Nama : Adelia Putri Widyasari

NIM : A11.2022.14426 Kelas : A11.43UG1

KUIS BLOCK CIPHER

IV: 101000111

Key: 426, 110101010 (biner)

Github: https://github.com/adeliaputriw/Kriptografi-BlockCipher-43UG1-

A11.2022.14426.git

1. Bagaimana hasil konversi bit artikel?

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11111110010000000110101011011000010011100100010001000110011101100100010\\
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111001111000010110100100100100100110001001101100011011100011011100011011001\\
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2. Bagaimana proses dan hasil enkripsi pada setiap block ofb?

Masukkan plain text: The latest image from NASA's James Webb Space Telescope shows a portion of the dense center of our galaxy in unprecedented detail, including never-before-seen features astronomers have yet to explain. The star-forming region, named Sagittarius C (Sgr C), is about 300 light-years from the Milky Way's central supermassive black hole, Sagittarius A*. A crowded region of space, full of stars and colorful clouds, more than twice as wide as it is tall. A funnel-shaped region of space appears darker than its surroundings with fewer stars. It is wider at the top edge of the image, narrowing towards the bottom. Toward the narrow end of this dark region a small clump of red and white appears to shoot out streamers upward and left. A large, bright cyan-colored area surrounds the lower portion of the funnel-shaped dark area, forming a rough U shape. The cyan-colored area has needle-like, linear structures and becomes more diffuse in the center of the image. The right side of the image is dominated by clouds of orange and red, with a purple haze. A crowded region of space, full of stars and colorful clouds, more than twice as wide as it is tall. A funnelshaped region of space appears darker than its surroundings with fewer stars. It is wider at the top edge of the image, narrowing towards the bottom. Toward the narrow end of this dark region a small clump of red and white appears to shoot out streamers upward and left. A large, bright cyan-colored area surrounds the lower portion of the funnel-shaped dark area, forming a rough U shape. The cyan-colored area has needlelike, linear structures and becomes more diffuse in the center of the image. The right side of the image is dominated by clouds of orange and red, with a purple haze. The NIRCam (Near-Infrared Camera) instrument on NASA's James Webb Space Telescope's reveals a portion of the Milky Way's dense core in a new light. An estimated 500,000 stars shine in this image of the Sagittarius C (Sgr C) region, along with some as-yet unidentified features. A large region of ionized hydrogen, shown in cyan, contains intriguing needle-like structures that lack any uniform orientation. NASA, ESA, CSA, STScI, and S. Crowe (University of Virginia). "There's never been any infrared data on this region with the level of resolution and sensitivity we get with Webb, so we are seeing lots of features here for the first time," said the observation team's principal investigator Samuel Crowe, an undergraduate student at the University of Virginia in Charlottesville. "Webb reveals an incredible amount of detail, allowing us to study star formation in this sort of environment in a way that

