigtende økonomier, og, i processen med samarbejdet at afslutte den geopolitiske kløft, der blev påtvunget af den britiske 'del og hersk'-operation. Denne reference til betydningen af internationalt samarbejde og at skubbe grænserne for menneskelig viden blev et kritisk tema for panelet. Et videoklip præsenterede Lyndon LaRouches egen beskrivelse af konceptet.

Megan Beets udviklede, hvordan SDJ-konceptet ville involvere aspekter af rummets indflydelse på vejret og klima samt et forsvar imod store soludbrud og solpletter. Beets og Deniston tog også andre spørgsmål vedrørende asteroide- og kometforsvar op, langvarige cyklusser i solsystemet og galakserne og hvordan disse spiller ind på arters uddøen, samt hvordan det kan spille ind på livscyklussen af vira. Ross påpegede endvidere, at dette at tolerere at blive holdt som gidsel af et virus eller af en fejlslagen økonomisk politik virkelig er et spørgsmål om tragedie – at undlade at befri os for fejlslagne aksiomer.

Jean-Pierre Luminet, Ph.d., astrofysiker og forsker emeritus ved Frankrigs Nationale Center for Videnskabelig Forskning, tog spørgsmålet om videnskabelig tænkning op i sin præsentation: "Frie Opfindelsers Rolle i kreativ Opdagelse." Luminet leverede sit syn på videnskabens udvikling fra oldtiden til Kepler, Einstein og moderne teorier, men understregede, at gennembrud mere var beslægtet med kunstneriske udtryk.

Luminet blev efterfulgt af to tidligere astronauter, Michel Tognini og Walt Cunningham. Tognini er brigadegeneral i det franske luftvåben, og tidligere astronaut hos både CNES og ESA, og kan tælle tilsammen 19 dage i rummet på den internationale rumstation, ombord på både Columbia og Soyuz. Tognini er et stiftende medlem af Association of Space Explorers (Selskabet af Rumforskere, *red*.), der har medlemmer fra 38 lande, og han redegjorde for nogle af sine oplevelser i sin præsentation: "Venskab mellem astronauter: en eksemplarisk præcedens for internationalt samarbejde." Tognini blev fulgt af den tidligere NASA-astronaut Walt Cunningham, der fløj på Apollo 7-missionen. Cunningham beskrev, hvordan han på radioen lyttede til opsendelsen af Alan Shepard, og efter at have kørt ind til siden for at høre nedtællingen, udbrød "Lucky S.O.B.!" ('lucky son of a bitch', eller 'heldige kartoffel', red.) 18 måneder senere delte han kontor med Shepard.

Astrofysiker Dr. Marie Korsaga fra Burkina Faso behandlede spørgsmålet om "Nødvendigheden af videnskabsuddannelse for afrikansk ungdom". Hun beskrev det faktum, at 40 % af Afrikas befolkning er under 15 år, hvilket vil være eksplosivt i de kommende år – godt eller dårligt, afhængigt af om denne 'skat' opdyrkes med uddannelse og økonomisk udvikling. Hun delte også sine refleksioner vedrørende kvinder inden for videnskab i Afrika, hvor hun desværre er en af få.

Senator fra New Jersey (2008 – nu), Joe Pennacchio, gentog Korsagas appel om en fremtid for ungdommen i sin præsentation: "Making Nuclear Fusion a Reality" (Gør fusionsenergi til virkelighed). Pennacchio er ophavsmand til et lovforslag i New Jersey, der kræver udvikling af fusionskraft. Han sagde, at han kæmper for fusionskraft for de kommende generationer.

Will Happer, professor emeritus i fysik ved Princeton University, som også har tjent i præsident Trumps nationale sikkerhedsråd, gav sine indsigter vedrørende kampen om klimaforandringer, og beskrev den som en "kultreligion", eftersom dens tilhængere endog nægter at debattere det. Happer beskrev, hvordan mange videnskabelige opdagelser er sket gennem "uheld", idet forskere har fundet, at deres eksperimenter ikke gav de forventede resultater, hvilket tvang dem til at komme med et højere ordens begreb om universets love for at forklare det uventede resultat. Dette fremprovokerede en hel del diskussion under den livlige spørgerunde.

Dr. Kildare Clarke, en læge fra New York, delte sin indsigt i implikationerne af afviklingen af det offentlige sundhedssystem i USA gennem privatisering. Dr. Clarke har i årtier arbejdet med LaRouche-bevægelsen om dette spørgsmål, der går tilbage til den af LaRouche ledede kamp for at redde D.C. General Hospital fra lukning i 1990'erne.

Clarke blev efterfulgt af Guangxi Li, M.D., ph.d. fra det kinesiske akademi for medicinske videnskaber i Beijing og ved Mayo-Klinikken. Li præsenterede sin succes med at bruge traditionel kinesisk urtemedicin i behandlingen af COVID-19 i tidlige stadier, som han beskrev som anderledes end andre virale lungebetændelser.

Det historiske panel afsluttedes med en spørgerunde, der berørte spørgsmål op om vigtigheden af, at internationalt samarbejde skaber muligheder for unge til at deltage i videnskabelige gennembrud og gøre en ende på de mislykkede aksiomer, der har bragt os til kanten af denne faktiske mørke tidsalder.

Panel 2: For a Better Understanding of How Our Universe Functions Saturday, April 25, 2002 With Jason Ross, Megan Beets, and Ben Deniston

[incomplete transcript] JASON ROSS: Hello! Welcome back to this Schiller Institute International Conference. This is Panel 2 in the afternoon on Saturday. If you're watching this on YouTube, you can find a link to the conference webpage in the video description. My name is Jason Ross, and I am a many-year collaborator with Lyndon LaRouche and the lead co-author on the Schiller Institute's recent draft program on addressing the COVID-19 pandemic entitled, "LaRouche's Apollo Mission to Defeat the Global Pandemic; Build a World Health System Now!" This panel will be a real treat. We are going to bringing together astronauts, astrophysicists, and other top scientists, as well as a physician, to gain a deeper insight into the role of science in the advancement of the human species and a deeper idea about the essence of what science itself actually is. After the presentations, and perhaps during them, there will be time for discussion. You can participate in that discussion. You can do so by sending your questions or brief thoughts to us at questions@schillerinstitute.org. We will definitely not be able to address every question that comes our way. We have received 50 or so, so far this morning. Apologies is we are not able to get to your question. We will be forwarding them to speakers afterwards so that they can respond if they'd like to. If your question is directed towards a particular one of the panelists, please indicate that in your question. We will begin with a discussion of the global health system that Helga Zepp-LaRouche had brought up in her keynote, considered from the broadest possible perspective — the strategic defense of the human species. The speakers for this first presentation will be Ben Deniston, Megan Beets, and myself. We’re also seeing Michele Tognini, who will be speaking after that. Ben, Megan, and I titled our talk “In Defense of the Human Species”. At present, the planet is being plagued by a tiny piece of RNA – just 30,000 base pairs long – that’s causing pandemonium, keeping us hostage in our homes. Just this tiny bit of RNA in a drop of oil with some protein sticking out. With all of the uncertainty that there has been around this disease – about how to treat it, how to prevent it, what measures are appropriate, what measures aren’t, controversy about masks. There’s a lot of ideas going around that aren’t correct, and we’ll discover that in due time. But, let’s talk about not just the missed opportunities to prevent this disease in particular, but what about the missed opportunities not to more quickly start producing masks, but what have we done over the past decades that has left us susceptible to a world in which we are held hostage by a virus? Over 50 years ago, human beings left the Earth and set foot on the Moon; forever expanding the horizon of the possible. Seventy-five years ago, the atom yielded to scientific thought, offering a bounty of energy many orders of magnitude greater than what could be provided by molecular or chemical means, such as coal, oil, gas. And definitely beyond what can be provided by physical means such as windmills or waterwheels. Over 100 years ago, human minds became aware of the existence of a new astonishing world of quantum phenomena, and began to forge ideas to comprehend and make use of this domain, as well as the realization that what we thought were space and time, energy and matter, were not distinct categories, but had a connection between them that was previously unknown. Over 400 years ago, Johannes Kepler created modern physical science through his faith in the power of human ideas to comprehend the causes of nature. Stepping beyond appearances, he hypothesized for the first time what made the planets move. So, how could such a species be held hostage by a virus? For that, we have to examine not the great successes of science, including those just mentioned, but the failures of science and of culture more generally that have allowed us to be prey to false and ugly axioms of thought that have plagued us for millennia. The most crucial concepts we have as human beings are those respecting our humanity; what we are as a human species. What we are capable of, and what our relationship to nature is. Consider two contrasting outlooks of the human species. On the one side, there is the view that the human mind is made in the image of God, and therefore coheres with creation in such a way that our ideas have the power of physical forces to unlock ever-improving knowledge of the world around us. Or, the idea that the human mind does not really exist. Free will is a delusion, as our brains — being biochemical in nature — are governed by the laws of physics; which we will one day be able to explain, at least in potential. We'll be able to explain our thoughts and decisions. Human thought can be replicated by a mechanical system; true artificial intelligence is possible. One view says that human beings are a remarkable species. Unlike any other form of life, we can improve our living from generation to generation; increasing in number and in quality. We can improve nature beyond the state that it happens to have at the present. On the other view, some people say that humanity is a horrible species. That what sets us apart from all other life is that we destroy ecosystems, drive species to extinction, and destroy the planet with our excessive numbers. We must end growth and return to nature, according to these people. One view holds that we create resources by the power of our minds. Whereby uranium, which was just a rock, becomes a useful fuel by the fact that we have learned how to unlock its atomic, nuclear potential. On the other side is the view that we are consumers of resources. That we gorge ourselves in a relentless pursuit of material comfort. One view is that humanity is the most beautiful species. That the world needs more people. The other view is that humanity is the worst species, and that the world should have fewer people. Most of us have varieties of both types of these thoughts echoing in our minds to some degree. Lyndon LaRouche and the Schiller

Institute maintain the first outlook of growing creativity and beauty, of growing humanity. That this is true in science, in culture, and in art. Recognizing the conflict between these two paradigms, Lyndon LaRouche saw the coronavirus coming. Not in its particulars, but as a potential. And he said what to do about it. The Schiller Institute saw this coming in potential, and we said what to do about it. Today, we have the coronavirus on our minds, but we are susceptible every day to a variety of horrors against which we and the Earth have no current defense. Other viruses, the dangerous drawdown of ground water, a comet striking our planet, the Sun throwing off a coronal mass ejection and destroying half of our planet's power grid. Or even the seemingly simple task in some of the developed countries of having clean water and proper sanitation for the over 2 billion of our fellow human beings who lack reliable access to improved water and sanitation. Or insects; consider the plague of locusts currently spreading. In the immediate sense, we need a global health system; a response to the COVID-19 pandemic. But we need much more. We must go beyond a group of medical experts with a few technicians that can be sent around the world. We need the resources, the commitment, and the intention to ensure that around the world, we have the global economic infrastructure required for a robust health infrastructure. Talking about handwashing where there is no running water is a cruel joke. Telling people to stay at home when they rely on their daily work to pay for their daily bread; this simply doesn't function. How do we address the fact that the world is in this condition? We have put forward a preliminary proposal on how to do this. It is posted on the Schiller Institute site, and you can find it by searching for its title — LaRouche's Apollo Mission to Defeat the Global Pandemic: Build a World Health System Now! But, let's now seem to leave behind our worldly cares. Let's reflect on our fundamental beliefs about the human species, and let's do it from the standpoint of the heavens; full both of promise and of peril. Let's look down on ourselves from that standpoint to get the broadest sense of what would be a strategic defense of the Earth, a strategic defense of the human species.

BEN DENISTON: Thanks, Jason. The term "Strategic Defense of Earth" specifically was first floated in the Russian press in 2011, for people who are not familiar with it. It was absolutely a direct reference to the Strategic Defense Initiative, the SDI, which was the Reagan-era proposal for a joint missile defense system between the US and the USSR to end the threat of Mutually Assured Destruction [MAD]. For many people around the world, Lyndon LaRouche is perhaps most famously known for his leading role in promoting his notion of the SDI. Also, his key position as a back channel between the US and Soviet governments at the time. However, while that is somewhat known, and Mr. LaRouche is somewhat famous for that, not everyone shared the same idea for how the SDI was supposed to be implemented. It is critical for us to emphasize Mr. LaRouche's unique conception for his SDI program, and illustrate how this core principle is as valid today with the Strategic Defense of Earth, as it was in the 1980s. This policy is derived from a scientific principle, a scientific assessment expressing the current stage of the long-term development of the human species. Mr. LaRouche's SDI program was not merely about defensive systems to prevent thermonuclear war. It was also about establishing the necessary political and economic policies to ensure lasting stable peace; to ensure durable survival generations into the future. There's probably nothing better than to let Mr. LaRouche state this in his own words. We have a brief clip from an address Mr. LaRouche in September 2000 — 20 years ago now — to a Schiller Institute conference.

