

Anthropology of Cosmic Intelligence: Toward a New Ethnographic Understanding of the Transformation of Astronomical Vision in the Age of Algorithms

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Abstract:

We are undergoing a tremendous transformation that is not confined to laboratories and telescopes; rather, it reaches into the depths of our civilization. The anthropology of cosmic intelligence proposes that this transformation, driven by algorithms and artificial intelligence, is reshaping our identity as human beings. We are no longer mere observers of the universe; we have become part of an epistemic network connected to machines, code, and the stars themselves. Artificial intelligence has transformed astronomy from a science of instruments into a new cultural and human space, where technology, knowledge, and culture intertwine within a contemporary landscape of the anthropology of science.

This article aims to enter into the depths of that transformation from an ethnographic perspective, focusing on how this technology has reshaped the “experience of astronomical vision” itself, and how the status of the human astronomer has shifted within this shared epistemic space, in pursuit of a deeper understanding of the “shared cosmic mind” that guides our field and anthropological inquiry.

key words: Anthropology of Science, Cosmic Intelligence, New Ethnography, Astronomical Vision, Algorithms.

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Introduction:

The last decade of the third millennium has witnessed a radical transformation in how cosmic knowledge is constructed and perceived-a profound shift that goes beyond the boundaries of technology to encompass, fundamentally, human and civilizational dimensions. The integration of artificial intelligence (AI) technologies-especially deep learning networks-into processes of astronomical observation and analysis represents a decisive epistemological rupture in the history of scientific practice. Traditionally, astronomy was a sensorially enhanced practice that relied on extending and amplifying human senses through instruments, while the astronomical self remained the ultimate source of intuition and scientific interpretation. Today, however, artificial intelligence has moved from being merely an assisting tool to becoming an autonomous epistemic agent that participates essentially and actively in processes of detection, classification, and inference, thereby creating a hybrid epistemic space that we call “cosmic intelligence”⁽¹⁾.

The phenomenon under analysis is the emergence of this hybrid epistemic system that compels a comprehensive re-evaluation of the human’s place within the framework of cosmic inquiry. This new partnership produces a profound existential entanglement between human, machine, and universe, such that the astronomer’s role is no longer confined to observation or traditional theorization; rather, it has shifted toward “training” algorithmic models, “organizing” the epistemic environment of big data, and “interpreting” automated outputs that may function as “black boxes”⁽²⁾. This major challenge raises fundamental questions about how epistemic legitimacy and scientific trust are constructed in results whose inferential pathways cannot be fully traced through traditional human logic, and how “rituals of verification”⁽³⁾ and scientific review are changing.

“Astronomy”, since “Galileo”, has long been a purely human experience: through it, one can look upward and search for true meaning in the darkness of the sky. Yet today this is no longer the case. Our second eyes have become the “algorithms”, and our knowledge of the universe is made through layers of complex code. This is not merely a technical evolution; it is regarded as a moment of radical “civilizational transformation”. Thus, the integration of artificial intelligence technologies into astronomical observation-whether in the discovery of exoplanets or the classification of galaxies-has created a new partner in the process of knowledge: how does the astronomer feel when

“discovery” is the product of an automated analysis of data whose sheer volume the human brain could not even comprehend? This is the central question that the “anthropology of cosmic intelligence”⁽⁴⁾ seeks to answer. Astronomy is viewed here as a “cultural space”, in which the human experience is reformulated through “new ethnography”⁽⁵⁾.

In the face of this profound transformation, this article finds in Science and Technology Studies (STS) the optimal theoretical framework. The main aim in choosing this topic was to provide an in-depth ethnographic reading of the new practices and concepts that arise in the “laboratory of cosmic intelligence”⁽⁶⁾, in order to reach conclusions that go beyond technical analysis to touch cultural and human dimensions. Through this, we sought to understand how the astronomer’s professional identity is being reshaped under the presence of the machine, and how this interaction is described within the framework of “distributed intelligence”⁽⁷⁾, which leads us to crystallize our proper concept of the “shared cosmic mind”⁽⁸⁾, where understanding is negotiated between human intuition and algorithmic logic. This anthropological analysis aims to demonstrate that the transformation in astronomy is, at its core, a civilizational transformation, and that studying the “culture of algorithms”⁽⁹⁾ in this cosmic context is the key to understanding the new relationship between humanity, knowledge, and truth in the age of cosmic intelligence.