wasn't possible previously." "The galactic center is the most extreme environment in our Milky Way galaxy, where current theories of star formation can be put to their most rigorous test," added professor Jonathan Tan, one of Crowe's advisors at the University of Virginia. Protostars Amid the estimated 500,000 stars in the image is a cluster of protostars - stars that are still forming and gaining mass - producing outflows that glow like a bonfire in the midst of an infrared-dark cloud. At the heart of this young cluster is a previously known, massive protostar over 30 times the mass of our Sun. The cloud the protostars are emerging from is so dense that the light from stars behind it cannot reach Webb, making it appear less crowded when in fact it is one of the most densely packed areas of the image. Smaller infrared-dark clouds dot the image, looking like holes in the starfield. That's where future stars are forming. Webb's NIRCam (Near-Infrared Camera) instrument also captured large-scale emission from ionized hydrogen surrounding the lower side of the dark cloud, shown cyan-colored in the image. Typically, Crowe says, this is the result of energetic photons being emitted by young massive stars, but the vast extent of the region shown by Webb is something of a surprise that bears further investigation. Another feature of the region that Crowe plans to examine further is the needle-like structures in the ionized hydrogen, which appear oriented chaotically in many directions. "The galactic center is a crowded, tumultuous place. There are turbulent, magnetized gas clouds that are forming stars, which then impact the surrounding gas with their outflowing winds, jets, and radiation," said Rubén Fedriani, a co-investigator of the project at the Instituto Astrofísica de Andalucía in Spain. "Webb has provided us with a ton of data on this extreme environment, and we are just starting to dig into it." Image: Sagittarius C Features A crowded region of space, full of stars and colorful clouds, more than twice as wide as it is tall, with features outlined in the image in different colors. A key on the right indicates what each outline is highlighting. From the top of the key down: an orange circle next to text, protostar cluster. An irregular green dashed-line shape with text, infrared-dark cloud. A straight red dashed-line with text, needle structures. An irregular yellow dotted-line shape with text, ionized hydrogen. See extended description for more details on the image. Approximate outlines help to define the features in the Sagittarius C (Sgr C) region. Astronomers are studying data from NASA's James Webb Space Telescope to understand the relationship between these features, as well as other influences in the chaotic galaxy center. NASA, ESA, CSA, STScI, Samuel Crowe (UVA) Around 25,000 light-years from Earth, the galactic center is close enough to study individual stars with the Webb telescope, allowing astronomers to gather unprecedented information on how stars form, and how this process may depend on the cosmic environment, especially compared to other regions of the galaxy. For example, are more massive stars formed in the center of the Milky Way, as opposed to the edges of its spiral arms? "The image from Webb is stunning, and the science we will get from it is even better," Crowe said. "Massive stars are factories that produce heavy elements in their nuclear cores, so understanding them better is like learning the origin story of much of the universe." The James Webb Space Telescope is the world's premier space science observatory. Webb is solving mysteries in our solar system, looking beyond to distant worlds around other stars, and probing the mysterious structures and origins of our universe and our place in it. Webb is an international program led by NASA with its partners, ESA (European Space Agency) and the Canadian Space Agency.

Masukkan kunci: 110101010

Masukkan Initialize vector (sesuai custom bit): 101000111

52552

Nilai IV 00000001 nilai key 1 00110001 Hasil XOR IV dengan key 1 00110000 nilai xor IV setelah shifting 00001100 nilai block original 01010100 Blok ke-2 Enkripsi XOR (C2): 01011000

Nilai IV 00000000 nilai key 2 00110001 Hasil XOR IV dengan key 2 00110001 nilai xor IV setelah shifting 01001100 nilai block original 01101000 Blok ke-3 Enkripsi XOR (C3): 00100100

Nilai IV 00000000 nilai key 3 00110000 Hasil XOR IV dengan key 3 00110000 nilai xor IV setelah shifting 00001100 nilai block original 01100101 Blok ke-4 Enkripsi XOR (C4): 01101001

Hasil enkripsi binary

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111001111000010110100100100100100110001001101100011011100011011100011011001\\
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Hasil enkripsi hexadecimal

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Pilihlah salah satu dari pilihan berikut:

- 1. Encrypt
- 2. Decrypt
- 3. Custom jumlah bit
- 4. Keluar dari program

Masukkan pilihan Anda: 1

Masukkan plain text: The latest image from NASA's James Webb Space Telescope shows a portion of the dense center of our galaxy in unprecedented detail, including never-before-seen features astronomers have yet to explain. The star-forming region, named Sagittarius C (Sgr C), is about 300 light-years from the Milky Way's central supermassive black hole, Sagittarius A*. A crowded region of space, full of stars and colorful clouds, more than twice as wide as it is tall. A funnel-shaped region of space appears darker than its surroundings with fewer stars. It is wider at the top edge of the image, narrowing towards the bottom. Toward the narrow end of this dark region a small clump of red and white appears to shoot out streamers upward and left. A large, bright cyan-colored area surrounds the lower portion of the funnel-shaped dark area, forming a rough U shape. The cyan-colored area has needle-like, linear structures and becomes more diffuse in the center of the image. The right side of the image is dominated by clouds of orange and red, with a purple haze. A crowded region of space, full of stars and colorful clouds, more than twice as wide as it is tall. A funnel-