LYNDON LAROUCHE:

This is the policy which became known as the Strategic Defense Initiative. Now, the important thing is to understand what the original SDI was. Contrary to the idiocy which you hear in the press today about missile defense—what you hear in the press is idiocy, by people who are worse than idiots; they don't know anything about missile defense…. I said, what we have to do is something completely different. We do have the ability to devise systems, new kinds of physical systems, which could deal effectively with thermonuclear missiles — that is, render them effectively, technologically obsolete, down the line. But that was not the extent of my proposal. The proposal was that, instead of having the Soviet Union and the United States engage in this crazy chicken game, called SALT I and ABM, why don't we find a way out of the conflict itself? How? Because the Soviet economy, like the U.S. economy, is collapsing. The present policies of the U.S. economy, the present policies of the Soviet economy, ensure a {collapse} of those economies, physical collapse. So, why don't we change the policy? Why don't we go back to the space program of Kennedy, and let's do what we proved with Kennedy? Remember, according to the estimates that were made in the middle of the 1970s, the United States got more than a dime of additional GNP out of every penny the United States invested in the space program, the Kennedy space program. The point is, that since increases in productivity come directly, only, from improvements in technology derived from fundamental scientific discoveries, the higher the rate you convert fundamental physical discoveries into practice, the greater the rate of increase of productivity per capita of population, and per square kilometer of area. The problem of both the Soviet system and our own, although in different degrees, I said at the time, was that the United States was not generating a rate of net growth in physical productivity, sufficient to maintain the economy. Therefore, we needed a program for forced draft, science-driven technological progress, with some mission, like the Moon mission, but as a byproduct of that mission, such as the Moon mission, we would generate spillovers in terms of technological progress, by such a crash, to put the United States economy back on the plus side, in terms of net growth. The Soviet economy does not work for similar reasons, different, but similar reasons. Therefore, if the Soviet Union, with its vast military-scientific technological capability, were to put that capability, in cooperation with us, in global technological progress, and if we focussed upon developing countries — South America, Africa, Asia — to do what Roosevelt proposed be done for these countries, had he not died, then the benefit of such a program would put — two things: would put the two economies back on the plus side, together with Europe; and it would also be a way of creating a global agenda which would solve the conflict problem. Now, that was the SDI, in original form….[end video]

DENISTON: So, obviously today we no longer have a conflict between the Soviet Union and the United States, but as we've been discussing in this conference, other geopolitical tensions have clearly emerged. LaRouche's core policy, {his SDI policy} is just as valid and necessary today. As Jason discussed in his opening, mankind has seen tremendous growth over the past few hundred years, and that is a relatively miniscule amount of time compared the history of our planet, our Solar System, the biosphere, our galaxy, and so on; a very short period of time. And only in the past 100 years has mankind entered into a new historical phase, in which the same technological capabilities and scientific discoveries which have brought tremendous growth and tremendous progress, have also created a new historical situation, in which mankind now technologically has the capability to annihilate itself through war and conflict. Mankind can no longer allow, not just full-scale military conflicts among nations as we've seen before, but we can no longer tolerate the political and economic preconditions which lead to those conflicts, as Mr. LaRouche outlined. So, an historical change is needed, as Helga Zepp-LaRouche has led the discussion in raising the need for a shift to a New Paradigm, as she has defined it. But, this relatively new historical period mankind finds himself in, defined by this new capability, comes with another more profound aspect. What do we really know about life on this planet, in our galaxy, and in this universe? We can know one thing for certain, the vast majority of all species of animal life that have existed on this planet, are no longer here. Estimates are that over 99% of all species of animal life that have emerged on this planet in our evolutionary record, have gone extinct — over 5 billion species, gone. Interestingly, we have evidence that this extinction process, this evolutionary process is not simply a planetary process, or even Solar System process, but somehow involves our Galaxy as well. 500 million years of records of species origination and extinction exhibit a cyclical pattern that matches our periodic changing relation to our Galaxy. There are very interesting studies pointing at this, indicating that the evolution of life on Earth is somehow also expressing some galactic influence, or is expressing some form of galactic process. This extinction principle is an undeniable fact of the evolutionary development of the biosphere. Under that principle alone, with no other intervening factors, you can guarantee that all existing species of animal life on the planet today are also going to go extinct at some point in the future, as the evolutionary process continues. There's only one scientific exception that we know of, one distinction, one form of life that expresses anything distinct from and transcending this principle of the biosphere. That is the existence of mankind, uniquely expressing a distinct power of creativity, as Lyndon LaRouche has uniquely defined a scientific understanding of human creativity. This is not seen in any form of animal life. The same science and technologies which give us the ability to destroy ourselves in conflict — the potential to wipe out our entire species on this planet — also provides the ability for mankind to be the only species on this planet which transcends and moves beyond the limits of the biosphere; which defeats the extinction principle. As Mr. LaRouche used to often say, mankind is the only potentially immortal species, if he chooses to fulfill that destiny. So, in the spirit of LaRouche's SDI, years later, decades later, we are discussing the evolution of that same core policy, now in the form of the

Strategic Defensive Earth. A policy to erode the economic and political causes underlying conflict through joint science-driver and technology sharing programs focussed on addressing the common threats facing all mankind. So, just as the SDI was designed to unite the leading powers of the planet against the common threats of thermonuclear missiles, the Strategic Defense of the Earth is intended to unite mankind against the common threats which all inhabitants of this planet inherently face: from space weather, to asteroid strikes; from cosmic climate change, to comet impacts; from pandemics, to catastrophic earthquakes and volcanism, mankind is unavoidably united in dealing with the dangers inherent to living on this small planet, subject to the influences of our Solar System, and Galaxy beyond.

MEGAN BEETS: I'd like to pick up from here, and I'd like to begin by talking for a little bit about the weather. We tend to think of the weather — including dangerous extreme weather events — as a local phenomenon. If we're a bit more astute, we realize it is actually a planetary phenomenon, with weather events on one part of the globe affecting those on another. In reality, there is nothing local or even merely planetary about the weather. Our Earth and the other planets in the solar system swim in an environment created by the Sun. One feature of that environment is the solar wind, which is a constant flux of charged particles streaming out from the Sun, which creates the interplanetary magnetic field, and modulates Earth's magnetic field. Why is this important? Because the Sun is a dynamic body; it is changing! And we are mere babies in our understanding of it. For example: Approximately every eleven years, the Sun goes through a cycle of increasing and decreasing activity, during which time the polarity of the Sun's magnetic field completely flips. We track the solar cycle by the number and polarity of sunspots, which if we pull up the first slide [Fig. 1], you can see as the dark areas on the Sun's surface, which are sites of intense magnetic activity. Here [Fig. 2], you see a chart of the number of sunspots over time going back to the early 1600s when they were first observed, showing a clear 11-year cycle of maximum and minimum. However, not every solar cycle is the same, and there are longer-period cycles of very low lows, called Grand Minima, in which almost no sunspots appear for a prolonged period, and very high highs, periods of Grand Maxima. What I want to talk about here for a moment is, I want to talk about the periods of solar maximum, when the Sun is its most active. Two space weather phenomena that occur as part of this intense activity of the Sun are solar flares and coronal mass ejections. If we go to the next slide [Fig. 3], we see on the left here, an image of a solar flare from NASA’s SDO satellite; and on the right, you see a coronal mass ejection. Solar flares are intense flashes of energy occurring on the Sun’s surface which release bursts of electromagnetic radiation. Coronal mass ejections, or CMEs, are often associated with solar flares, and as opposed to the flares, they fling large clouds of plasma, charged particles, out into space; some of which are directed at the Earth. While the energy from flares can disrupt radio communications on and near the Earth, CMEs are something much more dangerous. When a CME strikes Earth, it can induce an oscillation in the Earth’s magnetic field, causing a geomagnetic storm. These storms can be mild, and they create the auroras, which are lovely. But, they can also be severe. And if they’re severe, they have the potential to induce currents in electrical infrastructure. They can blow out transformers, causing black-outs in the electrical grid of an entire hemisphere of the Earth which receives the CME strike. With our current capabilities, we would not have the ability to repair that for several months, or possibly {years}. In 1859, a large CME struck the Earth, called the Carrington Event, with there were reports of auroras visible near the equator. There were reports of telegraph systems catching on fire, blowing out, glowing with induced current even though they weren’t hooked up. If a CME of that magnitude struck the Earth today, we could expect sweeping and long-lasting black-outs for which we are not prepared. Another effect of CMEs is a phenomenon called Forbush decreases. This is when intense magnetic activity from the Sun temporarily blocks the normal influx of cosmic rays from the galaxy. If we look at the slide [Fig. 4] here, we see two sudden drops in cosmic ray flux, labelled there as the Forbush decreases, as the result of two geomagnetic storms which you see in the red there on the top. These occurred in March 2011. Initial studies that were done, indicate that the resulting change in ionization of the atmosphere and the change in associated latent heat release can, in turn, increase the temperature differential with the ground. This can affect convection currents and potentially increase and intensify cyclones. This is believed to have happened in the case with Hurricane Katrina in 2005. The phenomenon of the atmospheric ionization caused by increased galactic cosmic ray flux has been studied and demonstrated to create an increase in cloud cover on the Earth. The galaxy increasing and modulating cloud cover on the Earth. This is a major factor in cycles of global temperature. In fact, there is a very interesting correlation between the 140 million-year cycle of our solar system’s transit in and out of the spiral arms of the Milky Way galaxy, which are regions of relatively high cosmic ray flux. There is a correlation between that cycle and the long-term cycles of warming and cooling of the planet, which you see in the slide [Fig. 5] here indicated as the icehouse Earth periods. Not only is the Sun acting to control our planet’s weather, but now we have to ask the question, what is, in turn, modulating the activity of our Sun? What is occurring in the galactic environment in which our Sun swims?

DENISTON: So, following on that thread of these unique threats that all inhabitants of this planet face, another existential threat, for which we currently have no protection, is the inevitability of future asteroid and comet impacts with the Earth. Much of the world was given a rather rude and surprising awakening to this reality in 2013. I think many of you have probably seen this footage and remember it, with the surprise explosion of a very small asteroid in the atmosphere above Chelyabinsk, Russia. No one knew this small asteroid was on a collision course with the Earth prior to its impact, because we've only been able to locate and track a relatively small percentage of the asteroids in the inner Solar System environment. Significant efforts have been made to track most of the larger asteroids, but there are literally hundreds of thousands of unidentified, untracked, medium- and smaller-sized asteroids that are out there by all current estimates. These are asteroids larger than the one that exploded over Russia which we just saw, which could devastate an area on the smaller end of the size of a city, or in the more medium range, up to the size of a nation or a continent. Furthermore, even if we found an asteroid which was on an impact trajectory with the Earth; say it was going to impact a few years from now, and we knew it was coming. We have no defense systems, we have no demonstrated capability to divert such a threatening object and ensure the defense of the Earth from that collision. A related threat also comes from long-period comets, which are distinct from asteroids because they spend the vast majority of their time not in the inner Solar System, but in the farthest outreaches of the outer Solar System, far beyond our detection capabilities. Although long-period comets are significantly less frequent, they're generally much larger and far more difficult to detect, and extremely challenging to divert. We'll just play an animation briefly of one example of this. This is data from an actual event that occurred in 1996. This comet was discovered less than two years before making a close pass by the Earth. If that had been on an impact trajectory, there is nothing we could have done. That could have been an extinction event right there. Just an example of how difficult these challenges can be from comets. While most of the potential threats posed from near-Earth asteroids are thought to be limited to local to continental scale effects, an impact with a long-period comet would likely be a global extinction event; threatening the entire existence of humanity on this planet. In line with this Strategic Defense Initiative perspective, efforts can be taken to build up mankind's defensive capabilities against these threats, taking us directly back to LaRouche's SDI principle. The same joint science-driver programs to expand mankind's capabilities in space generally, for the defense of the Earth, are the same programs that can generate the economic and political growth on this planet needed to erode and address the underlying causes of conflict and warfare, as Mr. LaRouche discussed. As Mr. LaRouche stated in his 1984 LaRouche doctrine, which Mrs. Helga Zepp-LaRouche had quoted from earlier in her keynote address today, the most important program, LaRouche says in that document, is a multi-generational Moon and Mars colonization project, driven by fusion technologies. While at the same time expanding technology sharing and capital goods export policies throughout the less developed regions of the planet. Again, ensuring the preconditions for durable peace and durable survival are met, and the causes underlying future conflicts are removed before those conflicts can arise. Again, this Strategic Defense of Earth perspective forces us to see our common place in our Solar System, within our Galaxy, and locate our actions on this relatively small planet from that perspective.

BEETS: To continue that line of thought, I'd like to read a quote from Vladimir Vernadsky, who was a Russian bio-geo-chemist. In the opening section of his 1927 writing, {The Biosphere}, he says, "The history of the biosphere is … sharply distinguished from that of the rest of the planet, and the role it plays in the planetary mechanism is quite exceptional. It is as much, or even more, the creation of the Sun as it is a manifestation of terrestrial processes." One area of study I'd like to raise that could give us unique insight into the role of extraterrestrial factors in shaping the biosphere and the evolution of life on Earth is viruses. Viruses are a relatively new object of study for humanity, not discovered until the end of the 19th Century, and not imaged until the 1930s with the invention of the electron microscope.

However, since that time, what has become undeniable is that viruses are inseparable from life. They are pervasive throughout the biosphere and are known to infect every type of organism. To give a quick sense of the ubiquity of viruses on the planet: there are millions of virus particles in a single teaspoon of seawater. Billions of viruses float in the air currents high above your head in the atmosphere. Even inside the human body, just has we have a microbiome of trillions of bacteria living inside us, we and other living things also have a virome with likely trillions of little viruses living inside us as a regular part of our organism; some of which are an essential part of our immune system. Viruses also play an important role in a phenomenon called horizontal gene transfer. We normally think of gene transfer as happening from parent to offspring. Horizontal gene transfer transfers genetic material from one organism to another unrelated organism, and it's incorporated into the genome of that next organism. This has been known for some time to occur regularly in single-celled organisms – bacteria and so forth. But studies in the past decades have shown this to have occurred between many types of much more complicated organisms, including fungi, plants, and animals. While specific figures on this are still being debated, some suggest that upwards of 100 genes in the human genome were transferred there at some point long ago by viruses. Some of these genes are very important ones dealing with metabolism, reproduction, and immune system response. This idea completely disrupts the typical textbook view of the "tree of life" with its separate, parallel branches. And posits a notion of evolution which is much more interconnected and complex. So, now I'd like to take up that idea and look at it in the context of the solar system and the galaxy. First is some very interesting research that was begun and presented in the 1980s by Dr. Robert Hope-Simpson among others, on the seasonal pandemics of influenza A, which, like many other seasonal phenomena that we're all familiar with, which are connected with Solar radiation, breaks out somewhat simultaneously in the winter in the

Northern Hemisphere, migrates across the tropics to the Southern Hemisphere for their winter, and then returns the following winter to the Northern Hemisphere. One element that interested researchers was the rhythm of outbreak of new strains of influenza, which, if we look back over the 20th Century, shows an interesting, even if not perfect, correlation with the eleven-year Solar cycle, as we see on the slide here [Fig. 6]. Here you see pandemics from the 1940s to the 1970s, mapped on top of the cycles of solar activity. If we look back over a longer period of time, 300 years, we see the possible fingerprint of a larger process [Fig. 7], perhaps a galactic driver. Not only do pandemics tend to occur more frequently during periods of solar maximum, but as you see here, indicated by the peaks of the blue curve, they tend to cluster around periods when solar maxima are more intense. We also have the anomalous years of pandemic during solar minimum. Studies were done which showed a very interesting fact, which is that these years were also years during which the Earth received a higher influx of cosmic radiation from galactic sources, due to — among other causes — bright supernovae. But a question mark left by these researchers was, what is the mechanism? This is unanswered. It is known that viruses can be activated and deactivated by certain frequencies of light. It’s also been observed in many astronauts on the International Space Station, that virus infections that were latent would suddenly become active again. While all of this research is still quite preliminary, and requires further investigation, it is undeniable that the anomalies that I’ve hinted at here point to a higher causality. A modulator of the development of life on Earth which is beyond earthbound chemical reactions. I think that it’s safe to say, having spent only 20 of the past couple millions of years that human beings have been on the planet, just 20 of those years being able to study life outside of the Earth environment, as we have on the ISS, we are mere infants in our understanding of the science of life. In the 1980s, Lyndon LaRouche called for massive investment into research in the field of optical biophysics: electromagnetic radiation as part of the physics of living processes — moving beyond a mere chemical approach to life. This is not an option. As we move civilization more and more off of the planet, off into the Solar System, we are going to be forced to deal with life in the cosmic environment, interacting with galactic processes in a relatively unmediated way. This demands a new and collaborative approach to the science of life.

