“It’s all Greek to me!”

An introduction to TSPC without the mathematics

Ian Salisbury, 3 August 2026 Back to the Home Page

If you have ever opened a paper on cosmology, glanced at a page full of Greek letters, tensors and equations, and quietly decided that life was too short, this little essay is for you.

It contains no mathematics. That is not because the mathematics is unimportant. On the contrary, if an idea is to survive, many would say that mathematics is the only language that will finally judge it. But mathematics comes at the end of the journey, not the beginning. Before anyone writes an equation, someone must first ask a question.

Looking up

With cosmology, there are only two questions to ask: “How?”, and then “Why?”. That second question has occupied the minds of many generations, but is not my subject. The closest I have come to considering it is in Paper 10, The Metastability of Entropic Zero. As to the “How?”, that arises naturally from the simple act of looking upwards. It must have been asked, in one form or another, by every culture that has ever lived beneath the open sky. A child in prehistoric Europe, a shepherd on the hills of Judaea, a fisherman on the coast of China, or a traveller crossing the Australian desert would all have seen essentially the same heavens. The sense of wonder for them, just as it is for us as we gaze upwards on a clear night, is universal.

It is hardly surprising that the records that have reached down to us show every civilisation striving to understand what it saw. The earliest answers were not scientific in the modern sense, nor should they be judged by modern standards. They were attempts to bring order to experience, to weave the changing heavens into stories that gave meaning to the world below. Long before astronomy became a science, it was poetry, mythology and philosophy that held sway; the stars were not simply lights in the sky but actors in narratives through which successive generations sought to understand both the universe and themselves.

In Mesopotamia, where some of the world’s earliest cities flourished between the Tigris and Euphrates, careful observation became almost a sacred duty. Babylonian astronomer-priests watched the heavens from the great temple towers, recording planetary positions, eclipses and conjunctions with astonishing diligence. Thousands of clay tablets survive, preserving observations extending over many centuries. These were not idle records. The heavens were believed to reveal the intentions of the gods, and the prosperity of kingdoms might depend upon reading those celestial messages correctly.

Ancient Egypt viewed the sky through a different lens. There the annual appearance of Sirius just before dawn announced the coming flood of the Nile on which the civilisation depended. The stars regulated agriculture, religious festivals and the calendar itself. Great temples were aligned with extraordinary precision to significant celestial events, demonstrating that careful observation and practical necessity could sit comfortably alongside religious belief.

Across the Aegean, the Greeks inherited many of these traditions. Homer's heroes navigated by familiar constellations, while Hesiod advised farmers to sow and harvest according to the rising of the Pleiades and Orion. Yet beneath these practical observations something new was beginning to emerge. A few Greek thinkers started to ask a different kind of question. Instead of asking what the gods intended, they began to wonder whether nature itself possessed an order that human reason might discover. It was a subtle change, but it would alter humanity's understanding of the universe for ever. It represented one of the greatest intellectual turning points in history.

Around 600 BC, one of those thinkers, Thales of Miletus (c. 624-546 BC), proposed something astonishingly simple: that natural events should be understood through natural causes rather than through the changing moods of the gods. His younger contemporary Anaximander went further, suggesting that the world might arise from universal principles operating according to their own necessity. Neither man would recognise modern science, yet both had begun to ask questions that scientists still ask today.

The philosophical tradition reached its classical flowering in Socrates, Plato and Aristotle. Socrates himself wrote nothing, preferring to teach through conversation and relentless questioning. Plato saw the visible universe as an imperfect reflection of perfect mathematical forms. Aristotle constructed the first comprehensive account of nature, placing the Earth at the centre of a beautifully ordered cosmos carried by concentric celestial spheres. Although later shown to be mistaken, his system was so coherent and persuasive that it dominated natural philosophy for almost two thousand years.

During that period there was no significant questioning that the universe might be otherwise; yet now, most of those ideas have been abandoned. That scarcely matters; the Greek's true achievement in understanding the cosmos was not in the answers they gave, but in the questions they dared to ask.

Every generation of scientists has, since, in one way or another worked within the tradition that the Greeks began. Copernicus, Galileo, Newton and Einstein all differed profoundly in what they believed about the universe, yet each accepted the same underlying principle. The cosmos was not arbitrary. It possessed an order that could be discovered, even if that order sometimes overturned everything previously believed. So the journey that began beneath the stars of Babylon has not ended. It remains the destiny that every cosmological theory, including those of our own time, must ultimately try to answer.