shaped region of space appears darker than its surroundings with fewer stars. It is wider at the top edge of the image, narrowing towards the bottom. Toward the narrow end of this dark region a small clump of red and white appears to shoot out streamers upward and left. A large, bright cyan-colored area surrounds the lower portion of the funnel-shaped dark area, forming a rough U shape. The cyan-colored area has needlelike, linear structures and becomes more diffuse in the center of the image. The right side of the image is dominated by clouds of orange and red, with a purple haze. The NIRCam (Near-Infrared Camera) instrument on NASA's James Webb Space Telescope's reveals a portion of the Milky Way's dense core in a new light. An estimated 500,000 stars shine in this image of the Sagittarius C (Sgr C) region, along with some as-yet unidentified features. A large region of ionized hydrogen, shown in cyan, contains intriguing needle-like structures that lack any uniform orientation. NASA, ESA, CSA, STScI, and S. Crowe (University of Virginia). "There's never been any infrared data on this region with the level of resolution and sensitivity we get with Webb, so we are seeing lots of features here for the first time," said the observation team's principal investigator Samuel Crowe, an undergraduate student at the University of Virginia in Charlottesville. "Webb reveals an incredible amount of detail, allowing us to study star formation in this sort of environment in a way that wasn't possible previously." "The galactic center is the most extreme environment in our Milky Way galaxy, where current theories of star formation can be put to their most rigorous test," added professor Jonathan Tan, one of Crowe's advisors at the University of Virginia. Protostars Amid the estimated 500,000 stars in the image is a cluster of protostars - stars that are still forming and gaining mass - producing outflows that glow like a bonfire in the midst of an infrared-dark cloud. At the heart of this young cluster is a previously known, massive protostar over 30 times the mass of our Sun. The cloud the protostars are emerging from is so dense that the light from stars behind it cannot reach Webb, making it appear less crowded when in fact it is one of the most densely packed areas of the image. Smaller infrared-dark clouds dot the image, looking like holes in the starfield. That's where future stars are forming. Webb's NIRCam (Near-Infrared Camera) instrument also captured large-scale emission from ionized hydrogen surrounding the lower side of the dark cloud, shown cyan-colored in the image. Typically, Crowe says, this is the result of energetic photons being emitted by young massive stars, but the vast extent of the region shown by Webb is something of a surprise that bears further investigation. Another feature of the region that Crowe plans to examine further is the needle-like structures in the ionized hydrogen, which appear oriented chaotically in many directions. "The galactic center is a crowded, tumultuous place. There are turbulent, magnetized gas clouds that are forming stars, which then impact the surrounding gas with their outflowing winds, jets, and radiation," said Rubén Fedriani, a co-investigator of the project at the Instituto Astrofísica de Andalucía in Spain. "Webb has provided us with a ton of data on this extreme environment, and we are just starting to dig into it." Image: Sagittarius C Features A crowded region of space, full of stars and colorful clouds, more than twice as wide as it is tall, with features outlined in the image in different colors. A key on the right indicates what each outline is highlighting. From the top of the key down: an orange circle next to text, protostar cluster. An irregular green dashed-line shape with text, infrared-dark cloud. A straight red dashed-line with text, needle structures. An irregular yellow dotted-line shape with text, ionized hydrogen.

See extended description for more details on the image. Approximate outlines help to define the features in the Sagittarius C (Sgr C) region. Astronomers are studying data from NASA's James Webb Space Telescope to understand the relationship between these features, as well as other influences in the chaotic galaxy center. NASA, ESA, CSA, STScI, Samuel Crowe (UVA) Around 25,000 light-years from Earth, the galactic center is close enough to study individual stars with the Webb telescope, allowing astronomers to gather unprecedented information on how stars form, and how this process may depend on the cosmic environment, especially compared to other regions of the galaxy. For example, are more massive stars formed in the center of the Milky Way, as opposed to the edges of its spiral arms? "The image from Webb is stunning, and the science we will get from it is even better," Crowe said. "Massive stars are factories that produce heavy elements in their nuclear cores, so understanding them better is like learning the origin story of much of the universe." The James Webb Space Telescope is the world's premier space science observatory. Webb is solving mysteries in our solar system, looking beyond to distant worlds around other stars, and probing the mysterious structures and origins of our universe and our place in it. Webb is an international program led by NASA with its partners, ESA (European Space Agency) and the Canadian Space Agency.