ROSS: So, to bring a conclusion to these thoughts that we've been elaborating, we're going to return our thinking to the immediate situation, and reflect on just how much work is needed to bring our institutions and our ideas and outlooks into coherence with the perspective that we just heard. For example, how effective is the current idea of the Department of Defense? Can current missiles defend us against asteroids? No. Can bombs save the life of your mother, if she is unable to receive adequate treatment and is dying of COVID-19-induced hypoxia? No. We will develop one or more vaccines against SARS-CoV-2 virus, but what will be the form of a vaccine against asteroids? How can we inoculate ourselves against anti-human, ugly patterns of thought that are both widespread and tragic? How can tragedy be overcome in a durable and ongoing way? Well, Lyndon LaRouche insisted, and Helga very strongly stated in the first panel, that an essential step towards creating a healthy culture on this planet is to achieve of the leaders of the United States, China, Russia, and India, to shape a truly new paradigm of international relations. We do have to work out a global approach to COVID-19, and we have to work out an international system that will go beyond just making sure we have enough ventilators and PPE. But to achieve the economic and cultural development required to completely eliminate poverty — 100% worldwide — and provide for the hygiene, the sanitation, the health and the optimism, and the science of the next chapter of the human experience, the world urgently needs a new paradigm for international collaboration on science, defined by the defense and growth of society, and without the poison of ugly and old ideas. Life sciences research cannot rely on the largesse of a few billionaires who happen to enjoy investing money in it. Consider the billions made off of the misery inflicted by opioids, and the relative paucity of money invested into studying diseases of plants and animals, many of which could potentially start threatening us next week. We could have another outbreak. Government funding has to be dramatically increased, so that the benefits can be public. Basic research is needed. Our progress in learning more about and improving our mastery over the universe; that is the truest sense of defense in the broadest scale. We must ensure that, as we move ahead, this is a shared mission of mankind. The three of us will be available during the Q&A period, if you have questions about any of the content we just discussed. And we’re going to move on now, to our next speaker, after, again, just briefly mentioning, the first volume of the {Lyndon LaRouche Collected Works}, which is available at the LaRouche Legacy Foundation website, https://www.larouchelegacyfoundation.org/ Megan Beets is one of the co-directors of the LaRouche Legacy Foundation and helped make this possible. Our next speaker is Dr. Jean-Pierre Luminet. He is a French astrophysicist, writer and poet. He’s well-known internationally as a specialist on black holes and cosmology, in particular. He worked as Research Director, and is now an Emeritus Researcher, at the prestigious CNRS in France, the National Center for Scientific Research. Dr. Luminet will be addressing some of the questions raised in this last presentation about errors in science in scientific method itself. The title of Dr. Luminet’s talk is “The Role of ‘Free Invention’ in Creative Discovery.” Here’s Dr. Jean-Pierre Luminet.

JEAN-PIERRE LUMINET: Hello. At the beginning of the 20th century, the poet and philosopher Paul Valéry wrote in his Notebooks, “Events are the foam of things, but it’s the sea that interests me.” The aphorism is dizzying. He says everything about what the physicist is looking for, underlying the dry body of equations. The poet seeks likewise under the velvet cloak of his words. Symbolizing depth, the sea enfolds what is essential. But what are the essentials? For the ordinary scientist, this is the "reality" of the world – if the expression makes sense. But for the theoretical physicist, as for the artist and the creator in general, is not the true reality of the world the life of the spirit, which maintains its distance from the fleeting effects of external events? In Valéry's mind, the depth of the sea's vitality is rich enough to accommodate the most tenuous and ephemeral manifestations of the experience. "A little foam, a candid event upon the dark of the sea," he still notes. The contrast between the sea and the foam expresses the striking discrepancy between the unity associated with the permanence and the happenstance associated with evanescence. In other contexts, such as the one I'm currently working on – namely, modern theoretical physics, which seeks to unify the laws of gravitation and quantum mechanics – it rather reflects a complementarity by which the constituent parts are no longer off-kilter, but coherent. I take as an example a brilliant hypothesis put forward by the great physicist John Wheeler in the 1950s. The most creative minds often function by analogy. Wheeler imagines that at the microscopic level, the very geometry of space-time is not fixed but in perpetual change, agitated by the fluctuations of quantum origin. It can be compared to the surface of a rough sea. Viewed from far above, the sea looks smooth. From a closer distance, we begin to perceive motions agitating the surface, which still remains continuous. But, closely examined, the sea is tumultuous, fragmented, discontinuous. Waves rise and break, throwing off drops of water that then fall. Following this analogy, space-time would appear smooth on our scale, but when scrutinized at an ultra-microscopic level, its "foam" would be come perceptible in the form of ephemeral and transient events: elementary particles, micro-worm holes, even entire universes. Just as hydrodynamic turbulence creates bubbles by cavitation, space-time turbulence could constantly bring forth, from the quantum vacuum, what we consider to be the reality of the world. All of this is superbly poetic; however, this does not imply that it’s physically correct. Fifty years after its formulation, Wheeler’s concept of the “quantum foam” is still debated; other approaches to “quantum gravity” have been developed, offering different visions of space-time at its deepest level – the sea – and of its manifestations at all scales of size and energy – the foam. Although none of these approaches, like the string theory, loop quantum gravity or non-commutative geometry, have yet come up with a coherent description, these various theories have at least the merit of showing how the scientific investigation of nature is a tremendous adventure of the mind. Deciphering the fragments of reality under the foam of the stars is to detach oneself from the limits of the visible, to free ourselves from customary deceptive representations, without ever forgetting that the fertility of the scientific approach is watered from underground by other disciplines of the human spirit such as art, poetry, music, and philosophy. This brings us back to Paul Valéry. The prescience of his words does not surprise us when we acquaint ourselves with his background. Curious about everything, Valéry was particularly interested in how great scientists worked mentally. He himself was full of ideas, and in order not to let any of them escape, he was always filling the pages of his notebooks. Several times during the 1920s, he met Albert Einstein, whom he admired, and who admired him. The mischievous father of the theory of relativity later recalled public debate at the Collège de France in Paris in the presence of Paul Valéry and the philosopher Henri Bergson: “During the discussion,” he recounts, “[Valéry] asked me if I got up at night to write down an idea. I replied, ‘But as far as ideas go, you only have one or two in your life.'” When it was Einstein’s turn to question another poet, Saint-John Perse, about how he worked, the explanation he received did not fail to satisfy him: “But it is the same as for the scholar. The mechanism of discovery is neither logical nor intellectual…. It begins with a leap of the imagination.” In his acceptance speech for the 1960 Nobel Prize in Literature, Saint-John Perse called it the “common mystery.” Einstein later spoke out about the essential role of imagination in scientific creativity. At this stage, it is fascinating to consider the bet made on the free invention of fundamental concepts to interpret the world. Einstein already believed that the principles of a global theory could not be adduced from experience alone or from the scientific method alone, in the strict sense of the term. Einstein said: “We now know that science cannot arise from the immediate experience alone and that it is impossible for us to build the edifice of science without availing ourselves of free invention, whose usefulness we can only verify in hindsight, in light of our own experience. My conviction is that we are able, through a purely mathematical construction, to find concepts, as well as laws that connect them, capable of unlocking the doors to the understanding of natural phenomena.” To take on the question of Valéry’s poetic statement, in its potential, but also within its limits, in the face of the field of equations that escape our common language – this must be the aim of a true scientific culture, which is in total opposition to the fashion of the day, consisting rather in accumulating tables of figures, formulas, code, protocols, and misleading statistics, and cramming them into skulls of young people eager to learn and to understand. A true scientific culture must boldly choose not to shrink from acknowledging the dizzying mystery of the world that surrounds and forms us. By accepting its strangeness, the public – especially the young – will benefit by gathering up some form rocks, at least for the time of a movement of the universe. As the great Johannes Kepler wrote to a fellow astronomer in 1605, “This is how we progress, by feeling our way, in a dream, much as wise but immature children.” Along with some other great innovators in the history of science and ideas, Kepler, too, offers an instructive model on how to conceive of the world in a way that opposed received opinion. In 1975, the philosopher Paul Feyerabend published {Against Method}, a book whose central thesis, supported by many historical examples, is that not only is the classical scientific method not the only valid way to acquire knowledge, but that applying it too strictly blocks creativity and innovation. Science is essentially an anarchist undertaking, in the sense that the origin of our scientific ideas can come from everywhere: from art, literature, poetry, philosophy, and even from myth. Anarchism, in theory, would thus be more humanist and more likely to encourage progress than doctrines based on law and order. I will not, however, go so far as to approve of the extreme attitude of Feyerabend's disciples, who say that "everything is good," "everything is equally valid"; which leads to absolute cultural relativism, which would, for example, put on the same level of value a Schubert melody and a Madonna song. As in all things, wisdom is about taking the right path between the two. But among the proponents of the strict scientific method, to the exclusion of any other form of thought, why ignore or pretend to ignore that the creative imagination of scientists undeniably appeals to mythical images? For example, the generating principles present in all cultures – Desire, the Tree, the Egg, Water, the Void, Chaos – clearly appear as archetypes of cosmogonic thought; namely, primitive and universal symbols belonging to the collective unconscious, to use [Carl] Jung's terminology. The term "archetype" was first used by Kepler himself: "The traces of geometry are printed in the world, as if geometry were a kind of archetype of the world," he wrote in 1606 in his treatise "On the New Star" – {De Stella Nova}. Certainly, the work of the great creators in the field of fundamental physics rarely reveals the philosophical background that underlies it. At first reading, we are often tempted to see extreme rationalism and a fundamentally skeptical position. In fact, behind the critical mind of the inventive physicist often hides a deep interest in everything related to the obscure regions of reality, and those of the human imagination, which are apparently opposed to the concept of reason. The work of epistemological reflection of Wolfgang Pauli, who is also one of the fathers of quantum mechanics, exerts skepticism towards skepticism itself, in order to track down the way knowledge is constructed, before we come to a rational understanding of things. The influence of archetypal representations on the formation of scientific theories is undeniable. As seen with Albert Einstein's statement, the theoretical physicist cannot be satisfied with a purely empirical view according to which natural laws could only be established on the basis of experimental material, subject to a strict protocol. Rather, one has to consider the role played by the decisions we make during the process of observation and the role of intuition. The bridge that connects the initially disordered experimental material is located in original images that pre-exist in the collective unconscious. These archetypes are not linked to rationally formulated ideas. Rather, they are forms or images with strong emotional content, which are not captured immediately by thought. The "Kepler case," to which Pauli devoted a book, is exemplary in this respect. Pauli takes the example of Kepler's adoption of the Copernican system. According to him, the persuasive power of the Copernican system holds sway above all for Kepler because of the correspondence he finds there with the Trinitarian symbol, the archetype of Christian thought. This conception of knowledge of nature, according to which the unitary order of the cosmos is not initially formulable rationally, refers us, in its essentials, to Plato and to the neo-Platonism of Plotinus and Proclus, but with an essential difference. In Plato, the original images are immutable and exist independently of human consciousness (Plato uses the term "soul"). Immanuel Kant's use of the concept of the {a priori} form of sensibility, applied to the geometric framework, is equally objectionable. It led him to argue that Euclid's postulates were inherent in human thought. However, the archetypes of psychology are not fixed; they can evolve in relation to a given situation of knowledge. The cosmologist seeks to describe this indefinite expanse of space using a geometric model. Several models are possible; the description obtained depends in particular on the degree of sharpness with which physical space is analyzed. In fact, for a long time, Euclidean space was the only space known to mathematicians. (It was still the case at the time of Kant, before we discovered the non-Euclidean geometries.) In addition, human beings have an instinctive tendency to interpret their sensory perceptions by means of Euclidean geometry. It has been shown that the semi-circular channels of our inner ear, which detect acceleration of the head in three perpendicular planes, construct a mental space whose local structure is Euclidean. So, it took a singular intellectual work to understand that Euclid's postulates were not the only possible ones. To say whether space has three or eleven dimensions, whether it is finite or infinite, flat or curved, simply connected or multiply connected, etc., is far from obvious. Indeed, it's usually counter-intuitive! In this case, the idea must necessarily pre-exist the sensory experience. Therefore, we must indeed place what Einstein called the free invention of theories at the heart of the process of discovery. After all, as the poet Novalis wrote: "Theories are like fishing; it is only by casting into unknown waters that you may catch something." For several decades, the Schiller Institute has adopted, among other goals, the mission of promoting this fruitful way of thinking about the world, and I am glad to have been able to share it with you. Thank you very much for your attention.

ROSS: For our next speaker, we're going to be hearing from a French astronaut, and given the time in France, we're very glad he's able to be on with us this late. And I'd also like to make sure that everybody knows that if you have a question for our next speaker, please email it in right away, so we'll be able to have a short dialogue with him before it gets too late. Michel Tognini is a French test pilot, engineer, and former astronaut at the Centre National d'Études Spatiales (CNES) the French Space Agency. He's also the former head of the European Astronaut Center of the European Space Agency, and one of the founding members of the Association of Space

Explorers. He has logged a total of 19 days in space aboard the Soyuz, the MIR station, the Space Shuttle Columbia and the International Space Station. What an impressive international space presence! His presentation is entitled, "Friendship Between Astronauts: An Exemplary Precedent for International Cooperation."

