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NSN Questions

1. If you discover a new nebula or star, do you already have a new name picked out for it?
    a. Stars are officially named by the International Astronomical Union (IAU). There is not a way to get a star officially named outside of the IAU. For other objects, like nebulae or galaxies, there are opportunities to introduce colloquial names – like the "ring nebula" or "butterfly nebula" or "Whirlpool Galaxy". These objects will still have official names provided by their position in the sky or catalog entry. I have not thought about what might be a fun colloquial name for a nebula or galaxy, but perhaps I should do that!
2. What does the Roman Telescope hope to discover?
    a. Roman has very broad science goals. It is a survey telescope that will do population studies of objects from our solar system out to the edge of the observable universe. It will also open up very sensitive time-domain studies – finding things that move or change in the universe. Many of the discoveries we simply cannot predict. When you open up the discovery space like we will with Roman, it will truly present us with opportunities to answer questions we did not even know to ask. There are some concrete discoveries we expect to make with Roman, such as detecting planets around other stars that are more like the planets in our outer solar system and a better understanding of how dark energy is influencing the expansion rate of our universe with time. In addition, we will certainly expand our understanding of the population of small icy bodies in the outer part of our solar system, stellar astrophysics, galaxy diversity and evolution, multi-messenger astronomy, the distribution of dark matter around galaxies, and much much more.
3. How does the JWT compare to the Hubble and Roman fields of view and useable wavelengths?
    a. JWST has a similar field of view to Hubble. Roman has ~200 times the field of view of Hubble and Webb in near-infrared wavelengths. JWST covers much more of the infrared part of the spectrum compared with Hubble and Roman. JWST is really the most sensitive infrared telescope ever developed, which enables astronomers to peer back into the distant universe to observe the faintest galaxies ever observed – among many other science cases.
4. How far back in time will it possiby see?
    a. Roman will peer back nearly as far as Webb with a typical observation. With the addition of potential gravitational lensing sources – which can magnify the light of a distant object – Roman may even see further. Webb can also benefit from gravitational lensing, but Roman's larger field of view and speed will enable it to capture many more instances of gravitational lensing.
5. How long is its anticipated lifetime?
    a. Roman's instruments and hardware are being built to last the five-year primary mission. After that, if everything is still functioning as expected and we are still getting good science, NASA may choose an extended mission for Roman enabling it to go longer.
6. Is the mirror being made in Arizona like James Webb?
    a. Roman's mirror was actually gifted from another government agency that had a couple of Hubble-sized mirrors in surplus. This enabled the mission some cost-savings. Although, the mirror still needed to be prepped for its purpose of observing the distant universe.
7. Where will it be placed?
    a. Roman will be at the Lagrange Point 2 – about 1 million miles away from Earth, just beyond the Earth's moon.
8. There are big gaps between the 18 sensors of the Roman telescope. is it planned to dither it to cover the gaps?
    a. The exact survey definitions are not final, but there will almost certainly be some dithering in the core surveys. The planned positions and cadences of the observations will depend on the science needs, which are being defined for each of the core community surveys over the next year or so.
9. Is it possible to solve the enigma of big galaxies and red stars just after the Big Bang with the Roman?
    a. Early results from JWST are finding increasing numbers of large galaxies in the early universe. Roman will certainly play a lead role in understanding galaxy evolution through cosmic time. Of

course, we do not know what we will know from JWST and other observatories by the time Roman begins science operations, but Roman surveys will capture millions of galaxies across cosmic time. The large populations of early (distant) galaxies observed by Roman will enable a better understanding of the demographics of galaxies in the early universe.