First: Anthropology of Science: Astronomical Vision in the Age of Cosmic Intelligence

The study of the phenomenon of astronomy’s transformation through artificial intelligence cannot be conducted in isolation from an analytical framework belonging to the field of anthropology and Science and Technology Studies. The aim here is to move beyond treating the algorithm as a purely mathematical tool, and to treat it instead as a “cultural system” that participates in constructing cosmic truth.

The concept of “astronomy” appears in “Diyar Hasan Karim” in his book (Astronomical Geography) as: the celestial study of bodies, stars, and planets, and of what surrounds our outer sky of objects and worlds. Diyar affirmed in his book that astronomers conducted systematic observations of the sky, and that astronomical artifacts were discovered during very early periods; nevertheless, it was necessary to invent the (telescope) before astronomy could develop into one of the modern sciences. Astronomy included observational astronomy, calendar-making, and astrology, but “professional astronomy”⁽¹⁰⁾ is

considered synonymous with astrophysics (Jiyar, 04/01/2026, 14:29). Therefore, acquiring a basic knowledge of algorithms enables us to take a meaningful part in conversations about the age of algorithms. This age is not imposed upon us; rather, it is made by our hands and built upon tools that we invented. “Algorithms” are wonderful tools, and an urgent knowledge of how they are constructed and how they work can help us enhance our way of thinking (Panyus, 04/01/20266, 15:22).

The concept of the word “algorithm” itself does not clarify its meaning. The name is derived from the name “Muhammad ibn Musa al-Khwarizmi” (c. 780–850 CE), a Persian scholar in mathematics, astronomy, and geography, whose contributions were numerous and widely disseminated. The term (algebra) is derived from the Arabic title of his most influential book, (Al-Mukhtasar fi Hisab al-Jabr wa al-Muqabala). His second most influential book was (On Calculation with Indian Numerals), as it addressed arithmetic operations and introduced the Hindu–Arabic numeral system to the Western world through its translation into Latin. Al-Khwarizmi’s name entered Latin as “Algorismus”, which came to refer to a method of numerical calculation using decimal numbers. The Latin term “Algorismus” was influenced by the Greek word “Arithmos”, meaning (number) (as in the word “Arithmetic”, meaning calculation). Subsequently, “Algorithm” came to mean algorithm, and it remained a reference to decimal arithmetic operations before acquiring its modern meaning in the nineteenth century (Panyus, 04/01/2026, 15:22).

1. Astronomy from the Traditional Instrument to the Algorithmic Actor:

1.1 The Story of Telescopes and the Birth of Modern Astronomy:

The journey began indirectly in (1608) with the Dutch spectacle-maker “Hans Lippershey” “Hans Lippershey”, to whom the first patent is attributed for a magnifying astronomical viewing device that revolutionized observation and discovery; this tool was later developed in (1609) into a scientific instrument by the Italian scholar “Galileo Galilei” “Galileo Galilei” (the father of modern observational astronomy), though it originally began as a mere optical toy.

With the arrival of Galileo, astronomy advanced through his discovery of the telescope and his use of the magnifying lens; he laid the foundation of modern experimental science. He was able to probe the vast depths of the universe: he observed sunspots, and he saw the mountains, valleys, and craters of the Moon; he also observed four of

Jupiter's moons orbiting it. Subsequently, the astronomer "Christian Huygens" was able to build a large telescope five meters in length, through which he discovered things that had not yet been discovered. He is regarded as the first to measure the sizes of planets and their distances; he also discovered that Venus is completely surrounded by clouds, and he arrived at the knowledge that a Martian day is equal to our day; he is also the one who discovered (Titan), the largest moon of Saturn and the largest moon in the solar system. Then "Giovanni Domenico Cassini" was able to observe the zodiacal light; he also discovered four of Saturn's moons, clarified the nature of the rings surrounding it, and discovered the dark gap that separates them, which was named (the Cassini Division). However, the greatest success achieved by astronomy was by "Isaac Newton", who discovered the laws of motion and gravity upon which subsequent astronomical studies relied (Adnan, 02/01/2026, 13:15).