MICHEL TOGNINI: Hello everybody and thank you for inviting me to speak about cooperation between astronauts and cosmonauts. I will ask you to give the next slide, please. We are going to talk about a brief history of space, and the cooperation between us and what we did in space. So, next slide; and next as well. So, if we look at what we did in the beginning, we had the first flight of Sputnik, in 1957. It was a big surprise all over the world, because the nobody was expecting this Sputnik to flight in space, except the Soviets at the time. And as you see very well, the Sputnik as it is designed, it is metallic and it was making a big because it was a tool to be seen and to be heard all over the world, which was propaganda tool in space. Next, in 1961 was the first human flight of Yuri Gagarin. It was the first time that a human left the Earth to go to space. He made one orbit around the Earth, which only is one hour and 40 minutes. And he landed safely. That was the beginning of human space exploration. Then, humans have been to space regularly, have been to the Moon, and they go to the International Space Station. If we consider all the flights made from Gagarin up to today, we have spent roughly 150 years in space. Next slide: Other important dates as well are: 1962: John Glenn, the first American went to space. As you can see, in the beginning was Russian, and then American. 1963: The first female in space was Valentina Tereshkova. She was Russian. 1965: The first space walk, Alexei Leonov went up in a spacecraft, in space, and then he went outside of the spacecraft with a spacesuit, to spend a little bit, like 15 minutes, in a space walk. 1969: You all know, the first humans on the Moon, with Armstrong and Aldrin. 1981: The first Space Shuttle flight. The Space

Shuttle flew roughly 30 years. 2001: The first tourist in space, Denis Tito, who was American. His dream was to fly in space, and he had to pay for his mission. So that was a way to demonstrate that the human space missions are safe enough to be flown by tourists. 2003: Yang Liwei, the first Chinese in space. We call them taikonauts. 2012: The first SpaceX mission, that was the mission made by Elon Musk, a private company going into space with a dream and with a goal to send humans to space. And I can tell you, 2012, when he started, nobody believed he that he would send a human into space, but this year, in May 2020, he will send the first human mission to the Space Station. 2017: China announces its planes to return to the Moon, to exploit the soil of the Moon. Next slide: You can see on this slide, the fact that Russians and Americans are the different paths for space flight. The Russians had the classical rocket, called Soyuz and the classical capsule. They made the progressive evolution of the rocket and capsule, in order to fly, almost the same rocket and the same capsule, but much more modern, and they had seven space stations called Salyut, from 1 to 7; they had the Mir space station that was used also to do the first flight between the Space Shuttle and the first docking of the Space Shuttle to a space station. And they tried to land a human on the Moon, but they could not have a [inaudible 1:12.34]. On the other side, the Americans had the Mercury for 1 person, Gemini for 2 persons, Apollo for 3 persons to go to the Moon, and to go to the space station called Skylab. They went to the Moon six times safely, and successfully. They had the Space Shuttle. So, it was more, for the Americans a zig-zag path. And we can say that at the time, when you see the two red and white columns, it was a kind of a confrontation between American and Russian. But, there was a flight called ASTP, Apollo-Soyuz Space Mission in 1975, where Soyuz went to space; an Apollo spacecraft went to space. They docked in space. When they docked, they opened the door, they shook hands, they gave each other gifts, and they started a very strong friendship. Next Slide: This shows you the crew of this Apollo-Soyuz mission in 1975. In green you have the Russian, in light brown you have the Americans. And in this five [inaudible 1:13.51], two persons, one American, one Russian became very good friends. This first mission was made because of the good friendship between two persons. And usually when I make a speeches, I ask people in the room to tell me who the two persons. I will tell you today, because you cannot speak to me: The two persons are Tom Stafford, an American fighter pilot, test pilot and astronaut; and on the right side is Alexei Leonov, who was also the first man who made a space walk. He was also a very courageous space, fighter pilot. And these two persons became friends, on this mission, before the mission, when they met in 1972, during the mission that was very successful, and also after the mission. And the pictures right after show you the two men, as they could be today. Next slide: You can see, on the left, Tom Stafford; on the right, Alexei Leonov, after 45 years of true friendship. I can tell you that every year, Tom Stafford went to visit Alexei Leonov in Russia to spend a few days with him on vacation. And every year, Alexei Leonov went to America to spend a few days with his friend Tom Stafford. And even sometimes, when the relationship between the two countries were slightly heavy, the two governments asked them to try to solve the problem. Unfortunately Alexei Leonov passed away a few months ago, so this friendship is no more. But the next slide will show you that we continue this friendship, as you can see, in space. We have today the space station, and these are young people on the space station: on the left side, you have the Russian cosmonaut, on the right side is an American astronaut. They fly in space: They have been flying long duration flights in space for 20 years now, and they have a very strong relationship and they have a good trust, because they can each cut the other’s hair, and this has led to what we called the ASE, which “Association of Space Explorers,” which was created 35 years ago. This Association of Space Explorers includes {38} different countries and this was created in 1985 in France. Since then we meet every year in a different country in the world. Next slide: To show you that we went from confrontation to cooperation, slightly. The confrontation gave very good speed to the space program. You remember when John Kennedy asked the country to go to the Moon. NASA went to the Moon in eight years, which is very, very fast. But, there was less emphasis on scientific content. Today we cooperation, which is slower evolution, but more focused on science, and we do have cooperation, among five partners, which are NASA, the Russian, European, Japan, and Canada. And also, we try slowly to have China and India with us, to have seven partners in space. Next slide: In this case, you could have a pattern to fly in space with seven different space agencies, and the seven space agencies would have seven tasks, to go to the Moon or go to Mars. On this slide, you could see that one space agency could be in charge of the launch site, the second space agency could be responsible for the access to low-Earth orbit, what we call LEO; the third space agency would be in charge of MTFF, which is a low-Earth orbit small space station; the fourth space agency would be in charge of the transfer, with a tug, from low-Earth orbit to the Moon orbit; number five would be the MTFF on the Moon; number six would be the descent to the Moon; and number seven would be in charge of the lunar base. You can see on this diagram that we can share all the activities between the whole world to have a common goal of going into space together. Next slide: I show what we did achieve with the space station. The first mission was in 1988. What we did in this mission is a real Apollo-Soyuz mission, with a left module which you called LTB, launch from Baikonur, on a Proto rocket. The right module was node number 1, launched on the space shuttle from Kennedy Space Center, and the two were docked together with the robotic arm from Canada. That was the beginning of the building of the space station Next slide: This shows that we put a third module called Salis [ph] module. Inside you have oxygen, you have life, therefore there was Soyuz on the back, in order to bring people into space. That was the beginning of the Space Station, with three persons on board. And the next slide shows you the complete

Space Station with the Space Shuttle on the top, the U.S. part on the top part of the picture; the tray with the solar panel on the side; and on the backside you have the Russian side and you have the European ETV that was able to fly five times in space, in order to be paid for the launch of Columbus, that you can see on the left front side of the station. The next slide shows you one of the current positions of the space station. You can see that you have two Soyuz’s, two Progress’s and we can congratulate the Russians, as today they launched a Progress which is like Soyuz but automatic; and they had the re-cut of the docking time, because they were going from the ground to the space station in less than 3.5 hours. So that’s the shortest time to go to space. And you can see on the left side the Dragon insignis; these are made by private companies. And the Beam is an inflatable structure, in order to have less weight and less volume from Earth to space. Next slide: So the first mission was 1 hour and 40 minutes, which was the one with Gagarin. We slowly made an evolution on the direction of the space flights, to go for 1 hour, to 1 day, 1 week, 2 weeks, and then 6 months. All the flights today are six month duration. Some flights have been 1 year. The record was 14 months with Valery Polyakov. So we knew that we could cope with the fight that we lost muscles, we lost [inaudible 1:21.07] in space. We can do exercise every day, two hours of exercise to compensate for this loss. In parallel, we understood that the difficulty was the psychological behavior, so we did some studies on the ground with Mars 500, 18 months on the ground with 6 international people, in order to simulate a flight to Mars, and also a flight on Hawaii with one French person, one year on that mission completed. It was also to test the psychological behavior in this long period of confinement. And the good is to have the best knowledge of human behavior in space, in order to make a trip the Moon, to Mars, or to an asteroid. Next slide: The goal is to make a long duration flight and to stay in space longer and longer, and also to be able to make operations in space, like repairing a satellite, or doing a space walk, or building some structure, like we did with the space station. But, because we're in space, we use the fact that we're in zero G to do science, like the control of muscles during long flight, or study on the risk of kidney stones during long flight. Next slide: And this also is an application of what we could do in space, we're starting to do it, in the growth of protein crystals. You see on the top left picture, what is protein crystal growth on Earth, and the one on the right side is the one in space. Because you are in zero G, the spatial protein is bigger so you can have better presentation of the disease, and you can make some special medicines, much more precisely because of that. Next slide: shows you also the impact of space missions, which is education. When Kennedy initiated the Apollo program, we had the top record of students going for PhDs, physical science, and engineering diplomas. We had the same in France. When we have the French astronauts playing in space, still don't want to study more science to better understand what's going on in space, and better understand what space science. And the space station we have today, which is a real success, we can say that all the building of the space station was successful, all the flights were successful; there is permanently on the space station at least one American and one Russian and they do work very well together. This cooperation program is between Russia, United States, European Canada and Japan. In Europe, 10 countries participate in this program, so altogether, 15 countries work together. It was a program made for joint science together with the participation of Russia in a great way. And the next slide, will be my last: which is slogan of Konstantin Tsiolkovsky "Earth is the cradle of humanity, but mankind cannot stay in the cradle forever." This is why we go to space, and this is also why we want to increase our knowledge there, today. Thank you very much.

ROSS: Thank you very much, Michel Tognini. If you have time, there are a few questions that came in for you. I can combine it into one question so you answer them together. One of the questions was, someone was saying that it seems like you had a very unique background, for being involved in the U.S. and the Russian space agencies. They wonder what the biggest lesson you learned for advising the future would be, based on that. Another question asks about how countries should work together to do the Moon-Mars program — this is an American and she says: This seems like it's too big for America to do alone! Should we work with other countries? And a Serbian, a member of the executive board for the Serbian Office for Space Sciences asks about international cooperation for space. This person writes: "I am a strong advocate that outer space should be considered as a common heritage of mankind, as the UN conferences also say. In this light, and being a space developing country, we are facing problems as well as many other countries to join the Space Club. I would like to hear your opinion on how we can rethink the global approach to outer space activities, policies and research."

TOGNINI: I will try to reply to the question, what did I learn from this cooperation with Russia and with NASA? I learned humility. And I think humility is really important for an astronaut, from people on Earth, and also for the consideration that life is very fragile. As someone said before, we could be hit by a comet or an asteroid any time, and we need to have a plan to fight against an asteroid or a comet. And the only way to fight this danger is to work together. In the Association of Space Explorers, where we have several different countries joined together and different astronauts from these countries, we have a plan to study every year, the way to deflect an asteroid from Earth. Today, it's an automatic program, but in the future, we will try to make it maybe a human program. And the second question is how to go to the Moon and Mars. I strongly believe that slowly, we need to cooperate together, even with China and India, because they have very good potential for a program in space. And the example of the International Space Station is an example that could be applied to the whole world. If we could succeed in the International Space Station, we are obliged to succeed if we include China and India together. So I believe in it. And, for the case of Serbia, you know Serbia could participate in a space program, whether it is with Russia or it with ESA, the European Space Agency. It’s a pretty good organization, it’s a pretty good will. But if a country wants to participate in space, at {any} level, even at 1% of the budget, it’s possible to do it.

ROSS: OK. Thank you very much, thank you for joining us. We know it’s late there, and we’re very happy to have had your participation. Thank you, Michel Tognini.

TOGNINI: Thank you very much, and good evening to all of you.

ROSS: We had sent in, not as a question, but actually as an interesting comment, a statement that was made today by Presidents Trump of the United States and President Putin of the Russian Federation, on the occasion of the 75th anniversary of the Meeting on the Elbe, which Dennis mentioned in his introduction to this conference. I’d like to read their joint statement:

“Joint Statement by President Donald J. Trump and President Vladimir Putin of Russia Commemorating the 75th Anniversary of the Meeting on the Elbe “April 25, 2020, marks the 75th Anniversary of the historic meeting between American and Soviet troops, who shook hands on the damaged bridge over the Elbe River. This event heralded the decisive defeat of the Nazi regime. “The meeting on the Elbe represented a culmination of tremendous efforts by the many countries and peoples that joined forces under the framework of the United Nations Declaration of 1942. This common struggle required enormous sacrifice by millions of soldiers, sailors, and citizens in multiple theaters of war. “We also recognize the contributions from millions of men and women on the home front, who forged vast quantities of war materials for use around the world. Workers and manufacturers played a crucial role in supplying the Allied forces with the tools necessary for victory. "The 'Spirit of the Elbe' is an example of how our countries can put aside differences, build trust, and cooperate in pursuit of a greater cause. As we work today to confront the most important challenges of the 21st century, we pay tribute to the valor and courage of all those who fought together to defeat fascism. Their heroic feat will never be forgotten."

ROSS: That is the joint statement by Presidents Putin and Trump. For our next speaker we're going to be hearing from an American astronaut: Walt Cunningham is a retired American astronaut, who served as Lunar Module Pilot on the 11-day Apollo 7 mission, the first Apollo that brought human beings into space. During the flight, the three-member crew did exercises in docking and lunar orbit rendezvous, completed eight successful tests and maneuvering ignitions of the service module propulsion engine, measured the accuracy of performance of all spacecraft systems, and provided the first effective television transmission of onboard crew activities. Among his many decorations and honors, Walt Cunningham is a recipient of the NASA Distinguished Service Medal; an associate fellow of the American Institute of Aeronautics and Astronautics; and a fellow of the American Astronautical Society. In preparation for this conference today, we asked him about his historic flight and the contributions that flight made to fulfilling the vision laid out by President Kennedy, and to making the Apollo Moon landing missions that came after a success. Let's hear Walt Cunningham's presentation: "Apollo 7: An Astronaut's Reflections."

Q: What did you have to do to qualify to become an astronaut?

CUNNINGHAM: My personal assessment is, you really shouldn't be there unless you're willing to stick your necks out a little. It took me years after that to fully put into the right perspective on this with fighter pilots. I have to tell you, in my book I have a section in there on the day that I decided I was going to apply to be an astronaut. That morning, actually I was getting my college degree in my mid-20s. I had not been to college. I joined the Navy out of high school, managed to pass the two-year test, became a fighter pilot. Smart enough to go in the Marine Corps instead of the Navy, which I never regret. [laughs] But I was going to college trying to get a degree that year, and I was driving in the morning, because I was working at the RAND Corporation, and I was driving that morning, and they were going through the countdown for Alan Shepard. It was 1961. And he was on the East Coast, and I'm driving along in my car, and we didn't have all those freeways out in L.A. at that time, I was going to UCLA. It got down to the last four or five minutes, and I had to pull over to the side of the road and park, so I could hear what was going on. I couldn't even keep driving. It got down, I remember the count – 5, 4, 3, 2, 1, lift-off – and I caught myself screaming out, "You lucky SOB!" [laughter] And that was the time – I felt like I was alone; I looked around to make sure, there was no one parking that was looking at me—and that was when I decided that that was what I was going to do, I had good background for it. And 18 months later, I was sharing an office with Alan. It was like joining a very unusual, unique kind of life at the time. That's evolved the way a lot of these kinds of things do. When we first had human beings sail around the world, that's the difference from how they evolved into consistent kinds of systems out there in the oceans.

