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#### Kamo’oalewa is NEO asteroid comprised of lunar material

Devlin 21 [Hannah Devlin is the Guardian's science correspondent, having previously been science editor of the Times. “Near-Earth asteroid is a fragment from the moon, say scientists.” November 11, 2021. <https://www.theguardian.com/science/2021/nov/11/near-earth-asteroid-is-a-fragment-from-the-moon-say-scientists>] //recut chskk

Scientists have identified what appears to be a small chunk of the moon that is tracking the Earth’s orbit around the Sun. The asteroid, named Kamo`oalewa, was discovered in 2016 but until now relatively little has been known about it. New observations suggest it could be a fragment from the moon that was thrown into space by an ancient lunar collision. Kamo`oalewa is one of Earth’s quasi-satellites, a category of asteroid that orbits the Sun, but remains relatively close to the planet – in this case about 9m miles away. Despite being close in astronomical terms, the asteroid is about the size of a ferris wheel and about 4m times fainter than the faintest star that can be seen with the naked eye. Consequently, the Earth’s most powerful telescopes are needed to make observations. Using the Large Binocular Telescope on Mount Graham in southern Arizona, astronomers found the spectrum of reflected light from Kamo`oalewa closely matched lunar rocks from Nasa’s Apollo missions, suggesting it originated from the moon. They had initially compared the light with that reflected off other near-Earth asteroids, but drawn a blank. “I looked through every near-Earth asteroid spectrum we had access to, and nothing matched,” said Ben Sharkey, a PhD student at the University of Arizona and the paper’s lead author. After missing the chance to observe Kamo`oalewa in April 2020 owing to a shutdown of the telescope during the coronavirus pandemic, the team found the final piece of the puzzle in 2021. “This spring, we got much needed follow-up observations and went, ‘Wow it is real,’” Sharkey said. “It’s easier to explain with the moon than other ideas.”

#### Space based solar power is being developed and transitions to 100% clean energy, but lunar regolith (soil) is key

O’Neill 13 [Ian O'Neill is a media relations specialist at NASA's Jet Propulsion Laboratory (JPL) in Southern California. Prior to joining JPL, he served as editor for the Astronomical Society of the Pacific‘s Mercury magazine and Mercury Online and contributed articles to a number of other publications, including Space.com, Space.com, Live Science, HISTORY.com, Scientific American. Ian holds a Ph.D in solar physics and a master's degree in planetary and space physics. “How to Turn the Moon Into a Giant Space Solar Power Hub.” December 3, 2013. https://www.space.com/23810-moon-luna-belt-solar-power-idea.html]

When it comes to space and energy, we need to think big. That's what one Japanese company is doing — and they're reaching for the moon, literally. The best thing about the moon is that one lunar hemisphere is constantly bathed in sunlight (except for the occasional eclipse), so using solar arrays to generate power may not seem like such a stretch. Take China's recently-launched Chang'e 3 Yutu rover for example, it's solar powered. Also, Apollo astronauts set up solar-powered experiments on the lunar regolith. But how about wrapping the moon's equator in a 250 mile wide band of solar panels and beaming the power generated back to Earth? That's exactly what Shimizu Corporation is proposing and they reckon their concept could harness a steady stream of 13,000 terawatts of power. According to Business Insider, "the total installed electricity generation summer capacity in the United States was 1,050.9 gigawatts." Such a vast energy resource could be transformative for our civilization. As Obi-Wan might say: "That's no moon. It's a space (solar power) station." "A shift from economical use of limited resources to the unlimited use of clean energy is the ultimate dream of all mankind," says the company's website. "The LUNA RING, our lunar solar power generation concept, translates this dream into reality through ingenious ideas coupled with advanced space technologies." Indeed, advanced space technologies will be needed, not only to harvest solar energy and efficiently beam it back to Earth, but its very construction will require several leaps in robotic technology development. Also, this mother of all engineering tasks will need to see some significant changes in international space treaties before it sees light of day. Resembling a moon born from science fiction, the LUNA RING is just that, a ring around the moon. The ring, stretching 6,800 miles around the moon's circumference, will be constructed by robots that will "perform various tasks on the lunar surface, including ground leveling and excavation of hard bottom strata." The entire project will be overseen by a team of humans while the bulk of the robotic tasks can be teleoperated from Earth. [Moon Base Visions: How to Build a Lunar Colony (Photos)] It’s all very well building a huge array of solar panels around the moon, but how would the power be sent to Earth? As our atmosphere is virtually transparent to microwaves and lasers, Shimizu envisages solar energy being fed through microwave/laser transmitters located around the Earth-facing side of the moon. As the moon orbits the Earth and the Earth rotates, international receiving stations will feed electricity grids with plentiful lunar solar power as the moon rises to when it sets. The designers are keen to point out that this is a green energy resource that could benefit the whole of mankind. What's more, when the infrastructure is set up, other resources can be exploited — such as mining for precious minerals and fabricating products from regolith. One could imagine an international consortium of nations and/or companies that buy a stake in the LUNA RING to aid its construction. Each partner would then have rights to construct receiving stations in their geographical location of choice, weaning us off polluting sources of power. Japan, which was hurt by the devastating Fukushima meltdown in 2011, is actively seeking out alternative power resources to wean itself off nuclear energy — it doesn't get more "alternative" than this.