10. How close will Roman & Webb be from each other at L2?
    a. This is an interesting question. Both Roman and Webb (among other telescopes) parked at L2 actually orbit around the L2 point. The L2 location is actually a region of empty space just beyond the moon where station keeping is less costly because the balance of the gravitational forces of the Sun, Earth, and Moon keep spacecraft from drifting too far, too fast. There are still maneuvers done periodically to keep the telescope in the proper L2 orbit. Given that the telescopes will be in a large orbit around the L2 point, the distances between Roman and Webb will be relatively large, but not constant. As a point of reference, it takes Webb about 6 months to complete one orbit around the L2 point. You can find more information about Webb's orbit here: https://jwst-docs.stsci.edu/jwst-observatory-characteristics/jwst-orbit
11. Any plans for updates/repairs?
    a. Although you can never say never, there are no current plans for updates/repairs for the Roman Space Telescope. The observatory should last at least five years for its primary mission after launch in late 2026 (or no later than May 2027).
12. Would Roman's surveys be available for public use, like in planetarium apps or would the data have to be used in a non-commercial setting?
    a. The Roman data will be publically available for anyone to use.
13. For time domain, will there be time lapse videos of supernovae, comets, and other universal objects?
    a. There will almost certainly be time-lapse videos made of Roman's time-domain surveys. What Roman catches in those surveys – well, we will just have to wait and see.
14. Will the Roman help us understand the Hubble constant and how it is not constant?
    a. There has been a lot of debate over the Hubble constant – or more generally the expansion rate of the universe at different epochs in the universe's history. Roman's observations will enable us to get a better understanding of the expansion rate of the universe at these different epochs.
15. Can Roman help us see where we are in the universe in a dynamic sense?
    a. Roman will capture many dynamics happening in the universe with its time domain surveys. In addition, Roman will survey the 3D positions of galaxies across the sky, giving us a sense of where we fit in with the cosmic web.
16. Is it cost-efficient to launch a coronagraph as a stand-alone instrument, or will it always be combined with a wider variety of instruments?
    a. There could be test-bed telescopes to test coronagraphs, but to do the science we want – e.g. directly image exoplanets like the ones we have in our solar system, it requires a large mirror on a very stable telescope. To launch such a large stable telescope in space, it usually makes sense to include instruments that enable a whole suite of astrophysics studies.
17. Will supermassive black holes be more apparent?
    a. Roman's surveys, by their very nature, will capture lots of galaxies. We know that all sufficiently large galaxies have supermassive black holes in their centers. Some will be active black holes, feeding on surrounding gas and dust. Some will not be active. So yes, Roman will enable the study of large populations of supermassive black holes. Roman's survey of the Galactic Bulge may also find isolated stellar-mass black holes via the microlensing technique.
18. Are there citizen science opportunities planned for the data coming in from the Nancy Grace Roman Space Telescope?
    a. At this early stage there are no citizen science opportunities currently planned, but this is precisely the type of observatory that could lend itself to citizen science projects. As we get closer to science observations, and the core surveys are defined, these conversations will likely increase.
19. Will it be able to possibly discern the presence of a wormhole in the center of our Galaxy?
    a. Currently, wormholes are hypothetical physical phenomena. We are not certain they exist. If they do exist, it is not clear how one would discover them via a telescope. Roman will observe millions of galaxies that have supermassive black holes in their centers.
20. Would the Core Survey be useful in searching for the hypothetical Planet 9 in our solar system?
    a. Depending on the planet's orbit, any of the core surveys could potentially find a new planet in the outer solar system. It should be noted that there will be other observatories that will survey large

swaths of the sky before Roman – like the Vera Rubin Observatory – that may catch interesting solar system objects first. If a large planet 9 exists, the expectation is that we should have direct evidence of it by the end of Roman's mission or much earlier from other telescopes – assuming its position is covered by observations from at least one of these telescopes.