Q: What did you think about President Kennedy's challenge to land on the Moon? What went through your mind?

CUNNINGHAM: It's interesting now as time goes on. I can only speak for myself, but I'm sure a lot of the other people feel the same way, too. As you get older and you get more mature, you can put in perspective some of these things that at the time you never even thought about; you just took it for granted. When he was making his speech, I remember that was before I had been selected by NASA. I got selected the first time I applied. But I can remember when he was saying that, I just thought, “it was a good speech.” Now, it’s something that goes down in history, and I think it’s because at the time, our minds were not working quite the same way. You’ve got to let your mind mature in order to get the perspective on what’s going on historically. It was a unique period in our history, for the people here with that kind of an activity to move to. If you go back 500 years, and you look at the first time they set out to sail around the world? I have to tell you, I think they started off with about 240 people, and there were 4 ships. When they finally made it, a year and a half or two years later, there were 18 of those original people still alive. And they had made it around the world. They were willing to pay the price. They moved our society forward. We felt a lot of pluses going out in society after that. That was 500 years ago. The society in the world benefits from being willing to stick your neck out, but not doing it wildly. You’ve got to be committed to what you’re trying to accomplish. I’m sure I feel I can speak a lot more about that now than I ever did at the time, because you’ve got to get wise.

Q: What was it like to be one of the first in space?

CUNNINGHAM: I think that they’ve said that 25% or 35% of people had a reaction to zero Gs, throwing up the first day and stuff like that. But they were all committed; they would all go on, anyway. The amount of weight that was lost by those folks – ours was the longest Apollo mission I think; there might have been one more mission slightly longer. I think the most anybody lost weight on our mission was 10 pounds, something like that. The attitude of the people in those days was different than the attitudes today because we were all military fighter pilots. Whether the world likes it or not, it takes a certain attitude on that to justify having those kinds of activities from one country to another. But I have to tell you this: One of the reasons that our mission was such a success – first off, it’s gotten a lot of criticism because Wally Schirra at the time had a cold. But I have to tell you this, everything that Wally needed to do operationally, he did it anyway. It was a problem with the verbiage back and forth, because he was recovering from a cold. As a matter of fact, he let the ground think that we all had a cold. We didn’t have colds. I didn’t cough once. Donn Eisele I think once or twice may have coughed, but we were juniors; he was a very serious guy. And whether we like it now at this stage, I think he did a very good job. He was a {good pilot} in my opinion. At the time, that flight, I think it surprised him, because it was an 11-day mission, and they added four different objectives to that mission. The ground, I’m sure, had lots and lots of reservations as to whether we would make 11 days; they did it. I can remember the last couple of days, we had some time on our hands, because we didn’t have a lot of film left. Now they take pictures all over the place. Our total film for the whole 11 days for 3 of us using the camera, was 500 pictures! Now, they might do that with one pass around the Earth. The world doesn’t realize that 53% of the Earth’s surface is covered by clouds. Whether we like it or not, most of the Earth is ocean, out there. Back in those days – and even today – they’re almost totally dependent on air-to-ground communication. Now they’ve got essentially pretty much 100% air-to-ground communication. But what we had for air-to-ground communication was 4% of our time. And you had to be directly able to contact it. They say, “Oh, gee, that was horrible!” No, we thought that was good, because we had so many things to d, that we felt it was good when we weren’t getting pushed to do other things. But we did need a certain amount of information. It was 4% or 4.5% of the time we had communication. You’re looking and talking to me at my age – I’m 88 years old. I’ll tell you this, I thought we had a great mission, I really do.

Q: What advice would you give to young people today who want to go into space?

CUNNINGHAM: I would not consider myself of giving the real overall best answer. I’m still stuck in that world of how important it is to be the world’s greatest fighter pilot – mentally, at least. But the other things, it’s a different way of living, and the public today has been educated now for 50 years, most of them. Well, I can’t even say most of them, but many of them want that opportunity to do that. Of course, now they’re selling tickets to people to ride a spacecraft up there. And I’m sorry, I can’t look positively at all that stuff. I know it’s got its positive side, but I live in a different world. And I think that they’re fortunate, if they become one of today’s astronauts. But to do that, you better perfect yourself in the skills it takes. There’s a lot of different skills that it takes today. There’s a pretty good number of doctors, for example, who have been up there. That’s good. They’ve had a number of ladies – there have been a couple of lady pilots, incidentally, that I thought were pretty doggone outstanding. They did a real good job.

Q: How do you think about taking risks and doing what sometimes seems almost impossible?

CUNNINGHAM: You have to have the attitude that comes automatically if you’re a major league fighter pilot. One of the best fighter pilots, or at least, and I’m specific about this, at least believing you are. The best kind of attitude when you go in to attack somebody else, rightly or wrongly, you have to have the kind of confidence that says you’re going to come out ahead, and you’re willing to pay whatever price it takes {to get that done.}

ROSS: That was Walt Cunningham, an astronaut on Apollo 7, the first Apollo to take human beings into space. Let me give you a sense of who’s coming up: I’ll introduce our next speaker in a moment. Follow our next speaker will be a State Senator who is a big supporter of nuclear fusion; a physics professor who has received two Presidential appointments to national scientific positions; a Chinese physician, speaking about their experience with COVID-19; and a New York City physician, who’s going to speak about what it’s like in the current hotspot here. Our next speaker, Dr. Marie Korsaga is from Burkina Faso and she holds a doctorate in astrophysics and specializes in the study of dark matter. She is West Africa’s first female astrophysicist and seeks to share her love of science, and its importance, more broadly, through expanding science education in Africa. Dr. Korsaga has entitled her presentation, “The Necessity of Science Education for African Youth.” Please go ahead, it’s fine: We’re having some audio difficulty, so I’m going to dub your video into English myself, rather than the interpreter. Please, Dr. Korsaga, go ahead.

Dr. MARIE KORSAGA: [as translated] My name is Marie Korsaga, I am an astrophysicist and originally from Burkina Faso. My research focuses on the distribution of dark matter, and visible matter in galaxies. In simple terms, it must be said that visible matter, that is to say, ordinary matter made up of protons, neutrons, electrons, everything that is observable with our devices, represents only about 5% of the universe — the rest is invisible matter, distribute as follows: 26% dark matter and 68% dark energy. Dark matter, with its gravitational force is used to explain the fact that galaxies remain close to each other, while dark energy causes the universe to expand faster over time. So we cannot speak of understanding the universe if we only know about 5% of its constituents. So, to understand our universe, that is to say, to be able to account for its formation and evolution, it is essential to understand what dark matter and dark energy are. Dark matter, as its name suggests, is something that you cannot see with even the most sophisticated telescopes. So far, no dark matter particles have ever been detected, nevertheless, we feel its presence thanks to its impact on gravity. The purpose of my research is to study how dark matter is distributed inside galaxies in order to better understand the formation and evolution of our universe, and therefore, the origin of life on Earth. Beyond my research, I am interested in the development side of astronomy in Africa. For this, I work at the Office of Astronomy for Development on a project which consists in using astronomy as a factor of development almost everywhere in the world, but especially in the developing countries, by supporting projects related to education, educational tourism and so on. Speaking of education, it is important to remember that according to the African Union, Africa has the youngest population in the world, with more than 40% of its young people under the age of 15, which will produce a demographic explosion in the next 10 years. This population growth has disadvantages, but also advantages. The downside is that if measures are not taken, such as access to quality education for boys and girls, especially in science, these young people, instead of becoming a source of development for the continent, risk, rather to be a source of socio-economic political instability and conflict, which will further plunge the continent into misery. However, the advantage of this population growth is that through a well-developed education system, this demographic growth, if accompanied by strong measures both on the side of public policies and the private sector, will be a great source of sustainable development, at the economic and political level of the continent. For this, it is very important to make significant investments in the field of education, with a focus on innovation, science and technology. It should be noted that today, African graduates mainly graduate from the literary and human sciences fields. STEM students – science, technology, engineering and mathematics – represent only 25% of the workforce on average, according to the World Bank. In addition, women are underrepresented in these areas. Take my case: I am the first woman to obtain a doctorate in astrophysics in Burkina, and even in West Africa. It may sound flattering, but it reveals a rather disturbing diagnosis, despite being a light of hope. Indeed, even if the region has a dozen doctorates in the field, there are almost no women among them. Unfortunately, this shows that we are still a long way from achieving gender parity in science, and there is still much to do. This requires a change in mentalities and the accessibility of science to women, especially among the underprivileged. It is not unknown that a career in astrophysics requires a course in physics, which is not obvious for women in our societies where the majority of people think that the scientific fields are dedicated to men, and that women must go to the literary streams. This has the effect of discouraging women from opting for long studies, especially in the scientific fields, and even if they opt for them, they tend to give up at the first obstacles, due to the lack of encouragement. Today, I can say that I have broken this barrier, at my level, and I would like to take advantage of the privilege to inspire and encourage as many young girls as I can, to opt for it. It is true that today there are efforts being made by several governments to break these stereotypes with, for example, the NEF, the Next Einstein Forum in Rwanda, which is a platform for popularizing science, and which offers opportunities for students through scholarships of the network of women in science, called OWSD, the Organization for Women in Science for the Developing World, which gives opportunities to girls and women in STEM fields. However, there is still a lot to do, because the representation of women in science is far from being reached. Beyond research, I intend to contribute to the training of young people in science in Burkina Faso, and in Africa in general, by giving courses at universities, and also supervising masters and PhD students. I also plan to take action to popularize science education in general, and astrophysics in particular in countries where access to science is limited. This will serve to motivate young girls and boys, especially young girls, to take up scientific studies. There are also other future actions that I plan to undertake, in collaboration with other researchers, namely the establishment of scientific schools in Africa, particularly dedicated to women; the organization of workshops to enable female scientists to speak about their inspiring work, and cultivate self-confidence. The creation of an astronomy club for children, etc. In addition to being fascinating as a science, astronomy can also be used as a development tool through, for example, education and tourism. The International Astronomical Union understands this and is making a lot of effort to address this development component in developing countries, and working to achieve a Sustainable Development Goals set by the United Nations. The typical example, in Sub-Saharan Africa is the case of South Africa, where the installation of telescopes in localities has not only facilitated the popularization of science and the creation of jobs for young people, but also has boosted the economy, and the development of infrastructure in these localities. The current context in which we, notably the COVID-19 pandemic, reminds us of how important science must occupy our lives and our education system. This importance must convince the African authorities that it is more than necessary to devote a large part of national budgets to the support and the promotion of studies and of scientific research, because investment in human capital remains a secure means for the growth of a country. Above all, we must understand that to get our continent out of underdevelopment, we will have to review our way of executing these programs, focusing on education, training in science, technology, and innovation, especially space science, could not only increase our human potential, which is a source of sustainable development, but also enable the management of our natural resources and thus impact the economy in the continent. Africa has an immense amount of natural resources, essential to the development of industry. It is necessary to arrive at a point where these resources are exploited, first for its development, by women and men trained on the continent and with compatible techniques. Thank you for offering me the opportunity to share my thoughts on the necessity of education in science in Africa. Thank you.

ROSS: Thank you, Dr. Korsaga. Sorry we had a little bit of trouble. We will be taking questions for Dr. Korsaga — send your questions in now. We will be taking them in a short moment. Our next speaker is Sen. Joe Pennachio. He has served in the New Jersey State Senate since 2008, and previously served in the state's General Assembly from 20012008. Senator Pennachio has a far-reaching vision and has been an outspoken advocate for the development of nuclear fusion energy. Senator Pennacchio sponsored a hearing in the New Jersey State Legislature last May entitled: "What Are the Prospects and Requirements for the Early Development of Fusion Energy, and What Are the Implications for the U.S., New Jersey, and the World?" This hearing pulled together leading scientists — from the Princeton Plasma Physics Lab, as well as from several New Jersey technical corporations that are working on fusion, including in collaboration with ITER [International Thermonuclear Experimental Reactor] project in France. A link to the video of that hearing that Senator Pennachio held will be included on the conference webpage. Following the hearing, Senator Pennacchio introduced an important group of six interrelated bills to support and attract businesses on fusion, to call on the federal government to offer greater support for this necessary new technology, and one, which passed the Senate this February, finances research positions for fusion energy and plasma physics, as part of this effort. In his introduction to his hearing he said that even with the estimate that we could have a sustainable fusion reaction by 2025 and commercial applications by 2050, he said "in my humble opinion, that is not soon enough." He then concluded: "The problems that we have … for instance, in space travel—we have to get a new propulsion system that can overcome those challenges—one of the ways to allow intergalactic and interplanetary travel in the future. Imagine the benefits that men and women can reap from its development…. Myself, and the other legislators in this building—we need to know how we can help that; how can we nurture and help this game changer come into being." Let's now hear from New Jersey State Sen. Joe

Pennacchio, serving New Jersey’s 26th District.

SEN. JOSEPH PENACCHIO: I’m New Jersey State Senator Joseph Penacchio.

Q: At the close of your hearing, there was a group of high school students there who had attended, as well as people from universities, and you said that the development of fusion — you said that the hearing was for them as much as for anybody, and that the development of fusion would fundamentally change their lives. What is your vision for the next 50 years for those young people, the next two generations, if we achieve fusion? If we get a commitment to actually achieve fusion today?

SENATOR PENACCHIO: Well, I don’t know if the word is “if.” From what I’ve been reading it’s not “if” but “when.” They’ve actually set up parameters and dates within the five years, 2025, they will actually have a sustainable fusion reaction, and then 25 years after that they think they can have the first commercial application of fusion. I think that more or less parallels what happened with nuclear fission, and the application and development of that. I would hope that, if you put a concerted effort into it, if we share our knowledge with knowledge that’s going on around the world, especially with the tokamak reactor and all the countries that have signed onto that [ITER] consortium, I would hope that it would be sooner than that. And it’s as much for their future as it is for mine. I’m 65 years old: My future is not measured in too many decades, if God is willing. But their future is measured in an awful lot more decades than I am. So again, imagine a clean, safe, renewable energy source, where we don’t have to go to war with each other to get it, and we don’t have to worry about breathing in some of the gases which may be harmful in the production of those energies.

Q: The idea that you have put forward, also, that you said in the hearing that politicians always think they're responsible for the good things, but your position is that actually, it's scientists who have changed history. I'd like to ask you to talk about that; and also, the influence of the ideas of the American Revolution which was very committed to science, from Ben Franklin on, — Ben Franklin, Alexander Hamilton, and then, of course, someone whose picture is all over your office, Abraham Lincoln. So, I'd like you to comment on that, on the question of the American System, the commitment to science and the relationship between political leadership and scientific advance: What is the responsibility of politicians to advance that, and what is the role of the citizens to make sure that that is done?