After that came "Alser William Herschel" (1738–1822), who was able to discover the planet Uranus, two moons of Saturn, and two moons of Uranus. He established his large telescope in (1789), with a diameter of (48 inches) and a focal length of (40 feet). He also discovered binary stars, applied Newton's laws to them, and concluded that gravity has an effect on these stars, as it brings together the members of double stars to orbit around a single center. He also studied the distribution of stars in the stellar system in space and observed nebulae with precision, indicating that there are more than (2500 nebulae). He took special interest in (the Andromeda Nebula M31), and through precise and deep observation he clarified that it is a massive gathering of large numbers of stars of different sizes, magnitudes, and ages, and that it is not merely a cloud as commonly believed-leading him to think that there are other worlds of gaseous matter. Human beings became able to explore the universe and probe its depths after the enormous development that affected astronomy, its technologies, and its instruments, making it possible to comprehend what could not be comprehended before. Thus, attention turned to the study of stars, star clusters, galaxies, and distant nebulae. Thanks to the enormous (Palomar Observatory) designed by "George Hale" in (1948), scientists were able to observe stars and galaxies spread throughout the profound depths of the universe. Scientists later shifted to "ethereal telescopes"⁽¹¹⁾, developed them, and the ethereal telescope called (V-LA) (Very Lary Array) is considered the most powerful of all such telescopes. It consists of (27 antennas), each weighing about (213 tons), and it is designed to capture sounds broadcast

roughly billions of years ago. The process converts faint whispers coming from space to the concave surface of the antennas and analyzes them with precision. Through analyzing these observations, astronomers have become aware of what is happening in space; they have also come to know the origin of the solar system and how it arose, and they have obtained important indicators regarding stellar masses, clusters, nebulae, and aggregates-thereby enabling the human being to understand the universe properly (Adnan, 02/01/2026, 13:15).

1.2. The Algorithm from the Perspective of Actor–Network Theory:

This ethnographic reading calls for a renewed explanation of the classical concepts in “Actor-Network Theory” as formulated by “Bruno Latour”. While the telescope was traditionally viewed as a “technical intermediary” whose essential function was to extend human senses visually, artificial intelligence imposes a different reality that goes beyond mere functionality. Here we move from the concept of “instrumental mediation”⁽¹²⁾ to the concept of “epistemic agency”⁽¹³⁾: algorithms-specifically deep learning models are no longer mere calculators, but have become “non-human acting entities” with decision-making authority in determining patterns and building inferences. In this new context, the algorithm plays the role of “translator”, not carrier: it does not merely display data, but performs complex interpretive operations to build detection models that human cognitive capacities cannot reach on their own, where this transformation imposes an “ethnographic displacement”⁽¹⁴⁾ in the research methodology. Analysis is no longer confined to social relations among scientists; rather, it has expanded to include the ecology of data practices.

Later, “Brandon Carter” formulated the theory of the strong anthropic principle, and in (1986) “John Barrow” and “Frank Tipler” analyzed in their book “The Anthropic Cosmological Principle”⁽¹⁵⁾, which bears the title (The Anthropic Cosmological Principle “the principle according to the strong version”). In the strong principle, the universe “must” possess those properties that allow life to evolve within it. This verb “must” shifts the focus from purely scientific to philosophical or metaphysical. In reality, the verb “must” presupposes the existence of an entity that expresses its will and exercises it in creating the universe. This phrase is indigestible for positivist science; nevertheless, the strong formulation of the “Anthropic Principle” describes a new relationship between the universe and the human being, as the old dignity that had been taken from the human is restored and

returned to him. The strong anthropic principle removes the human from the marginal position to which he had been relegated along with his planet. Naturally, Earth never returns to the center of the universe; the central position is occupied by the human being, for whom and because of whom the universe exists. The strong anthropic principle has a dual feature: restoring prestige to the human being and “illuminating science” with a new nobility, bringing it out of the grayness of mechanical Enlightenment (when we say the meaning of words) (Bruno, 04/01/2026, 18:03).