Learning to ask better questions

As to observation and science, by the second century AD those who watched the planets carefully had noticed that they occasionally slowed, appeared to stop, and even retraced part of their path before resuming their normal progress. These curious movements could be explained, but only by making the Aristotelian model steadily more elaborate. By the second century AD, the astronomer Claudius Ptolemy had developed an ingenious mathematical system of circles upon circles that reproduced the observed motions with impressive accuracy. It was not a simple picture, but it worked well enough that few saw any reason to abandon it.

It was not until the Renaissance that a re-examination was made. Europe was rediscovering many of the scientific writings of classical antiquity, while navigation, exploration and commerce were demanding ever more accurate astronomy. Into this atmosphere stepped a quiet Polish scholar, Nicolaus Copernicus, who proposed in 1543 that perhaps the complexity lay not in the heavens themselves but in the assumptions from which astronomers had begun. If the Earth travelled around the Sun, many of the awkward complications simply disappeared. The strange loops traced by the planets became natural consequences of viewing them from a moving Earth rather than from a stationary one. It was a beautiful idea, but beauty alone was not enough. Copernicus could offer no observation to prove that the Earth moved.

The decisive change came from an entirely unexpected direction. In 1609, news reached Italy of a Dutch device that could make distant objects appear much closer. Galileo Galilei quickly constructed improved versions for himself and, with a curiosity that now seems obvious but was anything but at the time, pointed one towards the night sky. It was a simple act, yet few moments in the history of science have had such profound consequences.

The familiar heavens immediately became unfamiliar. The Moon was revealed not as a perfect celestial sphere but as a rugged landscape of mountains, valleys and craters. The hazy band of the Milky Way dissolved into an immense multitude of stars too faint to be distinguished individually with the naked eye. Four tiny companions were seen circling Jupiter, demonstrating that not everything in the universe revolved around the Earth. Most persuasive of all were the changing phases of Venus, which agreed naturally with the Copernican arrangement but could not readily be reconciled with the traditional Ptolemaic system.

Over the following decades, Johannes Kepler carried the revolution a stage further by showing that the planets travelled not in perfect circles but in ellipses. Their motions, painstakingly derived from Tycho Brahe’s observations, could be described with extraordinary precision, although the underlying reason remained obscure. That explanation finally arrived in 1687, when Isaac Newton demonstrated that the same force which causes an apple to fall also governs the motions of the Moon and the planets. For the first time, the heavens and the Earth were united within a single mathematical framework.

The achievement was breathtaking in its simplicity and power. The universe no longer appeared as two separate realms, one celestial and perfect, the other earthly and imperfect. Instead, it became a single coherent system governed everywhere by the same physical laws. It was difficult not to feel that humanity had reached a profound understanding of nature, and for the next two centuries that confidence continued to grow. The universe came to be regarded as a vast and exquisitely ordered mechanism whose workings could, at least in principle, be understood completely.

A Universe that could change

By the beginning of the twentieth century, it was difficult to imagine that Newton's description of the universe could ever be seriously challenged. For more than two hundred years it had explained the motions of the planets, the trajectories of comets, the tides, the behaviour of falling bodies and countless other natural phenomena with extraordinary accuracy. Every successful prediction reinforced the conviction that nature had at last yielded its deepest laws.

Yet success often conceals unanswered questions. As instruments became more precise and measurements more demanding, small inconsistencies began to appear. Most were eventually explained, but one stubborn puzzle refused to disappear. Light seemed to behave in a manner that sat uneasily within the familiar framework of space and time inherited from Newton. However carefully it was measured, its speed appeared always to be the same, regardless of the motion of either its source or its observer. The result seemed almost impossible to reconcile with ordinary intuition.

Into this uncertainty stepped a young patent examiner working in Bern. Albert Einstein was neither an established professor nor the head of a great observatory. Much of his work was carried out in his spare time, driven less by experimental discovery than by an unusual ability to recognise hidden inconsistencies within accepted ideas. In 1905 he proposed that the difficulty lay not with light itself, but with humanity's understanding of space and time.

The conclusion was startling. Space could no longer be regarded as an unchanging stage on which events simply occurred, nor could time be thought of as flowing identically for every observer throughout the universe. Instead, space and time formed a single interconnected structure in which measurements of distance and duration depended on the relative motion of those making them. Time itself, once regarded as universal and absolute, became part of the physical world rather than something existing independently of it.

At first these conclusions appeared deeply counter-intuitive. Everyday experience offers little reason to suppose that clocks might tick at different rates or that lengths might depend on motion. Yet experiment after experiment confirmed Einstein's predictions. The behaviour of rapidly moving particles, the operation of modern satellite navigation systems and countless laboratory measurements have all demonstrated that space and time behave precisely as his theory requires.