21. Does Roman have the ability to spot supernovae?
    a. Yes, one of Roman's core surveys, the High Latitude Time Domain survey, is expected to catch many supernovae. Catching supernovae was one of the early science drivers for creating this telescope.
22. Is the gravitational effects the only way to determine the existence of Dark Matter?
    a. Because Dark Matter does not seemingly interact in other ways with normal matter, gravitational effects are the primary means by which we infer its mass and location in the universe. This is done in multiple ways (examples: gravitational lensing and galaxy rotation curves). Roman will play a large role in mapping dark matter on large scales by measuring the gravitational effects. Parallel to that, there are many physicists using experiments on Earth to better understand or find the types of particles that make up dark matter.
23. Can Roman give us a better idea what criteria which exoplanets can give us a better idea of ones that could have life and have evidence of life?
    a. Roman's primary exoplanet science will be to discover exoplanets. Through microlensing, the transit method, and possibly other techniques – Roman is expected to discover thousands of new worlds. The microlensing technique alone will enable us to discover exoplanets that are more like the planets in our solar system. To directly search for life – that requires characterization of the exoplanet atmospheres. This is something that the Webb telescope is looking at – studying what makes up any given exoplanet atmosphere by studying the host star's light as it passes through the exoplanet's atmosphere before it reaches Webb. This is an example of how NASA's missions complement each other. Some telescopes are adept at finding exoplanets (like Roman) and some telescopes are adept at studying known exoplanet atmospheres (like Webb). Webb itself will likely not find life, but may find examples of habitability on some exoplanets. It will take a future mission – perhaps like the recently named Habitable Worlds Observatory – to potentially find life on another world.
24. Can we see Near Earth objects or things that we might need to look out for if they have an Earth trajectory?
    a. Roman will – by its very nature – find objects in our solar system that are at the distance of Earth from the Sun or farther. No matter where you point, you will be looking out of the solar system and that will enable astronomers to discover new objects – particularly from the time-domain surveys. It is not known yet if any Roman surveys will look along the ecliptic of our solar system where most of the near Earth objects reside.
25. Besides microlensing, are there other techniques used to generate data like the 4-exoplanet system?
    a. Yes, the most common method used to date is the transit technique whereby we observe the light from a star dip slightly as its planets pass in front of it between us and the star. We may not see the planet directly, but we know they are there based on the repeated dips in the brightness of the starlight. Roman will discover exoplanets from this method as well. In addition, there are some more esoteric ways of discovering exoplanets that maybe – just maybe – Roman will provide – like astrometric measurements of exoplanets. In astrometry, if you have exquisite pointing, you may be able to monitor a star on the sky moving ever so slightly back and forth. The slight position changes – or wobble – could be due to an unseen planet or planets tugging on the star as they orbit around the star. Roman will also have a next generation coronagraph test demonstration instrument that is meant to directly image exoplanets – but these will be already known exoplanets in order to test that the coronagraph is working as expected. Still, we may get images of exoplanets discovered in other methods that have not been directly imaged before.
26. Why are the 18 detectors unevenly spaced in this telescope?
    a. This was an engineering decision. They designed the instrument to be off-axis of the main mirror, so the Wide Field Instrument's 18 detectors were aligned to catch as much light as possible coming in from the main/secondary mirrors in the optical system. This is what gives it the interesting shape.
27. Not clear to me, is the telescope moved to each sensor or are all 18 sensors exposed at the same time?
    a. All 18 detectors are exposed at the same time. They work together and act as one large camera.