“Barrow” and “Tipler” were subjected to severe criticism because they propose in their book a third type of anthropic principles, added to the two theories proposed by “Carter”. The authors propose the “Final Anthropic Principle”⁽¹⁶⁾, and with this additional theory they seek a better explanation of the astonishing coincidences that allow the existence of our universe and intelligent life. In the “final principle”, Barrow and Tipler begin from the assumption that if infinitesimally small changes were to occur in the values of the basic cosmic constants, the existence of the universe as we know it would vanish. In view of this, they conclude that we cannot study the current structure of the universe without considering our physical needs. The statement of the last anthropic principle reads as follows: “Intelligent information processing in the universe must necessarily come into being, and this intelligence, once it has arisen, will never perish”. At first, the famous astrophysicist “Stephen Hawking” expressed his doubts, mentioning that the existence of other galaxies that homogenize the universe on a large scale could conflict with the strong anthropic principle; but later, when he devoted himself to developing M-theory, Hawking changed his mind and became a strong supporter of the anthropic principle, introducing into many of his equations a variable related to this theory (Bruno, 04/01/2026, 18:03).

Finally, another famous American physicist, “John Archibald Wheeler”, proposed the theory of the “Participatory Anthropic Principle”⁽¹⁷⁾. This is an alternative version of the strong anthropic principle. Wheeler describes his idea as follows: “The universe must be such as to allow the creation of observers within it at some stage of its existence. Observers are necessary for the existence of the universe, and they are also necessary for knowing it; therefore, observers of the universe participate actively in its very existence”. The principle of participation is one form of the strong principle; it reverses the logic and says that the universe exists because we exist. The American astronomer

“Hubert Reeves” describes the anthropic principle as follows: “Since there is an observer, the universe possesses the properties necessary to generate it. Cosmology must take into account the existence of the cosmologist, and these questions would not have been raised in a universe that did not have these properties”. All the recent quotations point to a concept that may appear complex at present: the concept of (the observer), where the observer’s role is framed within the context of “quantum physics”⁽¹⁸⁾, and it is extremely decisive (Bruno, 04/01/2026, 18:03).

The ethnographic focus here is on considering new ethnography as a mirror of scientific culture, through the transformations of practice and identity in astronomical sciences in general, and through what we found in processes of “technical socialization”: that is, how astronomers integrate their values and assumptions into the algorithmic structure (humanizing the machine), and how the machine responds by producing new facts. Thus, a radical change occurred in the structure of the scientific question: instead of the traditional question, “What did the eye observe”?, we are faced with a new ethnographic question: “What did the algorithm decide to show”?. This shift translates “astronomical vision”⁽¹⁹⁾ in the age of artificial intelligence, and confirms that the algorithmic actor not only discovers cosmic reality but also contributes to re-“constructing” it ontologically. An example of this is forcing massive and ambiguous astronomical data to shift from a probabilistic state to a single, determined, and measured reality, making the study of interaction between researcher and machine an inevitable entry point for understanding the nature of contemporary scientific truth.

Second: The Formation of the Astronomical Self and Data Culture in Cosmic Space

This ethnographic reading offers a critical analysis of the processes of integrating artificial intelligence into astronomical practice, thereby going beyond the usual technical narratives. Its aim is to investigate the discovery of daily practices and emerging epistemic conceptions within what we called the “laboratory of cosmic intelligence”. The central question here is that the entry of artificial intelligence did not represent merely an updating of observational tools; rather, it produced an existential transformation in the “professional identity of the astronomer”⁽²⁰⁾, and in turn restructured the entire “culture of producing astronomical knowledge”⁽²¹⁾. Today we are witnessing the

birth of a new astronomical self, formed in the liminal zone between human intuition and algorithmic rigor.

1. The Transformation of Astronomical Identity: from the “Observer” to the “Algorithm Trainer”

1.1. The Identity of the Classical Observer:

As is the case with scientists, astronomers are dominated by doubt due to their long work in observations and their particular nature. What happens in the case of a discrepancy in the stellar view is that if two observations claim that they establish a star in a first position and then in another position, they will be dismissed immediately. There are many alternative explanations for a star’s behavior in “jumping” from one region to another, most of which relate to the observer’s lack of qualification or insufficient experience. In order to be convinced of the validity of a precise phenomenon such as stellar parallax, astronomers ask to see a series of well-timed and well-executed observations. They want to see data that is consistent with what is theoretically acceptable. In sum, they want to be convinced that parallax alone, and nothing else, can explain the set of evidence before them (Alan and Hayr, 06/01/2026, 12:19).