Masukkan kunci: 110101010

Masukkan Initialize vector (sesuai custom bit): 101000111

52552

Nilai IV 00000001 nilai key 1 00110001 Hasil XOR IV dengan key 1 00110000 nilai xor IV setelah shifting 00001100 nilai block original 01010100 Blok ke-2 Enkripsi XOR (C2): 01011000

Nilai IV 00000000 nilai key 2 00110001 Hasil XOR IV dengan key 2 00110001 nilai xor IV setelah shifting 01001100 nilai block original 01101000 Blok ke-3 Enkripsi XOR (C3): 00100100

Nilai IV 00000000 nilai key 3 00110000 Hasil XOR IV dengan key 3 00110000 nilai xor IV setelah shifting 00001100 nilai block original 01100101 Blok ke-4 Enkripsi XOR (C4): 01101001

Hasil enkripsi binary

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11100111100001011010010010100100100110001001101100011011100011011100011011001\\
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Hasil enkripsi hexadecimal
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b292e2e6c1f3c2d2f296c182920293f2f233c296c3f24233b3f6c2d6c3c233e382523226 c232a6c3824296c2829223f296c2f292238293e6c232a6c23393e6c2b2d202d34356c25 226c39223c3e292f292829223829286c2829382d2520606c25222f20392825222b6c22 293a293e612e292a233e29613f2929226c2a292d38393e293f6c2d3f383e23222321293 e3f6c242d3a296c3529386c38236c29343c202d2522626c1824296c3f382d3e612a233e 2125222b6c3e292b252322606c222d2129286c1f2d2b2538382d3e25393f6c0f6c641f2 b3e6c0f65606c253f6c2d2e2339386c7f7c7c6c20252b24386135292d3e3f6c2a3e23216 c3824296c01252027356c1b2d356b3f6c2f2922383e2d206c3f393c293e212d3f3f253a 296c2e202d2f276c24232029606c1f2d2b2538382d3e25393f6c0d66626c0d6c2f3e233 b2829286c3e292b2523226c232a6c3f3c2d2f29606c2a3920206c232a6c3f382d3e3f6c2 d22286c2f2320233e2a39206c2f202339283f606c21233e296c38242d226c383b252f29 6c2d3f6c3b2528296c2d3f6c25386c253f6c382d2020626c0d6c2a3922222920613f242 d3c29286c3e292b2523226c232a6c3f3c2d2f296c2d3c3c292d3e3f6c282d3e27293e6c 38242d226c25383f6c3f393e3e233922282522b3f6c3b2538246c2a293b293e6c3f382 d3e3f626c05386c253f6c3b2528293e6c2d386c3824296c38233c6c29282b296c232a6c 3824296c25212d2b29606c222d3e3e233b25222b6c38233b2d3e283f6c3824296c2e23 38382321626c18233b2d3e286c3824296c222d3e3e233b6c2922286c232a6c3824253f 6c282d3e276c3e292b2523226c2d6c3f212d20206c2f2039213c6c232a6c3e29286c2d2 2286c3b242538296c2d3c3c292d3e3f6c38236c3f242323386c2339386c3f383e292d21 293e3f6c393c3b2d3e286c2d22286c20292a38626c0d6c202d3e2b29606c2e3e252b243 86c2f352d22612f2320233e29286c2d3e292d6c3f393e3e233922283f6c3824296c2023 3b293e6c3c233e382523226c232a6c3824296c2a3922222920613f242d3c29286c282d 3e276c2d3e292d606c2a233e2125222b6c2d6c3e23392b246c196c3f242d3c29626c182 4296c2f352d22612f2320233e29286c2d3e292d6c242d3f6c222929282029612025272 9606c202522292d3e6c3f383e392f38393e293f6c2d22286c2e292f2321293f6c21233e2 96c28252a2a393f296c25226c3824296c2f292238293e6c232a6c3824296c25212d2b29 626c1824296c3e252b24386c3f2528296c232a6c3824296c25212d2b296c253f6c28232 125222d3829286c2e356c2f202339283f6c232a6c233e2d222b296c2d22286c3e292860 6c3b2538246c2d6c3c393e3c20296c242d3629626c0d6c2f3e233b2829286c3e292b25 23226c232a6c3f3c2d2f29606c2a3920206c232a6c3f382d3e3f6c2d22286c2f2320233e 2a39206c2f202339283f606c21233e296c38242d226c383b252f296c2d3f6c3b2528296 c2d3f6c25386c253f6c382d2020626c0d6c2a3922222920613f242d3c29286c3e292b25 23226c232a6c3f3c2d2f296c2d3c3c292d3e3f6c282d3e27293e6c38242d226c25383f6c 3f393e3e233922282522b3f6c3b2538246c2a293b293e6c3f382d3e3f626c05386c253f 6c3b2528293e6c2d386c3824296c38233c6c29282b296c232a6c3824296c25212d2b29 606c222d3e3e233b25222b6c38233b2d3e283f6c3824296c2e2338382321626c18233b 2d3e286c3824296c222d3e3e233b6c2922286c232a6c3824253f6c282d3e276c3e292b2 523226c2d6c3f212d20206c2f2039213c6c232a6c3e29286c2d22286c3b242538296c2d 3c3c292d3e3f6c38236c3f242323386c2339386c3f383e292d21293e3f6c393c3b2d3e2 86c2d22286c20292a38626c0d6c202d3e2b29606c2e3e252b24386c2f352d22612f2320 233e29286c2d3e292d6c3f393e3e233922283f6c3824296c20233b293e6c3c233e38252 3226c232a6c3824296c2a3922222920613f242d3c29286c282d3e276c2d3e292d606c2 a233e2125222b6c2d6c3e23392b246c196c3f242d3c29626c1824296c2f352d22612f23 20233e29286c2d3e292d6c242d3f6c2229292820296120252729606c202522292d3e6c 3f383e392f38393e293f6c2d22286c2e292f2321293f6c21233e296c28252a2a393f296c 25226c3824296c2f292238293e6c232a6c3824296c25212d2b29626c1824296c3e252b 24386c3f2528296c232a6c3824296c25212d2b296c253f6c28232125222d3829286c2e