#### Warming causes extinction

Peter Kareiva 18,( Ph.D. in ecology and applied mathematics from Cornell University, director of the Institute of the Environment and Sustainability at UCLA, Pritzker Distinguished Professor in Environment & Sustainability at UCLA, et al., September 2018, “Existential risk due to ecosystem collapse: Nature strikes back,” Futures, Vol. 102, p. 39-50//recut chskk)

In summary, six of the nine proposed planetary boundaries (phosphorous, nitrogen, biodiversity, land use, atmospheric aerosol loading, and chemical pollution) are unlikely to be associated with existential risks. They all correspond to a degraded environment, but in our assessment do not represent existential risks. However, the three remaining boundaries (climate change, global freshwater cycle, and ocean acidification) do pose existential risks. This is because of intrinsic positive feedback loops, substantial lag times between system change and experiencing the consequences of that change, and the fact these different boundaries interact with one another in ways that yield surprises. In addition, climate, freshwater, and ocean acidification are all directly connected to the provision of food and water, and shortages of food and water can create conflict and social unrest. Climate change has a long history of disrupting civilizations and sometimes precipitating the collapse of cultures or mass emigrations (McMichael, 2017). For example, the 12th century drought in the North American Southwest is held responsible for the collapse of the Anasazi pueblo culture. More recently, the infamous potato famine of 1846–1849 and the large migration of Irish to the U.S. can be traced to a combination of factors, one of which was climate. Specifically, 1846 was an unusually warm and moist year in Ireland, providing the climatic conditions favorable to the fungus that caused the potato blight. As is so often the case, poor government had a role as well—as the British government forbade the import of grains from outside Britain (imports that could have helped to redress the ravaged potato yields). Climate change intersects with freshwater resources because it is expected to exacerbate drought and water scarcity, as well as flooding. Climate change can even impair water quality because it is associated with heavy rains that overwhelm sewage treatment facilities, or because it results in higher concentrations of pollutants in groundwater as a result of enhanced evaporation and reduced groundwater recharge. Ample clean water is not a luxury—it is essential for human survival. Consequently, cities, regions and nations that lack clean freshwater are vulnerable to social disruption and disease. Finally, ocean acidification is linked to climate change because it is driven by CO2 emissions just as global warming is. With close to 20% of the world’s protein coming from oceans (FAO, 2016), the potential for severe impacts due to acidification is obvious. Less obvious, but perhaps more insidious, is the interaction between climate change and the loss of oyster and coral reefs due to acidification. Acidification is known to interfere with oyster reef building and coral reefs. Climate change also increases storm frequency and severity. Coral reefs and oyster reefs provide protection from storm surge because they reduce wave energy (Spalding et al., 2014). If these reefs are lost due to acidification at the same time as storms become more severe and sea level rises, coastal communities will be exposed to unprecedented storm surge—and may be ravaged by recurrent storms. A key feature of the risk associated with climate change is that mean annual temperature and mean annual rainfall are not the variables of interest. Rather it is extreme episodic events that place nations and entire regions of the world at risk. These extreme events are by definition “rare” (once every hundred years), and changes in their likelihood are challenging to detect because of their rarity, but are exactly the manifestations of climate change that we must get better at anticipating (Diffenbaugh et al., 2017). Society will have a hard time responding to shorter intervals between rare extreme events because in the lifespan of an individual human, a person might experience as few as two or three extreme events. How likely is it that you would notice a change in the interval between events that are separated by decades, especially given that the interval is not regular but varies stochastically? A concrete example of this dilemma can be found in the past and expected future changes in storm-related flooding of New York City. The highly disruptive flooding of New York City associated with Hurricane Sandy represented a flood height that occurred once every 500 years in the 18th century, and that occurs now once every 25 years, but is expected to occur once every 5 years by 2050 (Garner et al., 2017). This change in frequency of extreme floods has profound implications for the measures New York City should take to protect its infrastructure and its population, yet because of the stochastic nature of such events, this shift in flood frequency is an elevated risk that will go unnoticed by most people. 4. The combination of positive feedback loops and societal inertia is fertile ground for global environmental catastrophes Humans are remarkably ingenious, and have adapted to crises throughout their history. Our doom has been repeatedly predicted, only to be averted by innovation (Ridley, 2011). However, the many stories of human ingenuity successfully addressing existential risks such as global famine or extreme air pollution represent environmental challenges that are largely linear, have immediate consequences, and operate without positive feedbacks. For example, the fact that food is in short supply does not increase the rate at which humans consume food—thereby increasing the shortage. Similarly, massive air pollution episodes such as the London fog of 1952 that killed 12,000 people did not make future air pollution events more likely. In fact it was just the opposite—the London fog sent such a clear message that Britain quickly enacted pollution control measures (Stradling, 2016). Food shortages, air pollution, water pollution, etc. send immediate signals to society of harm, which then trigger a negative feedback of society seeking to reduce the harm. In contrast, today’s great environmental crisis of climate change may cause some harm but there