Thus, in the traditional astronomical paradigm (Paradigm), the astronomer possessed the “authority of constitution”⁽²²⁾ over the discovered phenomenon, such that the celestial body acquires its scientific reality through the direct meeting of human observation and theoretical framing.

1.2. The Identity of the Algorithm Trainer (the Machine):

In the current technical moment, artificial intelligence has often become the one that undertakes the “initial constitution” of astronomical topics, by assembling fragments of disparate data and revealing patterns that human senses and cognitive capacities are unable to capture. This shift imposes a fundamental anthropological question about “scientific paternity”: who is the true discoverer?, Is it the human mind that engineered the “algorithmic architecture”⁽²³⁾, or the neural network that captured the signal?, The more accurate answer points to a state of “distributed agency”, which strengthens our thesis regarding the “shared cosmic mind”⁽²⁴⁾.

It can be said here that algorithms are a set of ordered, clear steps, capable of executing a specific task with an end. There are two types of algorithms: “computational algorithms”, which refers to algorithms that deal with mathematical calculations and rely on logical sequencing in

their execution, and “non-computational algorithms”, which are the most widely used; among them are those used for processing texts, storing and retrieving information, managing databases, and assisting decision-making in all aspects of life. The topic of algorithms and their role in artificial intelligence and computational operations has received many studies, because they are the essence of the computational and non-computational processes carried out by the computer. The development of algorithms has been a decisive factor in the development of artificial intelligence, which means mastering the effective tools used for purposes of observation, analysis, design, computation, management, and control. These tools constituted the pillars upon which another massive renaissance in the discovery and development of the natural sciences—namely physics, followed by chemistry and materials development—was built, which itself was another foundation for a major industrial technical renaissance beginning in the second half of the eighteenth century (Maryam and Sayf al-Din, 06/01/2026, 21:42).

The concept of “expertise” has undergone a radical transformation: after the astronomer’s competence was measured by his phenomenological ability for “visual discrimination” of astronomical anomalies through the telescope, professional identity has shifted fundamentally. The researcher is no longer the “first observer”, but has become the “trainer” and the “validator”. This transformation calls for a comprehensive redefinition of “epistemic labor”: the astronomer’s mental effort is no longer concentrated in observation, but in processes of auditing and labeling massive data to train models.

From an anthropological perspective, this “teaching” process is not a neutral technical procedure; rather, it is a process of “cultural transfer” and “embodiment” of scientific intuition within the machine. When the astronomer classifies an image as a “spiral galaxy”, he is in fact “positioning” his tacit expertise within the code, reproducing “human classification culture” within artificial consciousness. Ethnography here reveals a profound existential tension: there is a longing among astronomers for the moment of “direct visual discovery”, which collides with the necessity of submitting to the logic of “epistemic trust” in the outputs of “black boxes” whose logical depths cannot be fully fathomed.

2. The Shared Cosmic Mind: from “Raw Data” to “Hybrid Culture”

2.1. The Journey of Transformation from Raw Data to Processed Knowledge:

“Astronomical quantum physics” was known in “Chile”, specifically on the “Chajnantor Plateau”, at an altitude of more than (5000 meters), where the sky appears closer. There stands the “Atacama Large Millimeter Array” (ALMA), a complex of (66 antennas) that observes the universe at millimeter and submillimeter wavelengths. In this extreme scene, in (2022), the “Cosmic Quantum Link” project was formed, a collaboration between (ALMA) and theoretical physics groups in Latin America. The ambitious goal is to search for subtle relationships between very distant astrophysical phenomena; these relationships may reveal a unified informational principle, as if the universe were a coherent network capable of “thinking,” or at least of preserving a comprehensive memory (Bruno, 04/01/2026, 18:03).

The observation protocol is strict: astrophysicists select pairs of “quasars” separated by billions of light-years. Each quasar is observed simultaneously, with precision reaching thousandths of a second, so that data is filtered from atmospheric noise and terrestrial interference; it is then analyzed using “quantum correlation algorithms”⁽²⁵⁾, developed in Santiago de Chile and Buenos Aires. The first discoveries surprised the team in two cases: it appeared that changes on the surface of one quasar preceded, by a few minutes, a similar change in another quasar located in the opposite direction in the sky. Researchers ruled out known gravitational effects or traditional causal links. The statistical probability of a random coincidence occurring, according to a calculation reported in a report published in (2024), was less than (0.1) percent. The Colombian theoretical physicist “Mateo Rios” commented: “If these data are confirmed, we will have to consider that there are informational structures distributed throughout the universe, with links that we cannot explain by classical physics.” Culturally, the project is linked to “Andean cosmologies”, where the universe is not regarded as a rigid mechanism but as a living, interconnected being. Scientists do not consider this vision to be true, but they recognize that such mental images can stimulate new research questions (Bruno, 04/01/2026, 18:03).