SENATOR PENACCHIO: Well, the evolution of our lives, the fact that they've gotten better has been through science. It wasn't politicians that got rid of cholera and typhoid and smallpox and polio: It was science. It wasn't politicians that got us to the Moon, it was science. But it was politicians that challenged us, and that redirected some of those resources that way, we {can} go to the Moon, we {can} fight off these infectious diseases. We can improve and lift the spirits of {all} Americans and all humankind! So my job as a politician is to form public policy and to act as catalyst for some of those good things that science can do. And part of that process is economic, of course, and we think that by generating that enthusiasm for fusion, we could also cultivate a resource in the state that we haven't seen, since Princeton first got themselves involved with fusion. So, it's a win-win-win for all those around us. For some reason we abrogated that responsibility to Paris and their tokamak reactor. And being the selfish New Jersey politician that I am, I'd like to see us get it back. The good news is that, as with the tokamak reactor and the ITER, International Thermonuclear Experimental Reactor, that a consortium put together, I would hope all of this material, all this science is shared, in real time: That way we can push this forward and make it a reality for those children that were attending that meeting that day, Susan. [end video]

ROSS: Wonderful. Thank you, to Senator Pennachio. Now, what I'd like to do, is pose to Marie Korsaga, two questions that are related to your presentation. The first comes from Ahmed Moustafa, who is the director of the Asia Center for Studies and Translation in Dakar, Senegal. He asks: "How should we reconsider the current educational pedagogic systems worldwide, according to this pandemic? What lessons must be realized?" One other question comes from Benoit Douteau [ph] from France, who asks: "How can we in Africa use the coronavirus pandemic to develop nuclear energy, infrastructure and industry in the next decade?" So the questions are about changes in the educational system, in pedagogical technique, as well as how to use the current problem as an opportunity to create growth in Africa. And I'd like to ask Dr. Korsaga, because we might be having some troubles with our translation facilities, if she could respond slowly to the question.

KORSAGA: [translated] To respond to the first question, I would say that to improve the quality of education, we must improve the Africa laboratories, scientific laboratories. Theoretical studies are more common due to a lack of material supplies and this must be rectified. We must also encourage students and provide them opportunities to be able to really extend their education and fulfill it to a higher level. We must also include facilities and tools to help women pursue their studies and feel more comfortable in the educational environment. On the second question, about the coronavirus pandemic, we don't yet have full scientific abilities to deal with the coronavirus, and in their absence, we're relying on governmental techniques, such as staying at home, washing your hands, or disinfecting them. Scientists are performing studies, they're simulating the reaction of the virus with different drugs they're considering, they're studying the propagation of the virus with methods of modeling.

ROSS: OK, and then she'll be available for more questions later. Thank you, Dr. Korsaga. Our next speaker is Prof. Will Happer: He has a long and distinguished scientific career. He is a Princeton University Professor of Physics Emeritus. Will Happer received his physics PhD at Princeton and began his career at Columbia University (where he became the director of the Columbia Radiation Laboratory), before joining the physics faculty at Princeton in 1980. In 1991 he was appointed by the President to serve as Director of Energy Research in the Department of Energy, where he oversaw a research budget of some $3 billion annually, which included much of the federal funding for high energy and nuclear physics, materials science, magnetic confinement fusion, environmental and climate science, the human genome project, and other areas. He then returned to Princeton as a physics professor until his retirement in 2014. From September 2018 to September 2019, Dr. Happer again served in an appointment by the President. He was the Deputy Assistant to the President and Senior Director of Emerging Technologies on the National Security Council. He has published over 200 peer-reviewed scientific papers. And he is happy to speak with us next.

WILL HAPPER: I'm Will Happer, and I'm a retired professor of physics at Princeton University, where I worked for many years. I still have an office there, thanks to the trustees of Princeton University. Before that, I spent many years New York City at Columbia University in my youth, and my children were born there. I'm trained in nuclear physics and atomic physics. I've done a lot of work on laser physics. I'm probably best known for inventing the sodium guidestar, which most modern telescopes use to compensate for atmospheric turbulence so you can get better resolution of galaxies and other astronomic objects. My career has been a mixture of theory and experiment. I've done a lot of experiments. I've spent a good fraction of my time in working on spin-polarized gases, spin-polarized nuclei, and one result of that was that we learned to polarize helium-3 and xenon-129 in such large quantities that there was enough that you could breed them, and then you could look at people's lungs with magnetic resonance imaging machines, that was impossible before. And so that's developed into an interesting diagnostic technique in medicine, still going on today. We actually did a little start-up company based on that, which was successful, and helped to launch the careers of some of our former students and post-docs. So, I guess, I would say, I'm a classical physics nerd: I like physics, I like quantitative things, I like things that you can model. I want them to be models that can be believed!

Q: You were requested by the Trump Administration to organize a panel to evaluate the claims of climate change, but that committee never functioned. What happened?

HAPPER: Well, it's not a very complicated idea. Almost any other important science or technology, or effort of our country has been carefully reviewed. Especially in defense, for example, before we buy something, we have what's called a "Red team review," where people intentionally try to poke holes in say, this weapons system, or this theory, or that. And then the proponents have to defend it. And you know, often they get through with A-plus certification. I defended what I'm trying to do, you got these people at their best, they couldn't poke any holes in it, so I'm stronger than when I started. And so, if climate is really so good, why are they afraid to stand up and defend what they're doing, to be questioned, answer questions – everyone else has to do that, why are they different? So, they were absolutely outraged to think that anyone would like to audit what they were doing. Everybody else gets audited, but they're free from audits. And so, it was a political issue. They called in all of their friends in the Senate, you know, and all across America – "how dare this evil Trump Administration us. We're the greatest scientists who ever lived on the planet, and we're saving the planet. And here are these guys are trying to ask us about how we calibrate this thermometer, you know? How dare they do that!” That was the situation. And then I think the President understood, but there were many, many other issues at the time, and it just didn’t seem like this was the right one to pick up. He was probably right.

Q: [2:16:24 no text]

HAPPER: What it tells you is that scientists always have to be very self-critical, you should always be questioning yourself, you should be questioning your colleagues. Have you thought about this? Could it have been caused by this, rather than what you claim it’s caused by? And that’s what does not happen in climate. Climate is completely impervious to criticism. You cannot criticize it. It’s like denying some religious belief. In fact, it’s interesting: The language that they use is all religious. “You’re {denying} climate..”. Well, what does “denying” mean? Why are you using that word in connection with a scientific field? So, it has all the trappings of a religious cult, and that’s what it has become for many people. There are exceptions; there are honest climate scientists, but they’re deluded by many cultists.

Q: What is your view of the nature of scientific research? How do you think fundamental discoveries in science are made?

HAPPER: A lot of people don’t realize how important accidents have been in the development of technology and science. You know, politicians think that we will set up a big program, we’ll spend a lot of money and we’ll have a war on cancer, and we’ll cure cancer. I remember when that happened – that was back in the ’70s, and we spent a lot of money and cancer’s still here! We’ve made a little progress, thank goodness. But that’s not the way that you solve a really hard problem. It’s usually solved because of some accidental discovery: Take nuclear energy, for example, fission energy. It was obvious there was a lot of energy involved in nuclear transformations, from the first discovery of the nucleus by Ernest Rutherford.

And when Rutherford was asked, “Are you ever going to get power?” He says, “Anyone who says they’re going to get a power out of nuclear physics, they’re talking moonshine.” I think that was the word he used, “moonshine.” And he was right, because, at the time, no one knew there was there was such a thing as a neutron. But, a few years after he had made this statement, the neutron was discovered – accidentally – they thought, at first, it was some odd gamma-ray, penetrating gamma-ray, so it took a long time to realize that this was a new elementary particle that was not charged, and so, could easily interact with nuclei – there’s no Coulomb force to keep it out. So that was the first accident. And then Enrico Fermi was very quick to use the neutron for studies of nuclear physics, and he and his team in Rome did lots of exciting work in those first few years. He got the Nobel Prize for making what he thought were transuranic elements. He deserved the Nobel Prize, he was such a good guy, but it was a mistake! You know, what he was really doing was causing fission of uranium, and it wasn’t until Lise Meitner and her team in Berlin started doing chemistry on this irradiated nuclear uranium, they realized it’s not transuranics at all. It’s barium, and intermediate weight nuclei, that have been formed when the uranium nucleus splits. Again, an accident. And so, those two accidents, the accidental discovery of the neutron and the accidental discovery of fission made nuclear power possible, not only weapons, but civilian power, too. That has not happened for fusion. I think it may happen: Somebody will make an accidental discovery, which will make what seems like a very, very difficult engineering problem right now, suddenly feasible. And so, I’m all for supporting work on fusion. But you have to be realistic that it won’t help to increase the budget by a factor of ten, if you don’t have a good, new idea!

Q: What areas of scientific research most excite you today?

HAPPER: Well, of course, satellites have been very important for climate science, because we have the best data available now, from satellite measurements of atmospheric temperatures, satellite measurements of cloudiness, satellite measurements of the radiation budget of the Earth; all of that's good stuff, and I'm 100% for that. That's a part of climate science that we can be proud of, and I think it doesn't get enough support. Of course, that's focused on the Earth, not on other planets, but, the way other planets' climate systems work is interesting, too. You know, Venus is quite different from Earth, most of that is because it's quite a bit closer to the Sun, so it gets twice as much insolation as Earth does. But there are interesting systems on the other planets: Jupiter has an amazing climate system, you know, clouds, the great red spot. So, there are a very rich set of targets out there for bright young people to work on, for NASA's exploration satellites to help with. So, all of that's very good stuff. I think if you ask, what is the fundamental question out there, it's really dark matter. You know, there's this huge part of the matter in the universe that nobody knows what it is. And it's obviously there, from not very subtle experimental observations: You know, how fast galaxies rotate about their center – they rotate much too fast, because of some of this missing mass, the dark matter. And then there's the dark energy. So, I think those are the fundamental frontiers. And there, too, I think this is probably a puzzle that will be solved by a lucky accident. You know, we should do our best to design experiments, but keep our eyes open for accidents. I think that's how it will be cracked. If you don't talk about space, I think the other huge area, if I were a young person, I would look very carefully at, biology, biophysics, biochemistry. We see, just in the case of COVID, if we were nimble, we could have had a vaccine or an antidote. And I would guess the time will come when we will be able to respond to new viruses very, very quickly, and nip them in the bud. We can't do that today, but that's certainly something that I believe could be done in the future. But it won't happen automatically: People need to work on it, there have to be accidents happening. There, too, there have been accidents. I think many of your listeners may know about the CRISPR revolution, that was, again, an accident in biology that discovered this CRISPR mechanism for gene editing. But it was because some smart people looked at data and realized, there's something funny about this, it doesn't fit the usual paradigm, and they worked it out. So, I think there's plenty of room for smart young people who are willing to work hard, to make a big difference to the human condition — and to have a good time doing it, you know, solving problems. [end video]

ROSS: That was Prof. Will Happer, Professor of Physics Emeritus from Princeton University. If, like me, you found several of the things he said surprising, or you'd like to ask him about them, please send in your questions, to questions@schillerinstitute.org. Professor Happer will be available for the Q&A shortly, as are Ben Deniston, Megan Beets, and Marie Korsaga. Our next presentations, before we get into that Q&A are about the treatments of COVID-19, and we're going to be hearing from two physicians who are involved in this. First we'll hear from Dr. Kildare Clarke who is a physician practicing in New York City, about what the situation is like at what is currently Ground Zero for the coronavirus.

DR. KILDARE CLARKE: I'm Kildare Clarke. I've been a doctor for many, many years, too many to even remember! However, I got very involved with the Lyndon LaRouche movement, which was a very important thing for me to do that point in time, due the fact that they were looking at the injustice which goes on in healthcare delivery, on the closing of various hospitals, turning over those spaces to private entities at the expense of the patients which we were taking care of. We warned them, back then! and with many protests, many demonstrations, even down to the Washington, D.C. General Hospital, where Dennis [Speed], myself, Lyndon LaRouche, and many of others went to protest the closing of that hospital. Despite our loss — because they did close the hospital — we have never given up that mission. Because healthcare is the {number one national product} of the world. Just to give you an example: If every person in this world is sick, nothing moves! So therefore, our national product is the healthcare of everyone, and that's where our focus must always go first, because we can think about politics. Anyhow, the powers to be think it is best for them to look at healthcare as a numbers game, like widget, which you play on Wall Street. But people's lives are not widgets; they're human beings. Without them, there is no world. And it is incumbent upon us, as healthcare providers to make that message go through loud and clear! We might have to give up a lot! We might be fired from our jobs, we might be thrown in prison! But it's a cause which is so indelible in my mind, that we must do it, and do it for the good of society. It's not a personal thing, it's for the good of society. [end video]

ROSS: I think Dr. Clarke put the moral terms of the necessity for a world health system very clearly in what he just said. Our next and final speaker for this panel is Dr. Guangxi Li. And the Schiller Institute would like to thank the CGTN Think Tank in helping to make Dr. Li available. Dr. Li is an MD-PhD at the China Academy of Medical Sciences in Beijing and he is with the Department of Cardiovascular Medicine at the Mayo Clinic in Rochester, Minnesota. His most recent paper, published on April 11 in the Mayo Clinic Proceedings, is "Association between Hypoxemia and Mortality in Patients with COVID-19." He will speak with us today about an aspect of the Chinese response to COVID-19. His title is "Preventing Acute Lung Injury – Essentials of COVID-19 Treatment." Following Dr. Li's remarks, we will be able to have more Q&A with all of the panelists I mentioned before.