are generally long time delays between rising CO2 concentrations and damage to humans. The consequence of these delays are an absence of urgency; thus although 70% of Americans believe global warming is happening, only 40% think it will harm them (http://climatecommunication.yale.edu/visualizations-data/ycom-us-2016/). Secondly, unlike past environmental challenges, the Earth’s climate system is rife with positive feedback loops. In particular, as CO2 increases and the climate warms, that very warming can cause more CO2 release which further increases global warming, and then more CO2, and so on. Table 2 summarizes the best documented positive feedback loops for the Earth’s climate system. These feedbacks can be neatly categorized into carbon cycle, biogeochemical, biogeophysical, cloud, ice-albedo, and water vapor feedbacks. As important as it is to understand these feedbacks individually, it is even more essential to study the interactive nature of these feedbacks. Modeling studies show that when interactions among feedback loops are included, uncertainty increases dramatically and there is a heightened potential for perturbations to be magnified (e.g., Cox, Betts, Jones, Spall, & Totterdell, 2000; Hajima, Tachiiri, Ito, & Kawamiya, 2014; Knutti & Rugenstein, 2015; Rosenfeld, Sherwood, Wood, & Donner, 2014). This produces a wide range of future scenarios. Positive feedbacks in the carbon cycle involves the enhancement of future carbon contributions to the atmosphere due to some initial increase in atmospheric CO2. This happens because as CO2 accumulates, it reduces the efficiency in which oceans and terrestrial ecosystems sequester carbon, which in return feeds back to exacerbate climate change (Friedlingstein et al., 2001). Warming can also increase the rate at which organic matter decays and carbon is released into the atmosphere, thereby causing more warming (Melillo et al., 2017). Increases in food shortages and lack of water is also of major concern when biogeophysical feedback mechanisms perpetuate drought conditions. The underlying mechanism here is that losses in vegetation increases the surface albedo, which suppresses rainfall, and thus enhances future vegetation loss and more suppression of rainfall—thereby initiating or prolonging a drought (Chamey, Stone, & Quirk, 1975). To top it off, overgrazing depletes the soil, leading to augmented vegetation loss (Anderies, Janssen, & Walker, 2002). Climate change often also increases the risk of forest fires, as a result of higher temperatures and persistent drought conditions. The expectation is that forest fires will become more frequent and severe with climate warming and drought (Scholze, Knorr, Arnell, & Prentice, 2006), a trend for which we have already seen evidence (Allen et al., 2010). Tragically, the increased severity and risk of Southern California wildfires recently predicted by climate scientists (Jin et al., 2015), was realized in December 2017, with the largest fire in the history of California (the “Thomas fire” that burned 282,000 acres, https://www.vox.com/2017/12/27/16822180/thomas-fire-california-largest-wildfire). This catastrophic fire embodies the sorts of positive feedbacks and interacting factors that could catch humanity off-guard and produce a true apocalyptic event. Record-breaking rains produced an extraordinary flush of new vegetation, that then dried out as record heat waves and dry conditions took hold, coupled with stronger than normal winds, and ignition. Of course the record-fire released CO2 into the atmosphere, thereby contributing to future warming. Out of all types of feedbacks, water vapor and the ice-albedo feedbacks are the most clearly understood mechanisms. Losses in reflective snow and ice cover drive up surface temperatures, leading to even more melting of snow and ice cover—this is known as the ice-albedo feedback (Curry, Schramm, & Ebert, 1995). As snow and ice continue to melt at a more rapid pace, millions of people may be displaced by flooding risks as a consequence of sea level rise near coastal communities (Biermann & Boas, 2010; Myers, 2002; Nicholls et al., 2011). The water vapor feedback operates when warmer atmospheric conditions strengthen the saturation vapor pressure, which creates a warming effect given water vapor’s strong greenhouse gas properties (Manabe & Wetherald, 1967). Global warming tends to increase cloud formation because warmer temperatures lead to more evaporation of water into the atmosphere, and warmer temperature also allows the atmosphere to hold more water. The key question is whether this increase in clouds associated with global warming will result in a positive feedback loop (more warming) or a negative feedback loop (less warming). For decades, scientists have sought to answer this question and understand the net role clouds play in future climate projections (Schneider et al., 2017). Clouds are complex because they both have a cooling (reflecting incoming solar radiation) and warming (absorbing incoming solar radiation) effect (Lashof, DeAngelo, Saleska, & Harte, 1997). The type of cloud, altitude, and optical properties combine to determine how these countervailing effects balance out. Although still under debate, it appears that in most circumstances the cloud feedback is likely positive (Boucher et al., 2013). For example, models and observations show that increasing greenhouse gas concentrations reduces the low-level cloud fraction in the Northeast Pacific at decadal time scales. This then has a positive feedback effect and enhances climate warming since less solar radiation is reflected by the atmosphere (Clement, Burgman, & Norris, 2009). The key lesson from the long list of potentially positive feedbacks and their interactions is that runaway climate change, and runaway perturbations have to be taken as a serious possibility. Table 2 is just a snapshot of the type of feedbacks that have been identified (see Supplementary material for a more thorough explanation of positive feedback loops). However, this list is not exhaustive and the possibility of undiscovered positive feedbacks portends even greater existential risks. The many environmental crises humankind has previously averted (famine, ozone depletion, London fog, water pollution, etc.) were averted because of political will based on solid scientific understanding. We cannot count on complete scientific understanding when it comes to positive feedback loops and climate change.