The most important part of our article lies in understanding how silent and massive cosmic signals-or what we call “raw astronomical data”-are transformed into “meaningful knowledge” with which we all engage. Here, algorithms do not operate as simple calculating machines, but as a translator of the universe: they receive those immense streams of

numbers and signals and mine them to find patterns that we could not see with our own eyes. In other words, algorithms are the intermediary that determines how we “see” the universe and how we “understand” it. Nevertheless, it should not be overlooked that these machines are not entirely neutral; software is the product of our own thinking. Therefore, it is necessary to investigate ethnographically the human biases that may seep into algorithmic models, affecting what the machine decides is “important” or “unimportant” in the universe. At the end of this process, our astronomical outlook changes entirely: certainty about a cosmic discovery no longer depends on the astronomer’s sight, but on the validity of the model’s computational competence. This profound shift in the way astronomical knowledge is produced is what paves the way for the birth of “hybrid culture”⁽²⁶⁾ in our relationship with the universe.

2.2. Producing Hybrid Culture and Applying Ethnographic Understanding to It:

There is a prominent difference in the concept of “hybrid culture” as being a product of structures stronger than the individual’s control. There is the power of machine learning, through which countless applications arise, and examples of that are many. For instance, in agriculture, artificial intelligence facilitates the precise management of pesticides, disease detection, and the prediction of crop yields (Mahdi Hanna, 08/01/2026, 12:25). It can be said that machines can develop their culture, since some machines can adapt and learn that is, develop a unique historical trajectory linked to the situations to which they have been exposed. But can machines become capable of learning from one another and collectively form phenomena that we can describe as “cultural phenomena”? (Kaplan and Shabutiye, 05/01/2026, 17:21).

The increasing reliance on artificial intelligence has produced a different “data culture”⁽²⁷⁾ within astronomical circles, in which raw data has shifted from being mere passive digital records to central “acting entities”. Data is no longer merely computational input; it has become the object of complex practices and rituals aimed at ensuring its “cleanliness” and its “ontological validity” to feed neural models. In this new cultural space, the concept of the “shared cosmic mind” is embodied as a tangible reality: knowledge is produced through a “hybrid network”⁽²⁸⁾ in which roles are distributed with precision. The machine undertakes the burdens of intensive statistical analysis and pattern extraction, while the human monopolizes the function of “contextual

interpretation”, reintegrating automated outputs within major narratives and physical theories.

In the end, we arrive at the final fruit of this epistemic journey: the birth of what we call hybrid culture. It is not merely a set of data, but an entirely new way of understanding the universe, produced through a deep collaboration between the human researcher’s mind and the “intelligence of algorithms”⁽²⁹⁾. Scientific and astronomical certainty has now become the product of a shared interaction that cannot be separated; each of “the human” and “the machine” leaves its imprint in shaping the “cosmic truth” in which we believe. Here, the role of Anthropology emerges to study this new scientific community: this new ethnographic culture not only redefines the profession of the astronomer, but also contributes to shaping our broader collective consciousness about existence-thus confirming that our contemporary understanding of the universe has come to depend on this profound epistemic partnership with the shared cosmic mind.