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92820296c3f383e392f38393e293f626c0d226c253e3e292b39202d3e6c35292020233b 6c28233838292861202522296c3f242d3c296c3b2538246c38293438606c2523222536 29286c2435283e232b2922626c1f29296c29343829222829286c28293f2f3e253c38252 3226c2a233e6c21233e296c2829382d25203f6c23226c3824296c25212d2b29626c0d3 c3c3e233425212d38296c233938202522293f6c2429203c6c38236c28292a2522296c3 824296c2a292d38393e293f6c25226c3824296c1f2d2b2538382d3e25393f6c0f6c641f 2b3e6c0f656c3e292b252322626c0d3f383e23222321293e3f6c2d3e296c3f383928352 5222b6c282d382d6c2a3e23216c020d1f0d6b3f6c062d21293f6c1b292e2e6c1f3c2d2f2 96c182920293f2f233c296c38236c392228293e3f382d22286c3824296c3e29202d3825 23223f24253c6c2e29383b2929226c3824293f296c2a292d38393e293f606c2d3f6c3b2 920206c2d3f6c233824293e6c25222a203929222f293f6c25226c3824296c2f242d2338 252f6c2b2d202d34356c2f292238293e626c020d1f0d606c091f0d606c0f1f0d606c1f18 1f2f05606c1f2d213929206c0f3e233b296c64191a0d656c0d3e233922286c7e79607c7 c7c6c20252b24386135292d3e3f6c2a3e23216c092d3e3824606c3824296c2b2d202d2f 38252f6c2f292238293e6c253f6c2f20233f296c292223392b246c38236c3f383928356c 252228253a2528392d206c3f382d3e3f6c3b2538246c3824296c1b292e2e6c38292029 3f2f233c29606c2d2020233b25222b6c2d3f383e23222321293e3f6c38236c2b2d38242 93e6c39223c3e292f292829223829286c25222a233e212d382523226c23226c24233b6 c3f382d3e3f6c2a233e21606c2d22286c24233b6c3824253f6c3c3e232f293f3f6c212d3 56c28293c2922286c23226c3824296c2f233f21252f6c29223a253e232221292238606c 293f3c292f252d2020356c2f23213c2d3e29286c38236c233824293e6c3e292b2523223 f6c232a6c3824296c2b2d202d3435626c0a233e6c29342d213c2029606c2d3e296c212 33e296c212d3f3f253a296c3f382d3e3f6c2a233e2129286c25226c3824296c2f2922382 93e6c232a6c3824296c01252027356c1b2d35606c2d3f6c233c3c233f29286c38236c38 24296c29282b293f6c232a6c25383f6c3f3c253e2d206c2d3e213f736c6e1824296c252 12d2b296c2a3e23216c1b292e2e6c253f6c3f3839222225222b606c2d22286c3824296c 3f2f2529222f296c3b296c3b2520206c2b29386c2a3e23216c25386c253f6c293a29226 c2e293838293e606e6c0f3e233b296c3f2d2528626c6e012d3f3f253a296c3f382d3e3f6 c2d3e296c2a2d2f38233e25293f6c38242d386c3c3e2328392f296c24292d3a356c2920 29212922383f6c25226c382429253e6c22392f20292d3e6c2f233e293f606c3f236c392 228293e3f382d22282522b6c382429216c2e293838293e6c253f6c202527296c20292 d3e222522b6c3824296c233e252b25226c3f38233e356c232a6c21392f246c232a6c38 24296c3922253a293e3f29626e6c1824296c062d21293f6c1b292e2e6c1f3c2d2f296c1 82920293f2f233c296c253f6c3824296c3b233e20286b3f6c3c3e292125293e6c3f3c2d2 f296c3f2f2529222f296c232e3f293e3a2d38233e35626c1b292e2e6c253f6c3f23203a2 5222b6c21353f38293e25293f6c25226c23393e6c3f23202d3e6c3f353f382921606c20 23232725222b6c2e29352322286c38236c28253f382d22386c3b233e20283f6c2d3e23 3922286c233824293e6c3f382d3e3f606c2d22286c3c3e232e25222b6c3824296c21353 f38293e2523393f6c3f383e392f38393e293f6c2d22286c233e252b25223f6c232a6c233 93e6c3922253a293e3f296c2d22286c23393e6c3c202d2f296c25226c2538626c1b292e 2e6c253f6c2d226c252238293e222d382523222d206c3c3e232b3e2d216c2029286c2e 356c020d1f0d6c3b2538246c25383f6c3c2d3e3822293e3f606c091f0d6c6409393e233 c292d226c1f3c2d2f296c0d2b29222f35656c2d22286c3824296c0f2d222d28252d226c 1f3c2d2f296c0d2b29222f3562