## 2 (1:45)

#### Strong commercial space catalyzes tech innovation – progress at the margins and spinoff tech change global information networks

Joshua Hampson 2017, Security Studies Fellow at the Niskanen Center, 1-25-2017, “The Future of Space Commercialization”, Niskanen Center, <https://republicans-science.house.gov/sites/republicans.science.house.gov/files/documents/TheFutureofSpaceCommercializationFinal.pdf> //recut chskk

Innovation is generally hard to predict; some new technologies seem to come out of nowhere and others only take off when paired with a new application. It is difficult to predict the future, but it is reasonable to expect that a growing space economy would open opportunities for technological and organizational innovation. In terms of technology, the difficult environment of outer space helps incentivize progress along the margins. Because each object launched into orbit costs a significant amount of money—at the moment between $27,000 and $43,000 per pound, though that will likely drop in the future —each 19 reduction in payload size saves money or means more can be launched. At the same time, the ability to fit more capability into a smaller satellite opens outer space to actors that previously were priced out of the market. This is one of the reasons why small, affordable satellites are increasingly pursued by companies or organizations that cannot afford to launch larger traditional satellites. These small 20 satellites also provide non-traditional launchers, such as engineering students or prototypers, the opportunity to learn about satellite production and test new technologies before working on a full-sized satellite. That expansion of developers, experimenters, and testers cannot but help increase innovation opportunities. Technological developments from outer space have been applied to terrestrial life since the earliest days of space exploration. The National Aeronautics and Space Administration (NASA) maintains a website that lists technologies that have spun off from such research projects. Lightweight 21 nanotubes, useful in protecting astronauts during space exploration, are now being tested for applications in emergency response gear and electrical insulation. The need for certainty about the resiliency of materials used in space led to the development of an analytics tool useful across a range of industries. Temper foam, the material used in memory-foam pillows, was developed for NASA for seat covers. As more companies pursue their own space goals, more innovations will likely come from the commercial sector. Outer space is not just a catalyst for technological development. Satellite constellations and their unique line-of-sight vantage point can provide new perspectives to old industries. Deploying satellites into low-Earth orbit, as Facebook wants to do, can connect large, previously-unreached swathes of 22 humanity to the Internet. Remote sensing technology could change how whole industries operate, such as crop monitoring, herd management, crisis response, and land evaluation, among others. 23 While satellites cannot provide all essential information for some of these industries, they can fill in some useful gaps and work as part of a wider system of tools. Space infrastructure, in helping to change how people connect and perceive Earth, could help spark innovations on the ground as well. These innovations, changes to global networks, and new opportunities could lead to wider economic growth.