Conclusion:

Ethnographic inquiry in the “Anthropology of cosmic intelligence” has led us to a central conclusion: the current transformations in astronomy have gone beyond being a procedural technological leap, to become a civilizational transformation that touches the existential structure of the knowing being. This ethnographic reading has shown that the integration of algorithms has re-engineered our self-awareness, as the astronomer’s professional identity has shifted from the “observer” grounded in visual intuition to the “engineer of astronomical knowledge” and the “algorithm trainer”. This shift reflects a profound process of “cultural transfer”, in which human expertise is “embodied” within the machine’s logical systems. This transformation has established the foundations of a new epistemic system based on the “shared cosmic mind”, which is a living embodiment of the theory of “distributed cognition”, where meaning is not generated in isolation, but through continuous negotiation between human and machine as equally “acting entities”. In the face of the challenge of “epistemic opacity” imposed by black boxes, we observed the emergence of complex “rituals of verification”, which are, in essence, human attempts to confer “epistemic legitimacy” upon the machine’s outputs a persistent effort to restore the authority of cultural interpretation over the process of discovery. The existential relationship with the universe has today become a “technically mediated” relationship, raising radical problems concerning the erosion

of the “authority of direct vision” and the fate of “cosmic wonder”⁽³⁰⁾ when its source becomes a purely algorithmic product.

In conclusion, the study recommends directing future research toward the ethics of cosmic intelligence and the mechanisms of distributing “epistemic accountability”, affirming that understanding the future of astronomy, in the final analysis, is an understanding of the future of humanity within a renewed networked existential context. The anthropology of cosmic intelligence is not merely a newly emergent academic field; it is an invitation to philosophical reflection on our new existential condition through the mirror of algorithms. We are not only rediscovering our position in the physical universe, but also repositioning ourselves within an intelligence network that transcends biological boundaries. From here, this reality calls for understanding technology as a “culture” that carries values and assumptions, and for redefining “human expertise” in the time of machine superiority, insofar as discovering the universe today is, par excellence, an anthropological discovery of the self, as a mirror reflecting transformations of identity and truth in the new cosmic age.

Bibliography List:

- (1) **Cosmic intelligence:** This refers to the theoretical lens that analyzes how algorithms (artificial intelligence) reorganize the astronomical vision of the universe through the epistemic interaction among cosmic data, the machine, and the community of scientists, thereby revealing the dynamics of producing contemporary astronomical knowledge.
- (2) **Black boxes:** In the context of the article, this refers to complex astronomical algorithms that produce inferential and epistemic outputs through mechanisms that are not fully transparent, raising a question about the effect of (non-interpretability).
- (3) **Rituals of verification:** A system of recurrent normative practices that astronomers rely on to attribute discoveries and justify accepting them, noting their transformation in the age of algorithms toward verification patterns more dependent on computational reliance and procedural agreement, compared to direct human verification or transparency of steps.
- (4) **Anthropology of cosmic intelligence:** A theoretical framework and research field that studies the transformation in the relationship among human, machine, and cosmic data, focusing on how artificial intelligence reshapes cultural practices and the standards of truth and trust within the astronomical community.
- (5) **New ethnography:** A methodological perspective concerned with observing cultural and behavioral transformations within the community of astronomers by tracing the effects of integrating algorithms into daily work, as generating new patterns of practice and meaning.
- (6) **The laboratory of cosmic intelligence:** An operational-data site (not necessarily a single physical place) in which astronomers interact with artificial intelligence

algorithms through data workflows, enabling the study of how cosmic vision is built and how new astronomical knowledge is made.

(7) **Distributed intelligence:** An analytical framework that assumes that producing astronomical knowledge is formed through an interconnected network of actors (humans, algorithms, technical infrastructures), such that “intelligence” is not reduced to a human self or an isolated automated system, but is distributed across the system as a whole.

(8) **The shared cosmic mind:** A concept describing the epistemic outcome arising from the synergy of human interpretation with the algorithmic capacity for processing and discovery, as a shared epistemic space that transcends the boundaries of a single actor, whether (human) or (machine).

(9) **The culture of algorithms:** A system of values, rules, practices, and professional language that crystallizes within the community of astronomers as a result of intensive reliance on artificial intelligence, thereby reordering standards of the “acceptable” and methods of constructing scientific truth.

(10) **Professional astronomy or astrophysics:** This term is used to denote scientific astronomical research based on big data and complex tools such as (advanced telescopes, computational infrastructures, and artificial intelligence), with the aim of interpreting the physical structure of the universe and its evolution.

(11) **Ethereal telescopes:** A conceptual metaphor indicating that artificial intelligence enables an “observational capacity” or “sensing” of patterns in cosmic data that exceeds the limits of human perception or traditional analytical tools, producing new forms of indirect scientific vision.

(12) **Instrumental mediation:** This means that tools such as (telescopes and algorithms) do not function as neutral media, but participate in shaping what is seen and how it is interpreted, by reconfiguring the astronomer’s relationship to data and to the observed world.