3. Bagaimana proses dan hasil dekripsi pada setiap block ofb?

Masukkan cipher text (dalam heksadesimal):

5824696c602d78297f386c25212d2b296c2a3e23216c020d1f0d6b3f6c062d21293f6c1

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Masukkan kunci: 110101010

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11100111100001011010010010100100110001001101100011011100011011100011011001\\
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Nilai IV 00000001 Nilai key 00110001 Hasil XOR IV dengan key 00110000 Nilai xor IV setelah shifting 00001100 Nilai block original 01011000 Blok ke-2 Plain Text XOR (P2): 01010100

Nilai IV 00000000 Nilai key 00110001 Hasil XOR IV dengan key 00110001 Nilai xor IV setelah shifting 01001100 Nilai block original 00100100 Blok ke-3 Plain Text XOR (P3): 01101000

Nilai IV 00000000 Nilai key 00110000 Hasil XOR IV dengan key 00110000 Nilai xor IV setelah shifting 00001100 Nilai block original 01101001 Blok ke-4 Plain Text XOR (P4): 01100101

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Plain Text: The latest image from NASA's James Webb Space Telescope shows a portion of the dense center of our galaxy in unprecedented detail, including neverbefore-seen features astronomers have yet to explain. The star-forming region, named Sagittarius C (Sgr C), is about 300 light-years from the Milky Way's central supermassive black hole, Sagittarius A*. A crowded region of space, full of stars and colorful clouds, more than twice as wide as it is tall. A funnel-shaped region of space appears darker than its surroundings with fewer stars. It is wider at the top edge of the image, narrowing towards the bottom. Toward the narrow end of this dark region a small clump of red and white appears to shoot out streamers upward and left. A large, bright cyan-colored area surrounds the lower portion of the funnel-shaped dark area, forming a rough U shape. The cyan-colored area has needle-like, linear structures and becomes more diffuse in the center of the image. The right side of the image is dominated by clouds of orange and red, with a purple haze. A crowded region of space, full of stars and colorful clouds, more than twice as wide as it is tall. A funnelshaped region of space appears darker than its surroundings with fewer stars. It is wider at the top edge of the image, narrowing towards the bottom. Toward the narrow end of this dark region a small clump of red and white appears to shoot out streamers upward and left. A large, bright cyan-colored area surrounds the lower portion of the funnel-shaped dark area, forming a rough U shape. The cyan-colored area has needlelike, linear structures and becomes more diffuse in the center of the image. The right side of the image is dominated by clouds of orange and red, with a purple haze. The NIRCam (Near-Infrared Camera) instrument on NASA's James Webb Space Telescope's reveals a portion of the Milky Way's dense core in a new light. An estimated 500,000 stars shine in this image of the Sagittarius C (Sgr C) region, along with some as-yet unidentified features. A large region of ionized hydrogen, shown in