#### Short innovation cycles mean every contract counts- the solutions are imminent

John J. Klein 19, Senior Fellow and Strategist at Falcon Research Inc. and adjunct professor at the George Washington University Space Policy Institute, 1-15-2019, "Rethinking Requirements and Risk in the New Space Age," Center for a New American Security, <https://www.cnas.org/publications/reports/rethinking-requirements-and-risk-in-the-new-space-age> //recut chskk

Unfortunately, these variances in models between the MDAP’s lengthy development cycle and the commercial space sector’s 18-month innovation cycle are a result of stark differences in thinking about requirements and risk. Requirements and risk for MDAPs commonly focus on ensuring critical mission capabilities at a given cost. In contrast, the commercial space sector tends to focus more on providing innovation quickly using economies of scale. The commercial sector understands that time dynamically shapes decisions related to requirements and risk because of the relatively short innovation cycle. In a highly competitive space sector with tight profit margins, those unable to innovate quickly will likely be out of business soon. Alternatively, space systems with mission assurance requirements – where failures are detrimental to national security and military operations – often drive DoD’s timelines. Program managers of critical national security space systems commonly require additional time to test and verify that satellites can perform missions with a very low probability of failure.

#### We need to stop focusing on specific scenarios- due to the low probability nature of the aff’s impacts we need to prioritize current innovation to be best prepared for all existential threats

Dylan **Matthews 18**. Co-founder of Vox, citing Nick Beckstead @ Rutgers University. 10-26-2018. "How to help people millions of years from now." Vox. <https://www.vox.com/future-perfect/2018/10/26/18023366/far-future-effective-altruism-existential-risk-doing-good> //recut chskk

If you care about improving human lives, you should overwhelmingly care about those quadrillions of lives rather than the comparatively small number of people alive today. The 7.6 billion people now living, after all, amount to less than 0.003 percent of the population that will live in the future. It’s reasonable to suggest that those quadrillions of future people have, accordingly, hundreds of thousands of times more moral weight than those of us living here today do. That’s the basic argument behind Nick Beckstead’s 2013 Rutgers philosophy dissertation, “On the overwhelming importance of shaping the far future.” It’s a glorious mindfuck of a thesis, not least because Beckstead shows very convincingly that this is a conclusion any plausible moral view would reach. It’s not just something that weird utilitarians have to deal with. And Beckstead, to his considerable credit, walks the walk on this. He works at the Open Philanthropy Project on grants relating to the far future and runs a charitable fund for donors who want to prioritize the far future. And arguments from him and others have turned “long-termism” into a very vibrant, important strand of the effective altruism community. But what does prioritizing the far future even mean? The most literal thing it could mean is preventing human extinction, to ensure that the species persists as long as possible. For the long-term-focused effective altruists I know, that typically means identifying concrete threats to humanity’s continued existence — like unfriendly artificial intelligence, or a pandemic, or global warming/out of control geoengineering — and engaging in activities to prevent that specific eventuality. But in a set of slides he made in 2013, Beckstead makes a compelling case that while that’s certainly part of what caring about the far future entails, approaches that address specific threats to humanity (which he calls “targeted” approaches to the far future) have to complement “broad” approaches, where instead of trying to predict what’s going to kill us all, you just generally try to keep civilization running as best it can, so that it is, as a whole, well-equipped to deal with potential extinction events in the future, not just in 2030 or 2040 but in 3500 or 95000 or even 37 million. In other words, caring about the far future doesn’t mean just paying attention to low-probability risks of total annihilation; it also means acting on pressing needs now. For example: We’re going to be better prepared to prevent extinction from AI or a supervirus or global warming if society as a whole makes a lot of scientific progress. And a significant bottleneck there is that the vast majority of humanity doesn’t get high-enough-quality education to engage in scientific research, if they want to, which reduces the odds that we have enough trained scientists to come up with the breakthroughs we need as a civilization to survive and thrive. So maybe one of the best things we can do for the far future is to improve school systems — here and now — to harness the group economist Raj Chetty calls “lost Einsteins” (potential innovators who are thwarted by poverty and inequality in rich countries) and, more importantly, the hundreds of millions of kids in developing countries dealing with even worse education systems than those in depressed communities in the rich world. What if living ethically for the far future means living ethically now? Beckstead mentions some other broad, or very broad, ideas (these are all his descriptions): Help make computers faster so that people everywhere can work more efficiently Change intellectual property law so that technological innovation can happen more quickly Advocate for open borders so that people from poorly governed countries can move to better-governed countries and be more productive Meta-research: improve incentives and norms in academic work to better advance human knowledge Improve education Advocate for political party X to make future people have values more like political party X ”If you look at these areas (economic growth and technological progress, access to information, individual capability, social coordination, motives) a lot of everyday good works contribute,” Beckstead writes. “An implication of this is that a lot of everyday good works are good from a broad perspective, even though hardly anyone thinks explicitly in terms of far future standards.” Look at those examples again: It’s just a list of what normal altruistically motivated people, not effective altruism folks, generally do. Charities in the US love talking about the lost opportunities for innovation that poverty creates. Lots of smart people who want to make a difference become scientists, or try to work as teachers or on improving education policy, and lord knows there are plenty of people who become political party operatives out of a conviction that the moral consequences of the party’s platform are good. All of which is to say: Maybe effective altruists aren’t that special, or at least maybe we don’t have access to that many specific and weird conclusions about how best to help the world. If the far future is what matters, and generally trying to make the world work better is among the best ways to help the far future, then effective altruism just becomes plain ol’ do-goodery.\*