28. Andromeda is coming toward us, can we see if we can find interesting objects in Andromeda that our Milky Way galaxy might not have?
    a. If Roman observes the Andromeda galaxy, it will do so with Hubble-like resolution in the near-infrared. Which means that it will be able to resolve individual stellar systems in Andromeda. So it would certainly be able to detect anything as small and as bright as a star in Andromeda. We do not expect Andromeda to have anything the Milky Way does not have – certainly not on the scale of stars, stellar clusters, etc. But we may find evidence of past supernovae, new star formation, etc that we did not know before. This type of information will be incredibly valuable for understanding how a large galaxy like Andromeda changes with time.
29. Is each sensor 5 square degrees for the supernova, transient survey?
    a. Each of Roman's 18 detectors has 16 million tiny pixels and the combined area covered by all 18 detectors is 0.281 square degrees. The High Latitude Time Domain survey is being defined over the next year or so – but some early suggestions from astronomers point to a potential survey size of 3-5 square degrees. This, of course, would require repeated observations of the same area to make it time-domain as well as observations in different pointings to build up to 3-5 total square degrees on the sky. But again, the exact implementation of this survey is not yet defined.
30. How to black an individual star? Move telescope or move the coronagraph?
    a. To block the star, you need to point the telescope at the star and then move the coronagraph mask in the right position to just block the light from the star. The Roman Coronagraph Instrument has several different blocking masks to test depending on the brightness of the star.
31. Will Roman get the same press that Webb got especially since the field of view pictures will be so much bigger? The media can really use it to get interest in the astronomy sector.
    a. That is a great question. I simply do not know. While Roman will provide larger images, the fact that they are so large can present challenges. If you show a full Roman survey on a single image or on a page of a newspaper, it will be so zoomed out you might not see details – particularly if you are observing fields of galaxies. But this is a good problem to have. We have several years to figure out how best to share the excitement of this mission, and I hope we can rely on all of you to help share that excitement.
32. Will Roman's primary mirror be tweaked like Webb's mirrors for final focus?
    a. No, Roman's mirror – 2.4 meters in diameter, is much like Hubble's mirror of the same size. It is a monolithic piece of coated glass. It is not made up of individual segments.
33. What are the expected number of exoplanets found relative to TESS?
    a. To date, TESS has discovered more than 6,000 exoplanet candidates and confirmed 3,000 exoplanets via the transit technique. TESS continues to make discoveries in an extended mission. In the Galactic Bulge Time Domain survey, Roman will monitor 200 million stars towards the center of our galaxy. It will discover thousands of planets in the habitable zones of their stars and further out – the colder exoplanets that the transit technique is not as suitable. In addition, Roman may reveal as many as 100,000 transiting planets. Here is a chart made back in 2019 comparing Roman and Kepler discoveries – but this chart shows expected Roman discoveries for microlensing only, not transit (which is where Kepler made its discoveries). https://roman.gsfc.nasa.gov/images/Roman_expected_planets-lg.png
34. You said that the Roman mirror is the same size as the Hubble mirror, yet you said that one image by the Roman telescope will cover much more area than Hubble. Please explain how this is possible.
    a. They both have the same collecting area of light, but their instruments see different sizes/areas of the sky. Hubble has four primary science instruments that can each see a different section of the sky. You can see that diagram here - https://frontierfields.files.wordpress.com/2014/01/fov_frontier-fields_4brandonblog_150ppi.jpg - the size of Hubble's mirror is the circle that includes on the outer edges the Fine Guidance Sensor instruments (FGS1, FGS2, FGS3). Included in that are the current primary science instruments/cameras (ACS, WFC3, STIS, COS). Hubble can actually take images of two fields at once by allowing the light from one field to go to one instrument and light from a different field to go onto a different instrument. In contrast, Roman has just one science instrument, the Wide Field Instrument. The field of view of the Wide Field Instrument was designed to capture as large a portion of the field covered by the mirror as possible.
35. What is a Grism?

    a. A grism is a combination of a prism and grating made so that the light from an object gets split into its component colors, creating a spectrum. A grism has certain advantages over other ways of collecting spectra, primarily that the same camera can be used for imaging as it can for the spectra.