DR. GUANGXI LI: Hello everyone. I'm Guangxi Li. I'm from the Academy of Chinese Medical Science. Today, my topic will focus on the Chinese medicine treatment of COVID-19. So, we all know the COVID-19 outbreak since January of this year has now spread all over the world, and it’s certainly a pandemic for humanity. We are fighting COVID-19 with different approaches. But in China we do have traditional Chinese medicine theory and a history of Chinese medicine, we are fighting different kinds of viruses and pandemic using only herbs. It’s really, really effective, and we have quite a lot of experience with that. So today, I would like to share some of our successful cases. We also have some data, and we are going to publish these data soon. Let me share this [slide show] screen first: [“Preventing Acute Lung Injury – Essentials of COVID-19 Treatment” Guangxi Li MD] My topic today is “Preventing Acute Lung Injury – Essentials of COVID-19 Treatment.” [Slide: “Clinical Presentation”] As we all know most patients who suffer from COVID-19 will have very mild symptoms, or even they may not have any symptoms. They are asymptomatic patients. In terms of our experience there are several stages: The first stage is the incubation period, that’s about 1-14 days. The second week of the disease is the most important window for us to prevent acute lung injury. That’s the fever period. That’s Day 1 to Day 7. Basically the first week of the disease onset. The patient will usually have mild fever to severe fever, so 37.5°Celsius to over 39.1°C. So, one patient may only have a very mild fever, then they stop at that line, and then other patients may develop a quite severe fever. The third stage is acute lung injury period. So if we cannot treat a fever, when the patients may develop acute injury, even in [alveoli? 3:10]. Now we need some kind of [inaudible 3:18] approach, especially when we need to intubate patients. And later on, if the patient can overcome this difficult stage and they will come to the current period, so that’s after two weeks. [Slide: “Whole Map of Treatment”] Basically, this is a whole map of the treatment using Chinese methods. What we need to do, is we need to start treatment early. There are several indications for the severe cases. Here, the high temperature increase, and dry cough increase, and the patient develops dyspnea, and that means the patient may go down the road of acute lung injury. So that’s a very dangerous indicator. So that's what we need to do. We need to treat the patient early, it's not too late. Once we start when a patient has already developed acute lung injury, then we treat them for what's really a very long treatment period, and the mortality is high. So the best, if we want to get some good outcome, we need to intervene at the early stage. [Slide: "Very Early Stage: Control Transmission"] So, the very early stage is what we need to do. Also we need to control transmission. So, test, test, test. Then we can find out who has the virus, and then we isolate the patients. That's what we have done. [Slide: "Fever Window"] So, the fever window is very, very important, as I said before. Right now, we don't have any confirmed antiviral drug that really works on these patients. So, if they have persistent fever, the patients may develop very severe, and they're falling off the cliff. So, the best way, what we've seen is the Chinese medicine. [Slide: "ALI Prevention"] Regarding Chinese medicine, we actually don't want to kill the virus, from the Chinese philosophy. We want to regulate our immune response to the virus, to attack the virus. Basically the virus actually can be killed by ourselves. The major reason why the patients die, because the virus causes very strong cytokine storm. And then the cytokine storm will kill us. So this is what we use. Here is a formula what we use for our patients [on slide]. Basically, the first important medication is the ginseng. Using the current Western medicine we tested, isn't really helpful to decrease cytokine storm, by regulating ourselves to attack the new virus. [Slide: "ALI Prevention"] And then we monitor patients' fever progression. We monitor their oxygen saturation. We monitor their cough and shortness of breath. So, we can prevent the acute lung injury. [Slide: "Rescue Therapy"] So, if we could not cure the patient at an early stage, and the patient may develop ARDS, then we use some kind of ventilator, even ECMO [extracorporeal membrane oxygenation]. [Slide: "Early Stage (Day 1-7) Fever Reduce"] [Slide: "Early Stage Case – Fever & Fatigue"] There are some kind of cases I would like to discuss. Here is a patient, 76 years old, he had a fever for 2 days, and you can see [CT video], here is the CT scan, and you can see the moderate bilateral lung infiltrate. We used medicine to treat him. And then you see four 4 days later, we had another CT scan and the patient with not much better symptoms. Here is another CT scan for him. We noticed that this disease is quite different from other pneumonias. The infiltrate could disappear in a very short period of time, if we treat patients in time. So the patient, even though he had quite a lot of co-morbidities, and other complications, but he still recovered in about 1 week. He did not get any Western medicine treatment, no antiviral drug, no antibiotics. There are some other cases, but I will not discuss too much. [Slide: "Fever Persistent (after 3-7 days) Early ALI"] [Slide: "Persistent Fever – Early ALI"] And here, the patients if the fever is persistent, maybe after a week, the patient could start to develop acute lung injury. Here is another case, I would like to discuss. The patient who is marathon runner, and after he got acute lung injury and you can see the bilateral infiltrate. And when we used the Chinese medicine, it stopped the fever, the patient could recover after the Chinese medicine; but it doesn't work with the Western medicine. [Slide: "Coughing & Dyspnea (Second Week) Early ARDS"] [Slide: "Early ARDS – Coughing & Dyspnea"] In this case, the patient really had acute lung injury, even he had already developed lung injury, how it [s/l shake up 9:27]. This is another case. Once the patient had the acute lung injury, his O2 was about 65 and his saturation only 81. Obviously, it's very severe acute lung injury. And what we did is, we used Chinese medicine, and nothing else, some kind of trapping and fashion, all this stuff to stop the coughing. And the patient recovered after 1 week of Chinese medicine treatment. And you can see the CT scan is very severe: Almost 90% of his lung was infiltrated, it was damaged. [Slide: "Treatment Summary"] So, the basic stuff I want to summarize, the mechanism of this COVID-19 is the development of acute lung injury. If the patient doesn't acute lung injury, that's [inaudible 10:26]. The only patients we need to treat are those who develop acute lung injury. You can see this last figure from the {New England Journal of Medicine}, talking about the acute lung injury. The right side is abnormal alveolus after an attack of COVID-19. Recently, you could see those patients, where the alveoli were broken, and we have quite a lot of infusions, and there was [s/l flattening?], it's worse here. So then we need to treat patients at the early stage, so that's why we use the Chinese medicine to stop the fever and stop the inflammation, and stop the cough. After that, with some patients maybe, we still need oxygen support on a respirator support. We should not use any antiviral drugs or antibiotics. [Slide: "Questions & Discussion"] So that's what my talk is. Thank you. I would like to take any questions. [end video]

Panel 2 CONCLUSION: For a Better Understanding of How Our Universe Functions

Saturday, April 25, 2002 With Jason Ross, Megan Beets, and Ben Deniston

Question & Answer Session

ROSS: Thank you Dr. Li. We're now at our discussion period and we've got a fair amount of time available — I don't know if that's true for all speakers, but currently available for questions are myself, Ben Deniston, Megan Beets, Marie Korsaga, and Professor Happer is being connected, as well.

While he's being connected, I'll just make an announcement that *Lyndon LaRouche Collected Works, Vol. 1* is available at larouchelegacyfoundation.org

I see Professor Happer is now with us, thank you so much for joining us. Several questions came in for you based on the speech you gave, and so I'd like to combine a couple of them, and maybe just chat for a minute.

One of the things that you brought up in your talk was about the role of accidents in making discoveries, even if you weren’t really intending to — that they sort of come up. You had said at the end of your talk that it might be possible one day, to be able to rapidly react to a virus that arises, be able to create antibodies or antidotes quickly; but that making that breakthrough might require a fortunate accident.

I was wondering if you could say more about the role of accidents in scientific discovery. And also the apparent contrast between the ability to have a science-driver program, like when Kennedy said “We going to the Moon,” — how do you see the relationship between having a crash program to really try and make a scientific discovery, versus the serendipitous nature that some of them take?

HAPPER: Well, frankly, you can have focused research programs and they can do some good. But the really big breakthroughs historically have usually been some accident or another. For example, the discovery of X-rays was a complete accident: Roentgen was perceptive enough to recognize something strange was happening in his laboratory, and he worked hard and he turned it into modern X-ray technology. It was an accident that fission was discovered. Nobody predicted fission: It was thanks to Lise Meitner and Otto Hahn that when they tried to repeat Enrico Fermi’s experiments, transuranics, and did some chemistry on it, they did not find what they thought should be there. They thought there should be neptunium and plutonium transuranics; that’s what Fermi got the Nobel Prize for. But in fact, that wasn’t what he was doing. He was splitting the nucleus, and Meitner and Hahn were smart enough to demonstrate that. The radioactivity really associated with barium not with plutonium.

So there are many cases like that, where the initial breakthrough is just completely unexpected. The other extreme of that is you take something like the semiconductor industry, you know, Moore’s Law, that has been systematic investment in better and better equipment, higher resolution, photolithography, better photoresists, better control of the equipment – that also works. But it's a different type of scientific progress than the type that I think will be necessary for example to solve the controlled fusion problem: I think that will be solved by an accident.

Another example of that is not practical, but I think you know that the low-hanging fruit in physics and cosmology today is what is the nature of dark matter? What is it that makes galaxies rotate a lot faster than they really should be rotating? And people are desperately trying to figure out what it could be, trying to build detectors that would detect weakly interacting particles, hereto-unimagined – this, again, I think will be a problem that will be solved by a lucky accident and some perceptive person who can tell the difference between an important accident and just the usual mistakes that are made in experiments. I hope that's enough.

ROSS: Another one of the panelists from this discussion would also like to ask a question. Ben, are you there? Ben Deniston, go ahead.

DENISTON: Glad to be here with all the guests we've had, and glad to speak to you Mr. Happer: One thing I wanted to ask, you've discussed and other people have discussed the benefits of higher levels of CO_2 in the atmosphere, and I've found that to be some fascinating areas of science to look at, just how our biosphere responds to some of these things. And when I've discussed that with other people, what I find is that there seems to be more of a gut reaction, even from scientists, about that that doesn't seem to fit a certain narrative; and oftentimes, in the most fundamental sense there tends to be a narrative that human activity is inherently problematic for the planet and human activity inherently causes problems and catastrophes and any idea that it could be good just doesn't fit this perspective. And people tend to think about science as "objective," "fact based," kind of like a cold just-follow-the-facts process, when in reality it seems like we have these narratives and dogmas that do play a substantial role in affecting where science goes and doesn't go, and what areas of science which could be incredibly beneficial and interesting, including various factors of natural causes of climate change are actually affected by this. So, I'd definitely appreciate any thoughts you have on that reality of this social aspect and these narratives in science, and the affect that has; and where we can go to get past some of that.

HAPPER: I think science has always been much more subjective than scientists would like you think, and people have been disputing science since Galileo and long before, over the nature of this aspect of science or that. And the idea that scientists are somehow different from other human beings who have prejudices and who have infatuations or are mistaken frequently, that's just not true. Scientists have all those faults, and it's been demonstrated generation after generation. An example is continent drift: You remember that this was originally proposed by a very good, very bright German, but he was not trained in geology, so his ideas — it was Alfred Wegener — he was an excellent scientist and he was just dismissed out of hand, especially by American geologists. And I remember, even when I was a graduate student in the early '60s, he was still being dismissed. But he was completely right. And now, nobody would even think to question continental drift, it's a real fact. But it wasn't easy for the first proposers and first disciples who made headway: You didn't get tenure, for example, if you believed in continental drift in the 1950s.

Coming back to your question, people don't like to admit that CO_2 is a benefit to the world. It actually clearly is: The geological history is completely clear, and I think the most compelling thing is that if you go to greenhouse operators, they routinely double, triple, quadruple the amount of CO_2 in their greenhouses, and not because they're involved in the debate over climate, but because they want to make money! And if you grow cucumbers or if you grow decorative flowers in a greenhouse with more CO_2, you get a better product, and you get a better price. You have to pay for the CO_2 – it's not cheap – but it's a good investment.

And so, here we're getting this free CO_2 that's enriching the entire planet, and we should be very grateful for that. But of course, it doesn't fit the narrative, and what can I say? It's the human condition.

ROSS: Dr. Happer, in your short talk here, you mentioned dark matter. Another speaker we have on the panel who's not appearing on the screen right now, but we have with us, Marie Korsaga: She recently received her doctorate in astrophysics looking at dark matter. And I'd like to pose a question to her, and then return to ask you a question, Professor Happer.

Dr. Korsaga will answer this one in English, I believe. The question is from [inaudible 2:53:16] who asks that since gender divisions in enrollments are more pronounced in STEM than they are in other areas of education, what can be done by Africa states to encourage girls to study space sciences. And congratulations for setting the ground for future girls to study astrophysics.

That's a question for Marie Korsaga, and then we have another question for you, Will Happer.

KORSAGA: To answer this question, I'm really not an expert to the method, but my opinion is that girls need to be inspired from a young age, and for that they need role models. That's why it's important to encourage girls and women to pursue scientific studies, by allowing them to have more access to science, for example, during meetings in organizations, or meetings and workshops.

And also what I would like to say, we need more scientific schools for girls, to have access, and give them opportunities like scholarships to pursue in STEM studies. And what I would also like to say, is may be if the government would give more opportunities, and to give more opportunities for girls in science, like having interactions between girls and women who already have science backgrounds, so they can see them as role models, and then they will be inspired to continue and pursue scientific studies.

ROSS: Thank you Dr. Korsaga. I'd like to pose a question to Will Happer now. Professor Happer, one of the earlier speakers on this panel who is not able to join us for the Q&A — he's in France — Dr. Jean-Pierre Luminet, who's an astrophysicist, he in his presentation had contrasted the necessity for free invention, and he used quotations from Einstein about this; he spoke about the method of Johannes Kepler; and he contrasted the role of free invention in being able to actually create concepts to improve our understanding of physics — he contrasted that with the too-strict implementation of what's called the "scientific method," which he believes is too formal, really, to bear the greatest kinds of fruit.

Do you have a response to this distinction that Jean-Pierre Luminet had laid out in his talk?

HAPPER: OK, well, unfortunately, I didn't hear the talk because I had some trouble signing in. But I agree with what you describe, that the scientific method is often a straitjacket that hinders progress. It certainly hinders these accidental discoveries if you take it too literally. It is important eventually to make sure this brilliant idea you think you've had, it really is a brilliant idea, and most people I know have lots of brilliant ideas of which maybe one in ten really is brilliant, you know. And so it takes a little while to sort out which ones really are important. But they don't come from following some textbook. They come from God knows where, but they come to prepared minds, to people who are prepared to recognize some important new idea.

ROSS: Good, thank you. I'd like to ask one more to Dr. Korsaga. Here is the question that came in from someone in

New York. He says, “The great historian and physicist, Cheikh Anta Diop, wrote in his 1978 short book on Africa that advanced technologies such as thermonuclear fusion must be pursued in African nations and astronomical observatories and elements of space exploration are needed to be put online as rapidly as possible, to allow African states to enter the 21st century on the same footing as other parts of the world.

This did not occur. In what way do you think we must act to encourage, in particular young people, the people that Professor Happer and others expect to make the new breakthroughs, how do we encourage them despite the many hardships that may exist?

KORSAGA: Thank you for this question. It’s an interesting one. What I can say is, to encourage them is before we need to create more opportunities, and also we need to let them know the importance of these sciences, these scientific programs for Africa, for the development of Africa, and the impact of these in Africa.

And what I also want to add, is when you take space science, astronomy and others, even if it’s not the other impact related to different kinds of studies like taking, for example, a program for astronomy, you need to develop competence in engineering, mathematics and physics, and all those skills are useful for the development for the country in many sectors. So I think we need to give all this information to young people in Africa, to let them know the importance and the positive impact of these scientific studies.

ROSS: Thank you Dr. Korsaga.