## 3 (2:45)

#### **Deadly solar flares will hit soon- best case is grid collapse and worst is extinction**

Crane 17’ – Leah Crane, Leah Crane is the physics and space reporter at New Scientist, based at the US office, “A tech-destroying solar flare could hit Earth within 100 years”, NewScientist, 10/16/17, [https://www.newscientist.com/article/2150350-a-tech-destroying-solar-flare-could-hit-earth-within-100-years/] Accessed 12/13/21 AHS//AP //recut chskk

The sun could be one of our biggest threats in the next 100 years. If an enormous solar flare like the one that hit Earth 150 years ago struck us today, it could knock out our electrical grids, satellite communications and the internet. A new study finds that such an event is likely within the next century. “The sun is usually thought of as a friend and the source of life, but it could also be the opposite,” says [Avi Loeb](https://www.cfa.harvard.edu/~loeb/) at Harvard University. “It just depends on circumstances.” Loeb and [Manasvi Lingam](https://itc.cfa.harvard.edu/people/manasvi-lingam), also at Harvard, examined data on other sun-like stars to see how likely solar “superflares” are and how they might affect us. They found that the most extreme superflares are likely to occur on a star like our sun about every 20 million years. The worst of these energetic bursts of ultraviolet radiation and high-energy charged particles could destroy our ozone layer, cause DNA mutations and disrupt ecosystems. But in the shorter term, the researchers say that less intense superflares of a type we know can happen on our sun could still cause problems. In 1859, a [powerful solar storm](https://www.newscientist.com/article/2146617-the-sun-just-belched-out-the-strongest-solar-flare-in-12-years/) sent enormous flares towards Earth in the first recorded event of its kind. Telegraph systems across the Western world failed, with some reports of operators receiving shocks from the huge amounts of electrical current forced through the wires. “Back then, there was not very much technology so the damage was not very significant, but if it happened in the modern world, the damage could be trillions of dollars,” says Loeb. “A flare like that today could shut down all the power grids, all the computers, all the cooling systems on nuclear reactors. A lot of things could go bad.” Loeb says an event as powerful as the 1859 one could cause about $10 trillion of damage to power grids, satellites and communications. A flare just a bit stronger could even damage the ozone layer. Previous work has shown that such an event seems likely to occur in the next century, with a 12 per cent chance of it happening in the next decade, but nobody seems to be all that worried, Loeb says. [Asteroid impacts](https://www.newscientist.com/article/dn25080-earth-is-prepared-enough-for-the-next-asteroid-strike/) get all the attention when it comes to life-threatening space events, but Loeb and Lingam found that superflares would be just as deadly and are just as likely. “I’m not lying awake in bed at night worrying about solar superflares, but that doesn’t mean that someone shouldn’t be worrying about it,” says [Greg Laughlin](http://astronomy.yale.edu/people/gregory-laughlin) at Yale University.

#### Even the USFG says private sector key to early warnings.

USGPO 19’ – Chairwoman Kendra Horn, “SPACE WEATHER: ADVANCING RESEARCH, MONITORING, AND FORECASTING CAPABILITIES”, U.S Government Publishing Office, October 23rd, 2019, [https://www.govinfo.gov/content/pkg/CHRG-116hhrg38122/html/CHRG-116hhrg38122.htm] Accessed 12/14/21 AHS//AP //recut chskk