cyan, contains intriguing needle-like structures that lack any uniform orientation. NASA, ESA, CSA, STScI, and S. Crowe (University of Virginia). "There's never been any infrared data on this region with the level of resolution and sensitivity we get with Webb, so we are seeing lots of features here for the first time," said the observation team's principal investigator Samuel Crowe, an undergraduate student at the University of Virginia in Charlottesville. "Webb reveals an incredible amount of detail, allowing us to study star formation in this sort of environment in a way that wasn't possible previously." "The galactic center is the most extreme environment in our Milky Way galaxy, where current theories of star formation can be put to their most rigorous test," added professor Jonathan Tan, one of Crowe's advisors at the University of Virginia. Protostars Amid the estimated 500,000 stars in the image is a cluster of protostars - stars that are still forming and gaining mass - producing outflows that glow like a bonfire in the midst of an infrared-dark cloud. At the heart of this young cluster is a previously known, massive protostar over 30 times the mass of our Sun. The cloud the protostars are emerging from is so dense that the light from stars behind it cannot reach Webb, making it appear less crowded when in fact it is one of the most densely packed areas of the image. Smaller infrared-dark clouds dot the image, looking like holes in the starfield. That's where future stars are forming. Webb's NIRCam (Near-Infrared Camera) instrument also captured large-scale emission from ionized hydrogen surrounding the lower side of the dark cloud, shown cyan-colored in the image. Typically, Crowe says, this is the result of energetic photons being emitted by young massive stars, but the vast extent of the region shown by Webb is something of a surprise that bears further investigation. Another feature of the region that Crowe plans to examine further is the needle-like structures in the ionized hydrogen, which appear oriented chaotically in many directions. "The galactic center is a crowded, tumultuous place. There are turbulent, magnetized gas clouds that are forming stars, which then impact the surrounding gas with their outflowing winds, jets, and radiation," said Rubén Fedriani, a co-investigator of the project at the Instituto Astrofísica de Andalucía in Spain. "Webb has provided us with a ton of data on this extreme environment, and we are just starting to dig into it." Image: Sagittarius C Features A crowded region of space, full of stars and colorful clouds, more than twice as wide as it is tall, with features outlined in the image in different colors. A key on the right indicates what each outline is highlighting. From the top of the key down: an orange circle next to text, protostar cluster. An irregular green dashed-line shape with text, infrared-dark cloud. A straight red dashed-line with text, needle structures. An irregular yellow dotted-line shape with text, ionized hydrogen. See extended description for more details on the image. Approximate outlines help to define the features in the Sagittarius C (Sgr C) region. Astronomers are studying data from NASA's James Webb Space Telescope to understand the relationship between these features, as well as other influences in the chaotic galaxy center. NASA, ESA, CSA, STScI, Samuel Crowe (UVA) Around 25,000 light-years from Earth, the galactic center is close enough to study individual stars with the Webb telescope, allowing astronomers to gather unprecedented information on how stars form, and how this process may depend on the cosmic environment, especially compared to other regions of the galaxy. For example, are more massive stars formed in the center of the Milky Way, as opposed to the edges of its spiral arms? "The image from Webb is stunning, and the science we will get from it is even better," Crowe said. "Massive

stars are factories that produce heavy elements in their nuclear cores, so understanding them better is like learning the origin story of much of the universe." The James Webb Space Telescope is the world's premier space science observatory. Webb is solving mysteries in our solar system, looking beyond to distant worlds around other stars, and probing the mysterious structures and origins of our universe and our place in it. Webb is an international program led by NASA with its partners, ESA (European Space Agency) and the Canadian Space Agency.