The next question goes to Will Happer, and this is a question that another one of our panelists wanted to ask you. Megan Beets, go ahead.

BEETS: Hi Dr. Happer. Earlier in the presentation that Jason, Ben and I gave, we discussed some of the common threats to the planet including space weather events like CMEs, asteroid strikes and so forth, and something that I raised as part of my presentation was the fact that our planet is in a galactic system. And what I specifically wanted to ask you about is the weather system. You've had people live Nir Shaviv, Henrik Svensmark, and others demonstrate that cycles of our Solar System's motion through the galaxy and the influence of galactic cosmic rays in the atmosphere play a big role in modulating weather on Earth. So I was wondering if you could say a little bit more about that, and also if you have any thoughts on why that outlook is so rejected and resisted today?

HAPPER: I'm a big admirer of Henrik Svensmark and Nir Shaviv. They've done absolutely very beautiful work, very interesting work. They're still working hard on actual experiments to see how cloud nuclei form in the atmosphere in response to cosmic rays, so they don't just make theories, they actually do measurements. As they pointed out, the Earth and the Solar System drift in and out of the spiral arms of our galaxy and so this modulates cosmic ray backgrounds on a long-term basis over maybe tens of millions of years. And there's some evidence that that has played a role in the climate of the Earth, if you take these very long periods into account.

So, if you don't know about their work, I do recommend it to you. Nir Shaviv in particular has written some very accessible summaries of the ideas. It's good physics, good astronomy – and, they may be right! I don't know whether they're right or not, but it looks better than many of the establishment theories of what is controlling climate which are clearly – those theories are clearly not working very well.

ROSS: Dr. Happer, we've got some more questions that have come in for you – well, we have many questions on many topics: There are about 20 questions about COVID, ranging from implanting microchips when you get a vaccine, to digital identity cards, to vitamin C, to masks being bad for you.

We’re going to leave those aside for now, and stick with some of the topics of the speaks that we have actually available for the Q&A. We will forward those to two physicians that we heard from earlier to see if they have any responses.

The next question that came for you is sort of a combined topic about national science objectives: This is sort of three questions put together. One is that Trump has called for international collaboration in space exploration as the U.S. plans to return to the Moon by 2024. U.S.-Soviet cooperation in space science has had a long and productive history. Recently, Putin has outlined a bold plan for multi-nation work to finally realize thermonuclear fusion as an inexhaustible energy source, says the questioner, and they’d like to know what the pathway is to realize those potentials?

I’d like to combine that with another question that came in, about the social role of science and of scientists.

Another question was about Trump’s approach towards science and how it may be related to the work of, I believe his great-uncle, who is Prof. John Trump, who I believe was at MIT doing work during World War II. If you have any thoughts — those are sort of two different questions there — but about the cultural aspect of a commitment to science and how we could learn from working with others internationally?

HAPPER: I think international collaboration, to the extent that it provides career paths for young people is very good. For example, the Russians did us a big favor by launching Sputnik, in the United States, because science was languishing until that point, and it woke many people in the U.S. up to realize that there are a lot of smart people all over the world, not just in the United States, not just in Europe. There were smart people in Russia and China, even Africa. So, it was time for us to pull up our bootstraps and start moving again.

I think programs like this that inspire young people are important, programs that give them a career path forward, something they can do that gives them some self-respect. And I'm convinced that we will solve a number of problems because of the young people of the future having smart ideas, good ideas, and these accidents that I mentioned before, they don't have to come to young people, but they often do. So having some kind of a goal, even if you don't reach the goal often it doesn't matter, because you've discovered something else that you didn't expect to discover. And perhaps the type of joint efforts on controlled fusion or on space exploration with other countries will help us to do that. I'm all in favor of that.

ROSS: I'd like to switch to one more question to Dr. Korsaga. We'd like to ask you to give some of your thoughts about how you believe the question of dark matter may be resolved? I know this was the topic of your PhD dissertation: Where do you think the future will lead us in exploring this phenomenon?

KORSAGA: My thought is first to state that dark matter for the moment it's a hypothetical matter. We cannot observe this matter. But we can feel it through gravity. So, knowing more about this matter will help us to understand form and evolve with time. But if you take a galaxy, you can notice that the rotation that the velocity as a function of the radius, the way it rotates, it's faster compared to the visible matter inside. When I'm talking about visible matter, I'm talking about the stellar components inside the galaxy, and also the gas components.

So, if we take these components, we can notice that the rotation, the way the galaxy is rotated is faster, compared to the rotation that we can only get when using the visible matter inside. So to understand how the galaxies rotate, we need to include the dark matter inside, to describe the rotational core of the galaxies.

So knowing this dark matter will help us to understand both the distribution and how the quantity of dark matter inside galaxies, and then to understand how the galaxy rotates, ends to better inform the formation in evolution and to better understand the universe.

One interesting thing to also notice, is that when we observe a galaxy at a certain distance, which are galaxies far from us, the luminosity that we collate is disturbed by the dark matter. And so, we call this the gravitational lens, and this gravitational lens can help us have a knowledge on how the dark matter is distributed, and the real quantity of the dark matter inside the universe. So knowing our universe, it's very, very important to understand the behavior of dark matter.

And when I'm talking about visible matter inside the universe, it only represents 5%, and the dark matter is five times the abundance of the visible matter. So we cannot say that we can understand how our universe is forming in time and evolving, if we only know 5% of the constituent. So knowing the dark matter will be an opportunity for us to understand the formation and evolution the galaxies and also the universe, and then, to go back, to understand the formation our planets and the appearance of life on Earth.

ROSS: Hmm! Thank you.

There are several more questions that came in, one in particular to Professor Happer about his work on developing the guidestar approach for adaptive optics. I first wanted to ask Professor Happer if you would like to add anything on the topic that Dr. Korsaga just addressed, of dark matter, before we move on?

HAPPER: I think she did a very nice job explaining that. It's obvious there's dark matter there, because galaxies are rotating too fast, if you don't assume dark matter. So it's clearly there, but the question is, what is it? Is it little particles; at one time people thought maybe it was dwarf stars that were too small to be seen. There is not much support for that any more. But it's a wonderful mystery, and it's a big effect. I would love to be the one to discover it – I don't expect to be, but I encourage young people to take that as one of their goals.

And I do agree with Dr. Korsaga about the importance of role models for young women. It's very hard for women in physics and astronomy to get started, at least in the United States, you don't get much support from your peers. If you're a young woman in middle school or high school and you show an interest in math or science, people make fun of you. And unless you have tremendous strength of character and you have family support, you often just give up before you've even had a chance to try something. One of my good friends was Sally Ride, the first female astronaut in the United States – I'm sorry Sally died far too young – but she was a tremendous inspiration to many young women, and I hope that she still is. And I hope that Dr. Korsaga will be an inspiration one of these days to a new generation of young women: So, good luck to you!

KORSAGA: Thank you very much!

ROSS: And I want to thank Dr. Korsaga: She's joining us from Burkina Faso and it's getting a little late there.

KORSAGA: I'm studying in South Africa.

ROSS: Oh, you're in South Africa, OK! Well, it's still pretty late, though. Well, I want to thank you for joining us. And if you can stay on, that's great, and if not, we wish you a good night, and thank you being with us.

Dr. Happer, Ben had a question for you about your development of the guidestar approach.

DENISTON: I definitely appreciate your taking the time: I was just curious if you had any favorite discoveries or areas of investigation that had been dependent on and built upon this ability to see through the atmosphere more clearly for astronomy, which you're guidestar system contributed to.

HAPPER: Yeah. Well, it certainly played a major role in defining the properties of the black hole in the center of our galaxy, because it allowed people like Claire Max and Professor Malkin [ph] as UCSC to measure stars that a very, very close to the galactic center with infrared telescopes, and the additional resolution you could get from the USIP GuideStar was a key part of this, so I'm pleased that it had that application.

Of course, it has applications also in laser propagation. If you try to project a lot of laser power through the atmosphere, if you don't correct for the atmospheric turbulence, you just can't get much power onto target. And there it's routinely used also.

So there have been uses. It was heavily classified for 10 years, so we couldn't talk about it, but again, thanks to Claire Max it has been declassified since the early '90s, and has proved its worth in astronomy.

ROSS: I'd like to ask one final question, and Professor Happer if you want to stay on for it – I'll pose the question and let you decide. I'd like to ask all of our panelists to respond to it. This came in: "What do you believe is the one axiom that is most holding back scientific progress? What do you think is the post pernicious false belief that's holding us back in our creativity?"

HAPPER: I wasn't aware that we were being held back, actually. It seems to me we've made good progress! [laughter]

ROSS: Wow! OK. Well, thank you very much then. If you have anything that you'd like to say in summary, Professor Happer, and then, our other panelists and we'll wrap up the panel. Is there anything else you'd like to say to our viewing audience?

HAPPER: I think the main thing I want to say, is that especially young people should keep their courage up. People often give up too soon, and so if you're a young scientist, or you want to be a scientist, don't be easily discouraged if people say you can't do it, you usually are being misled. You can do it, if you keep trying. There's this great quote from *Faust* [quotes in German] "Whoever keeps trying, we can save." That's good advice: It was good advice then, it's still good advice today.

ROSS: Thank you very much, and thank you for joining us on this panel, Dr. Happer.

There are still dozens and dozens of questions that came in, and if you asked a question and we haven't answered it, there are literally dozens that we didn't get to that were sent in just for this panel.

So, Megan or Ben would either of you like to share any concluding thoughts with our audience today?

BEETS: Yes, I can say a few things: first, on your question about the axioms holding back science, there are probably many things to name. One thing I think is extremely important, and which was addressed in part by Dr. Luminet earlier, is the false belief that what we know about the universe from our own creative mental processes, cannot be applied when we look at the physical world outside of our skins. And I think this is an idea which really came to prominence in the 20th century, and I think that it should be eliminated: Because things we learn, for example, from our experience in Classical musical composition, especially the compositions of Beethoven, these can help us investigate the paradoxes having to do with time, that absolutely apply to our investigation of the physical universe. So that's one thing I would put out, is something which is extremely important, and I'll reference people to the work of Johannes Kepler as somebody who is exemplary as *not* having this problem, and his discoveries certainly speak for themselves.

But, just in a final summary word, in terms of what we presented today, I think the main message I'd like people to take is that coming out of this crisis we must have a new paradigm, not only in economic policy and many other things we spoke of this morning, and will continue to speak of; but scientific collaboration must be defined by this optimistic outlook for cooperation around these common aims: Humanity must be allowed to pull together and apply the best talents from among us from all over the world, to solve these real threats to human civilization. The only solution to these problems is progress: Scientific leaps forward, and that intention really does have to guide our scientific collaboration coming out of this period of crisis.

ROSS: Ben, do you have anything you'd like to say in conclusion.

DENISTON: I endorse everything Megan said. [laughter] She sums it up very well. When we were discussing with Helga Zepp-LaRouche about the formation of this panel and some of the content, she made the point that we want to be very clear that we're having this COVID pandemic; if it wasn't COVID, it could have been a surprise asteroid, surprise comet, this is just — in a certain sense the best thing that can come out of this crisis is taking that as a warning to get this shift we're talking about, to get nations united against these common, larger threats, and not go through just the tragic fate of failing to get beyond this geopolitical perspective and end up going extinct, like many other, as we discussed, over 5 billion other species have gone before. It's on us to decide not to go.

So the best thing that can come out of this crisis is using this as a motivation to ensure that we do make the changes needed and go with LaRouche's program, as we've discussed, addressing not just the technical ways to avoid war, but addressing the underlying causes that lead to conflict, and finding the solutions in mutual, shared progress, that is uniquely human. Without that, as Mr. LaRouche spent his life defining, there's no durable survival. So shared progress is the guarantee of durable survival.

ROSS: I'll say something in conclusion and then we'll have some closing announcements.

As Ben just said, building on Megan, this conference takes place at a time where we have this COVID pandemic taking place, and it could have been any number of other disasters to which we're susceptible. That susceptibility is what we must take on.

And I'd just like to say one thing about the search for enemies, that unfortunately people are being pushed into right now: People are being told that China has lied about the coronavirus, that China created the coronavirus, etc., these kinds of things. There is no evidence that any virologist takes seriously that this was a manmade virus, that it was deliberately created in China, etc. There are also people who find fault with the performance of various governments. Michele Geraci had mentioned how Italy could have learned more from China's experience in dealing with the coronavirus. I believe that's clearly the case in the United States.

When people make the mistake, however, of looking for somebody to blame, they ignore the overall environment in which these decisions get made, and I'd like to read a quote from LaRouche to end things off here. It's from a paper that he wrote, so I can't play a video, but it's about his view of what is the real essence of tragedy. Take, for example, a Shakespearean tragedy such as *Hamlet*: Many people learn from their literature teachers that the tragedy is in Hamlet himself, that he failed to do what he should have done.

LaRouche takes a different view about where the tragedy is located. So, I'll read this paragraph from his 2000 essay, entitled, "Politics as Art." https://larouchepub.com/lar/2000/2745_politics_as_art.html

In it, Lyndon LaRouche wrote: "The principle underlying all competent composition and performance of what is known as Classical tragedy, is based upon the historical evidence it reflects. That principle is, that, in real life off stage, entire cultures, excepting those destroyed by natural causes beyond man's present ability to control, have been usually destroyed by the fatal defects inhering within that prevailing popular culture itself, as the U.S., as a nation, is being destroyed, like the ancient pagan Rome of the popular arena games, by no single factor as weighty as the effect of what is called 'popular entertainment' today."

So he says that most cultures have been destroyed by the "fatal defects inhering within that … popular culture." What we need to do, and which this entire conference has been addressing on the highest level, is, what is a new paradigm? What is a new cultural outlook that we can adopt internationally, in discussion with each other, to replace the tragic one, in which we are susceptible to what we are currently experiencing, and overcoming that, with a real victorious, and enduringly growing future?

I'd like now to wrap things up. I'd like to thank our speakers today: Dr. Jean-Pierre Luminet, Michel Tognini, Walt Cunningham, Dr. Marie Korsaga, Sen. Joe Pennachio, Prof. Will Happer, Dr. Guangxi Li, Dr. Kildare Clarke.

Before the panel that begins tomorrow morning at 11 a.m., which is going to be a panel on culture, we do have a playlist of some cultural experiences for you, to enjoy and learn from before that panel begins. [https://www.youtube.com/playlist?list=PLoHwt4KyUk5BLyjo-lYI1akY_m95R12QD] You'll find that on the conference website.

I'll just make one final reminder about the *Collected Works* of Lyndon LaRouche which are available and you can purchase online at https://www.larouchelegacyfoundation.org