Our Nation's infrastructure is not all that is threatened by space weather events. I proudly represent the Johnson Space Center, the home to NASA's Astronaut Corps. These are the astronauts who currently work on the International Space Station (ISS) more than 200 miles above the Earth's surface and will one day serve on missions to the Moon and Mars. While we have developed techniques and technology to reduce the threats posed by increased radiation exposure due to a severe solar event, we have more work to do to mitigate these hazards to our astronauts. As the Ranking Member of the Space and Aeronautics Subcommittee, I've supported efforts to spur the commercialization of low-Earth orbit by private sector companies. These new entrants into the space economy have a vested interest in protecting their assets. However, they also offer an opportunity to provide data and resources to our Federal agencies as we seek to improve our space weather efforts. As this Committee potentially considers legislation relating to space weather monitoring and research, we must be certain that whatever legislation that we mark up is not a top-down legislative mandate and ensures a role for the commercial sector. The Weather Research and Forecasting Innovation Act, which was passed by this Committee and signed into law 2 years ago, serves as a template for how we could accomplish this. The Weather Act took steps to integrate commercial weather data into NOAA's forecast models, and a similar model should guide us when developing space weather legislation. NOAA is also advancing our research to operations processes. This includes a new program, the Earth Prediction Innovation Center or EPIC. EPIC will use partnerships with academia, the private sector, and relevant agencies to test and validate new capabilities and transition these capabilities from research to operations, thereby improving our existing forecast and warning capabilities. NOAA is also exploring with NASA the potential for a space weather testbed to further accelerate the transfer of research to operations and operations to research. Strong public-private partnerships are essential to maintain and approve the observing networks, conduct research, create forecast models, and supply the services necessary to support our national security and our economic prosperity…NOAA is committed to working toward the growth of the private sector as our national infrastructure and technological base becomes more sensitive to the impacts of space weather, thus demanding more improved space weather services. NOAA will continue to explore partnerships with the commercial and academic community as we work to maintain and improve our operational capabilities. In closing, NOAA appreciates the ongoing support we have received from Congress for our critically important space weather program. We will continue to work with other Federal agencies, the private sector in this effort to develop and strengthen our activities in space weather research and forecasting, and I look forward to answering your questions.

#### Early warnings are key to protect grids

Winick 19 - Erin Winick, MIT Technology Review, March 27th, 2019 “The space mission to buy us vital extra hours before a solar storm strikes” [https://www.technologyreview.com/2019/03/27/136297/the-space-mission-to-buy-us-vital-extra-hours-before-a-solar-storm-strikes/] Accessed 12/15/21 SAO

For minor space weather, more timely warnings could ensure that no spacewalks are scheduled during a storm and that emergency responders on Earth have backup communications ready to go in case their radios go out. In case of a Carrington-like event, satellite operators could shut down their operations, warnings could be issued to the general public that their GPS devices will shut down, and power grid operators could be given the chance to protect their equipment.

#### Grid collapse—9 of 10 American’s will die

Pry 15’ - PETER VINCENT PRY Executive Director of the Task Force on National and Homeland Security, EMP TASK FORCE ON NATIONAL AND HOMELAND SECURITY, 2-28-2015["Terrorism–An Existential Threat", http://www.emptaskforcenhs.com/uncategorized/terrorism-an-existential-threat/, 3-24-2019] AWS //recut chskk

Terrorists do not need a nuclear missile to pose an existential threat to the United States, however. Technology has so evolved since World War II and the Cold War that the U.S. and the West have become an electronic civilization. Our prosperity and very lives depend upon a complex web of high-tech information, communications, financial, transportation, and industrial critical infrastructures, all supported by the keystone critical infrastructure–the electric power grid. Admiral Michael Rogers, Director of the National Security Agency and U.S. CYBERCOMMAND, in November 2014, warned that China and other actors could make a cyber attack that would blackout the U.S. national electric grid for 18 months, with catastrophic consequences for society. The Congressional EMP Commission warned that a nationwide blackout lasting one year could kill up to 9 of 10 Americans from starvation and societal collapse. Terrorists and hostile nations are probing U.S. cyber defenses every day and are working hard to develop the cyber equivalent of a nuclear warhead. Terrorists can also pose an existential threat to the United States by attacking its technological Achilles’ Heel the old fashioned way, using bullets and bombs. A study by the U.S. Federal Energy Regulatory Commission, the government agency responsible for grid security, warns that a terror attack that destroys just nine (9) key transformer substations, out of 2,000, could blackout the entire nation for over a year. Terrorists have learned that the electric grid is a major societal vulnerability. Terrorist attacks have already caused large-scale blackouts of 420,000 people in Mexico (October 2013), the entire nation of Yemen (by Al Qaeda in the Arabian Peninsula in June 2014), and 80 percent of the grid in Pakistan (January 2015)–this last a nuclear weapons state. And if terrorists steal a nuclear weapon from Pakistan, buy one from North Korea, or are given one by Iran, they could loft the warhead by balloon or missile to high-altitude over the U.S. to make the ultimate cyber attack–a nuclear electromagnetic pulse (EMP). EMP could blackout the national electric grid and other life sustaining critical infrastructures, perhaps permanently.