Remarkable though these ideas were, an even more profound insight soon followed. Newton had described gravity as an invisible force acting across empty space, drawing one body towards another according to their masses and separation. Einstein began to wonder whether this, too, might reflect a deeper misunderstanding. After years of intense effort, he arrived at a radically different picture.

Matter, he proposed, does not simply occupy space and time. It changes their very geometry. Massive bodies distort the structure of spacetime itself, and what had previously been interpreted as the force of gravity is more naturally understood as the motion of planets, stars and light following the curved geometry created by those distortions. The familiar image of a force pulling objects together gave way to a universe whose geometry determined how everything moved.

Published in 1915, the General Theory of Relativity transformed the understanding of gravity. It accounted for subtle features of Mercury's orbit that had resisted Newtonian explanation, predicted that light itself would be bent as it passed massive bodies, and implied that time would run more slowly in stronger gravitational fields. Each of these extraordinary predictions was eventually confirmed by observation, reinforcing confidence that Einstein had uncovered something fundamental about the nature of reality.

Perhaps the greatest consequence of General Relativity, however, was one that Einstein himself viewed with considerable hesitation. His equations did not naturally describe a static universe. Instead, they suggested that space itself could expand, contract or evolve over time. The universe, long imagined as an unchanging cosmic stage, had become dynamic.

That conclusion was unexpected and unsettling. For thousands of years the heavens had seemed permanent and immutable. Even after Copernicus and Newton had displaced the Earth from the centre of the cosmos, the universe itself was still generally assumed to exist in an eternal and unchanging state. Einstein's equations hinted at something altogether different. They suggested that the universe possessed a history.

At first, Einstein resisted that implication. His original field equations naturally admitted an evolving universe, but this conflicted with the prevailing belief that the cosmos was eternal and unchanging. He therefore introduced what is now called the cosmological constant, a deliberate modification of the equations intended to permit a static universe. It was not proposed because observation required it, but because the prevailing belief in an eternal and unchanging universe appeared to demand it. It was an understandable reaction. Almost everyone believed that the universe ought to be eternal and unchanging. Yet nature was preparing another surprise. Within little more than a decade, observations made with the world's largest telescopes would reveal that the universe was not standing still after all. It was expanding.

Before the equations could be applied to the cosmos as a whole, a geometric description first had to be chosen. This was recognised from the outset. During the early 1920s, the Russian mathematician Alexander Friedmann found a family of expanding solutions to Einstein's equations by assuming that, on sufficiently large scales, the universe is homogeneous and isotropic. A few years later, working independently, the Belgian priest and physicist Georges Lemaître arrived at closely related conclusions, combining the mathematics with the emerging astronomical evidence for expansion. Neither man claimed to have demonstrated that the universe possessed these symmetries exactly. Rather, they regarded them as reasonable idealisations that captured the large-scale simplicity that both theory and the limited observations then available appeared to suggest while rendering the equations mathematically tractable.

During the following decade, between 1922 and 1937, the work was gradually placed into its most general form. Howard Robertson and Arthur Walker showed that these symmetry assumptions lead to a unique class of spacetime geometries. Together with the earlier work of Friedmann and Lemaître, this became known as the Friedmann-Lemaître-Robertson-Walker, or FLRW, geometry. The underlying assumption, that the universe is homogeneous and isotropic on sufficiently large scales, became known as the Cosmological Principle.

The FLRW framework was adopted not merely because it simplified the mathematics, but because the large-scale distribution of galaxies and, later, observations of the cosmic microwave background appeared broadly consistent with those symmetries. Whether those symmetries are exact properties of the universe or idealisations that remain approximately valid on sufficiently large scales is a question that continues to be examined observationally.

The consequences of that discovery would reshape cosmology once again, opening questions that continue to occupy astronomers to this day. During the 1920s, Edwin Hubble began using the newly completed 100-inch telescope on Mount Wilson in California to study the faint spiral nebulae scattered across the sky. For many years astronomers had debated whether these objects belonged to the Milky Way or lay far beyond it. By identifying variable stars within several of these nebulae which exhibited almost identical behaviour, Hubble was able to determine their distances with unprecedented confidence. The conclusion was unmistakable: these nebulae were not nearby clouds within the Milky Way, but galaxies in their own right. Each contained an enormous number of stars, separated from one another by distances that stretched the imagination.

The universe immediately became incomparably larger than anyone had previously suspected. The Milky Way was no longer the universe itself, but only one member of a vast and growing population of galaxies extending in every direction.