(13) **Epistemic agency:** The capacity to make epistemic and procedural decisions based on acquired understanding within an algorithmic work environment, assuming that this agency is distributed between the human actor and the automated system within the chain of knowledge production.

(14) **Ethnographic displacement:** A shift in the ethnographic center of gravity from the “field” as a traditional human or geographic site to a networked field shaped by relations among humans, algorithms, and data, where computational systems are treated as an actor participating in shaping the object of study and its procedures.

(15) **The anthropic cosmological principle:** A hypothesis that examines how the observed universe is formed through human consciousness and its analytical tools (including algorithms), focusing on assumptions and cultural biases embedded in research models.

(16) **The final anthropic principle:** An assumption that sees the universe’s givens as being read or implicitly reselected, in a way that makes them consistent with the conditions for the emergence of the conscious observer, calling for an analysis of mechanisms that marginalize data that do not fit this interpretive framework.

(17) **The participatory anthropic principle:** A hypothesis that considers the existence of conscious observers-including (machine observation) as a procedural

extension as a participating element in determining the properties of observed reality, by fixing them within conditions of measurement and analysis.

(18) **Quantum physics, quantum theory, or quantum mechanics:** Invoked as a theoretical-philosophical framework that helps discuss the role of (observation and measurement) in the transition from a space of probability to a measured outcome, with a rethinking of the place of algorithms as a measuring-interpretive intermediary within contemporary science.

(19) **Astronomical vision:** A cognitive, technical, and social process for receiving, processing, and interpreting cosmic signals to produce an “image” or interpretation of truth; in big-data contexts it has become more dependent on algorithmic mediation in filtering, extraction, and modeling.

(20) **The professional identity of the astronomer:** A hybrid identity that shifts from “visual observer” to “analyzer of cosmic data”, where competence centers on engineering algorithms and managing data, while the human role remains central in interpretation and constructing the explanatory narrative.

(21) **The culture of producing astronomical knowledge:** An ethnographic description of a set of communal rituals and standards, such as (mutual code review, data sharing, and publication standards), that legitimate discovery and establish its validity in an environment mediated by algorithmic technologies.

(22) **Authority of constitution:** A concept referring to the ability of advanced technical systems to go beyond “describing” reality toward contributing to shaping the conditions of its appearance and its standards within the scientific community, through the methods of classification, filtering, and stabilization of knowledge that they impose.

(23) **Algorithmic architecture:** The logical or technical structure designed to process astronomical data, embodying implicit human assumptions and influencing what is recognized as “truth” through mechanisms of filtering and procedural calibration.

(24) **The shared cosmic mind:** This refers to the collectively organized, algorithmically structured epistemic framework within the community of astronomers, where the methodological goals and implicit biases of research are embodied, as an ethnographic background regulating what is seen and what is accepted.

(25) **Quantum correlation algorithms:** Programs developed in quantum computing contexts to benefit from the phenomenon of quantum entanglement in executing computational or inferential operations with high efficiency.

(26) **Hybrid culture:** An ethnographic framework describing a structural intertwining between algorithmic systems and human cosmic conceptions in astronomy, producing new rules for meaning-making and data interpretation within a shared epistemic space.

(27) **Data culture:** A normative system that defines the values and principles that regulate collecting, processing, documenting, and sharing data, granting it the status of “scientific truth” within methodological and ethical controls.

(28) **The hybrid network:** An interconnected relational structure that includes astronomers, algorithms, telescopes, and data within a single system for producing astronomical vision, highlighting the entanglement of roles between human and non-

human actors.

(29) **The intelligence of algorithms:** The capacity of computational systems to organize big data and extract patterns and meaning with an efficiency that exceeds direct human performance, granting them an active role in redrawing the boundaries of interpretation and demonstration in astronomical knowledge.

(30) **Cosmic wonder:** An affective state that drives questioning about the vastness and complexity of the universe; it is re-understood in the age of algorithms as a cultural phenomenon mediated by computational tools and what they enable of new images, patterns, and discoveries about cosmic space.

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Anthropology of Cosmic Intelligence: Toward a New Ethnographic Understanding of the Transformation of Astronomical Vision in the Age of Algorithms-----

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