36. Why are the 18 detectors of the Wide Field Instrument not overlapping?
    a. This was a requirement needed to essentially wire/connect the detectors together. It was an engineering requirement.
37. Will spectra of exoplanets help us understand if there are life possibilities?
    a. Absolutely. This is a primary method of proposed future missions' search techniques for biosignatures – or chemical markers in a planet's atmosphere that indicate life is present. Roman's Wide Field Instrument will not be taking spectra of exoplanet atmospheres, since Roman's goal is to discover exoplanets. But other telescopes do study exoplanet atmospheres, like the Hubble Space Telescope, the recently retired Spitzer Space Telescope, the James Webb Space Telescope, and some ground-based telescopes. Future proposed observatories look to build off of this technique to attempt to find these biomarkers in exoplanet atmospheres.
38. Is it possible for the Jupiter size exoplanets to harbor extremophiles?
    a. Potentially! We simply do not know the answer to that right now. It is hard to find life as we know it, let alone exotic life that lives in extreme environments. The search for life elsewhere in the universe is truly a multidisciplinary approach, requiring the expertise of astronomers, chemists, geologists, planetary scientists, and others.
39. Are there slight gaps between the 18 detectors as it is illustrated? Or is there actually some overlap?
    a. The gaps are actually there, and they were a requirement in order to engineer the 18 individual detectors into one camera. Gaps in detectors on telescopes are actually common. Sometimes we do not notice the gaps because astronomers move the telescope to dither observations together and cover the gaps.
40. Will we be able to see past the cosmic microwave background or understand it better?
    a. Seeing past the Cosmic Microwave Background is likely impossible. Before that, the universe was a hot dense soup of particles where light could simply not travel far before being bounced in another direction. It is hard to imagine a direct way to study the universe prior to the Cosmic Microwave Background, but the Cosmic Microwave Background provides clues to the earlier universe and physical/mathematical models also provide insight into this mysterious period. Of course, if scientists discover a way to directly probe that period, they will jump at the chance. There will likely be future observations of the Cosmic Microwave Background itself, to better understand it.
41. Is expansion of the universe only caused by Dark Matter?
    a. Actually, dark matter acts to slow the expansion of the universe since dark matter primarily presents itself through gravity. The expansion of the universe is caused by two primary factors. One – the original Big Bang and inflationary period at the start of our universe began the expansion. If the universe were only made of normal matter and dark matter, we would expect that expansion to slow with time due to the gravitational pull of the normal and dark matter within the universe. The observed fact that the universe's expansion is accelerating with time presents us with a form of anti-gravity we have dubbed dark energy. This mysterious dark energy presumably fills all of the vacuum of space and accounts for ~70% of the mass/energy content of the universe. Roman will explore the nature of dark energy by observing its effects on how galaxies are distributed in the universe and how the expansion rate of the universe has changed with time.
42. Will Roman be connected to quantum computers in the future?
    a. Honestly, I do not know. I think as soon as quantum computers become widespread and affordable, all areas of science, industry, etc. will take advantage of them.
43. Will Starlink from SpaceX mess up the viewing for Roman?
    a. No. Starlink satellites are in Earth orbit while Roman will be located at L2, nearly one million miles away.
44. Position in space compared with Webb? Will Webb block Roman?
    a. No. There are already many telescopes/satellites at L2. It is actually a large volume of space. Webb and Roman both orbit around the L2 point, which makes the volume they cover even larger.
45. Will data download overwhelm the Deep Space Network? Or are there plans to use new technology such as DSOC (Optical communication) to compensate?

    a. Truly the Deep Space Network is getting busy! Roman's antenna was recently completed. Part of the technology development for Roman is to make sure the high volume of data on the telescope can get to the Earth. The antenna for Roman is incredibly accurate at pointing to the Earth and will provide the highest downlink rates of any NASA astrophysics mission to date – a rate of 500 megabits per second to ground stations on Earth (part of the Deep Space Network).

46. In comparison to MBR data, will Roman add info to explain the anomaly which may indicate existence of another adjacent universe?
    a. The Roman mission will not observe the Cosmic Microwave Background directly. Its detectors work in near-IR wavelengths, not microwave wavelengths.
47. How could I access the slides later?
    a. You can find most of these slides in this presentation, here: https://www.stsci.edu/roman/documentation/technical-documentation#section-4a1b612a-12a1-4f21-9099-837747715c9f
48. Any chance of an Oort Cloud survey?
    a. Perhaps. By definition, all of Roman's observations peer through the Oort cloud. The time domain surveys may find objects moving across the sky or background stars being occulted by foreground Oort cloud objects. It is too early to tell if there will be proposed archival science or surveys that explicitly aim to address the Oort cloud. Roman's archive of data will be massive and much of the science will come from people looking and comparing images in the archive across many years of observations.