## 4

#### No 1ar theory:

#### A] 2nr has to cover substance and over-cover theory since the 2AR gets to collapse to it and persuade the judge since they speak last.

#### B] They have a 2-1 and 7-6 time advantage on the shell meaning the aff will always win the shell

#### D] responses to the counter interp are new necessitating intervention

#### Implications: A] reject 1ar theory – it cant be a legitimate check for abuse and B] drop the arg to minimize chance the round is decided unfairly, dropping it also good since it prevents them from reading like 20 shells and spreaidng us out.

**C] the 1ar isn’t too short – get more efficent, and time you spend on theory is useful since we lost time on reading args that we dropped.**

## 5

#### Interpretation: Affirmatives must not defend the implementation of an action.

#### Resolved in context of the resolution is a statement of value.

UPitt n.d. – University Of Pittsburgh Communications Services Webteam, copyright 2015-21, "Basic Definitions," Department of Communication , <https://www.comm.pitt.edu/basic-definitions> CHO

Affirmative/Pro. The side that “affirms” the resolution (is “pro” the issue). For example, the affirmative side in a debate using the resolution of policy, Resolved: The United States federal government should implement a poverty reduction program for its citizens, would advocate for federal government implementation of a poverty reduction program. Argument. A statement, or claim, followed by a justification, or warrant. Justifications are responses to challenges, often linked by the word “because.” Example: The sun helps people, because the sun activates photosynthesis in plants, which produce oxygen so people can breathe. Constructive Speech. The first speeches in a debate, where the debaters “construct” their cases by presenting initial positions and arguments. Cross-examination. Question and answer sessions between debaters. Debate. A deliberative exercise characterized by formal procedures of argumentation, involving a set resolution to be debated, distinct times for debaters to speak, and a regulated order of speeches given. Evidence. Supporting materials for arguments. Standards for evidence are field-specific. Evidence can range from personal testimony, statistical evidence, research findings, to other published sources. Quotations drawn from journals, books, newspapers, and other audio-visuals sources are rather common. Negative/Con. The side that “negates” the resolution (is “con” the issue). For example, the negative side in a debate using the resolution of fact, Resolved: Global warming threatens agricultural production, would argue that global warming does not threaten agricultural production. Preparation Time. Debates often necessitate time between speeches for students to gather their thoughts and consider their opponent's arguments. This preparation is generally a set period of time and can be used at any time by either side at the conclusion of a speech. Rebuttal Speech. The last speeches in a debate, where debaters summarize arguments and draw conclusions about the debate. Resolution. A specific statement or question up for debate. Resolutions usually appear as statements of policy, fact or value. Statement of policy. Involves an actor (local, national, or global) with power to decide a course of action. For example, Resolved: The United States federal government should implement a poverty reduction program for its citizens. Statement of fact. Involves a dispute about empirical phenomenon. For example, Resolved: Global warming threatens agricultural production. Statement of value. Involves conflicting moral dilemmas. For example, Resolved: The death penalty is a justified method of punishment. Topic. A general issue to debate. Topics could be “The Civil War,” “genetic engineering,” or “Great Books.”

#### “Is” is a linking verb – no implementation since it’s a description.

GM n.d. – “Linking Verbs," Grammar Monster, <https://www.grammar-monster.com/glossary/linking_verbs.htm> CHO

What Are Linking Verbs? (with Examples) A linking verb is used to re-identify or to describe its subject. A linking verb is called a linking verb because it links the subject to a subject complement (see graphic below). Infographic Explaining Linking Verb A linking verb tells us what the subject is, not what the subject is doing. Easy Examples of Linking Verbs In each example, the linking verb is highlighted and the subject is bold. Alan is a vampire. (Here, the subject is re-identified as a vampire.) Alan is thirsty. (Here, the subject is described as thirsty.)

#### Violation: they defend a ban.

#### Negate for limits and ground – justifies infinite unpredictable advantages which overstretches research spiking generics. Precision outweighs – non-topical affs violate tournament rules so the judge doesn’t have the jurisdiction to vote on them and it controls the internal to pragmatic offense in a question of models.

#### TVA – read a whole res phil aff – creates better ethics and critical thinking and outweighs on uniqueness – switching to policy solves your offense.

#### 3] No RVI’s- 1) illogical to vote us down for being fair 2) no time skew if there’s no abuse story 3) chilling effect deters norm setting since people will always lose to better theory debaters 4) people will bait theory with abuse 5) doesn’t deter friv theory, cx has less friv and rvi’s