As Hubble's observations accumulated, another pattern gradually emerged. The light arriving from these distant galaxies was shown to be displaced towards the red end of the spectrum, an idea entirely consistent with the expanding solutions already identified by Friedmann and Lemaître. Even more remarkable was the discovery that the greater the distance to a galaxy, the larger this redshift appeared to be. The simplest interpretation was that the galaxies were receding from one another. Yet this did not imply that they were flying through an otherwise static cosmos like fragments from an explosion. Rather, it suggested something much more remarkable. Space itself appeared to be expanding, carrying the galaxies apart as it did so.

Einstein's static model of the universe could no longer be maintained. Whatever reservations he may once have held, the observations were now pointing towards a cosmos that possessed a history. The universe had evolved from an earlier state and would continue to evolve into the future. General Relativity had always permitted such behaviour; Hubble had now provided compelling evidence that it was how the Universe actually behaved.

The triumph of modern cosmology

The importance of this development can scarcely be overstated. Einstein's equations supplied the laws governing gravity, while the FLRW geometry supplied the large-scale spacetime to which those laws were applied. The choice was neither arbitrary nor dogmatic. It reflected the best evidence available and a natural preference for the simplest geometry consistent with that evidence. It also proved extraordinarily successful. Within this framework the expansion of the universe, the formation of the light elements, and later the relic radiation from the hot early universe could all be understood within a single coherent picture.

As observations improved throughout the twentieth century, confidence in this approach steadily increased. The discovery of the cosmic microwave background radiation by Arno Penzias and Robert Wilson in 1965 provided powerful evidence that the universe had once existed in a far hotter and denser state. This faint glow of microwave radiation, arriving almost uniformly from every direction in the sky, is widely interpreted as the cooled remnant of the intense heat that filled the infant universe. Its existence beautifully confirmed ideas that had been developed some years earlier by George Gamow, Ralph Alpher and Robert Herman.

Increasingly powerful telescopes enabled astronomers to map the universe on an unprecedented scale. Millions of galaxies were catalogued, their distances estimated, and their distribution across the sky carefully measured. At the same time, advances in computing allowed theorists to compare these observations with increasingly sophisticated models of how the universe might have evolved over billions of years. Observation and theory appeared to reinforce one another, and confidence steadily grew that the broad history of the universe was becoming understood.

Yet success often brings its own surprises. The more closely astronomers observed the universe, the more difficult it became to reconcile certain measurements with the simplest expectations. Galaxies appeared to rotate too rapidly for the visible matter they contained: they should be tearing themselves apart. The largest structures in the universe seemed to require extraordinarily delicate initial conditions. Most unexpectedly of all, observations of distant supernovae suggested that the expansion of the universe was not slowing under gravity, as had long been anticipated, but was somehow accelerating.

None of these discoveries overturned the remarkable achievements of the previous century. They did, however, present cosmologists with a series of new questions whose answers were far from obvious. The framework that had proved so successful now faced a succession of challenges that its founders could scarcely have anticipated, and the search for explanations would shape cosmology for decades to come.

Bigger telescopes, bigger questions

The Second World War transformed far more than politics. Technologies developed for conflict, particularly radar, electronics, rocketry and precision engineering, soon found peaceful applications that previous generations could scarcely have imagined. Telescopes became larger and more accurate, photographic plates gave way to electronic detectors, and entirely new regions of the electromagnetic spectrum were opened to observation. Radio astronomy, X-ray astronomy and infrared astronomy revealed a universe that had never before been in contemplation.

The Cold War accelerated these developments still further. What began as a strategic rivalry between the Soviet Union and the United States soon became a competition for technological prestige. In 1957 the launch of Sputnik demonstrated that satellites could be placed into orbit. Four years later Yuri Gagarin became the first human to travel into space, an achievement that captured the world’s imagination and intensified the race still further. The United States responded with the Apollo programme, culminating in the first human footsteps on the Moon in 1969. These spectacular achievements not only carried enormous political symbolism, they also transformed public attitudes towards space itself. Exploration beyond the Earth had become a practical reality rather than the preserve of science fiction.

Governments that had once regarded astronomy as an academic curiosity now viewed space as a matter of national importance. Vast resources flowed into rocket technology, satellites, communications, navigation and scientific instrumentation. Observatories were established on remote mountain tops, far from atmospheric turbulence and city lights, while increasingly sophisticated detectors allowed astronomers to observe objects so faint that earlier generations could never have come closer to imagining their existence. Eventually, telescopes themselves escaped the atmosphere altogether. Orbiting observatories such as the Hubble Space Telescope, and later many others in space and on the ground, operating across the electromagnetic spectrum, delivered images of unprecedented clarity and opened entirely new windows on the universe.

Those instruments have also become astonishingly diverse. Giant optical telescopes have been joined by radio arrays stretching across continents; satellites measuring the faint microwave radiation that fills the sky; detectors buried beneath mountains in search of elusive particles; gravitational-wave observatories capable of sensing distortions in the Earth's crust 10 thousand times smaller than the diameter of an atomic nucleus over a distance of 4 kilometres; and spacecraft visiting planets, asteroids and comets throughout the Solar System. Each new instrument revealing another aspect of a universe that had previously been hidden.

With this unprecedented wealth of observational data, cosmology entered a new phase. Ideas that had once rested largely on elegant mathematics could now be tested against measurements of extraordinary precision. Questions that had occupied philosophers for centuries became matters for engineers, statisticians and computer scientists as well as astronomers. Never before had so much intellectual effort, technological ingenuity and financial investment been directed towards understanding the universe. Yet an unexpected pattern had begun to emerge. The better the observations, the more often they were hinting that something important was still missing.

Success and surprise

By the closing decades of the twentieth century, cosmology had become one of the great scientific achievements of the modern age. General Relativity had transformed the understanding of gravity, the expansion of the universe had been established, and the discovery of the cosmic microwave background radiation by Arno Penzias and Robert Wilson in 1965 provided compelling evidence that the universe had once existed in a far hotter and denser state, confirming ideas developed earlier by George Gamow, Ralph Alpher and Robert Herman. With increasingly sophisticated telescopes on the ground and in space, the broad outline of cosmic history appeared to be falling into place. Yet the clearer the picture became, the more unexpected questions began to emerge.

The first concerned gravity itself. In 1933 Fritz Zwicky found that galaxies within the Coma Cluster were moving too rapidly to be held together by visible matter alone, leading him to propose the existence of unseen "dark matter". His suggestion attracted little attention until the 1970s, when Vera Rubin and Kent Ford showed that stars in the outer regions of spiral galaxies continued to orbit at unexpectedly high speeds. Similar discrepancies soon appeared elsewhere, and the simplest explanation was that galaxies were embedded within vast halos of invisible matter. Although no such particles have yet been detected directly, dark matter became one of the central ingredients of modern cosmology.

A second puzzle concerned the remarkable uniformity of the observable universe. Regions separated by billions of light years possessed almost identical properties despite appearing never to have been in causal contact with one another. The overall geometry of the universe also exhibited an extraordinary degree of spatial uniformity, a circumstance that appeared difficult to explain as a matter of chance alone. In 1980 Alan Guth proposed an ingenious solution. During an unimaginably brief interval, lasting between one millionth of one billionth of one billionth of one billionth of a second and one ten-thousandth of that interval, space itself was proposed to have expanded by at least one hundred million trillion trillion times, carrying regions that had once been intimately connected to enormous separations. In a tiny fraction of a second, a region far smaller than an atom would have grown to macroscopic dimensions so rapidly that regions of space were carried apart at an effective rate many millions of times faster than light itself could travel. Inflation, later developed by Andrei Linde, Andreas Albrecht and Paul Steinhardt, appeared capable of explaining both the remarkable large-scale uniformity of the universe and the tiny primordial irregularities from which galaxies, stars and ultimately ourselves would eventually emerge.

Before these questions had been resolved, another surprise arrived. During the late 1990s Saul Perlmutter, Brian Schmidt and Adam Riess found that the expansion of the universe appeared not to be slowing under gravity but accelerating. The simplest explanation revived Einstein's cosmological constant in the form of dark energy, a component whose physical nature remains unknown.

By the beginning of the twenty-first century these ideas had been combined within what became known as the ΛCDM model. Ordinary matter accounted for only a small fraction of the universe, while dark matter, dark energy and inflation provided the accepted framework for interpreting observations. It proved extraordinarily successful and remains the foundation of modern cosmology. Yet its very success encouraged increasingly precise tests, and those tests gradually revealed a growing collection of tensions and anomalies. None was individually decisive, but together they served as a reminder of a lesson that has accompanied science from its beginning: every generation believes it has almost completed the picture, only to discover that there is another question waiting to be asked.

When maths runs ahead of observation

Mathematical insight had often anticipated observation. In 1864, James Clerk Maxwell's equations predicted the existence of electromagnetic waves many years before Heinrich Hertz first detected radio waves experimentally in 1887. Albert Einstein's General Theory of Relativity, published in 1915, foretold the bending of light, black holes and gravitational waves many years before technology could confirm them. There was every reason to hope that mathematics might once again reveal a deeper understanding of nature.

The result was an extraordinary flowering of ideas. From the late 1960s onwards, Roger Penrose, Stephen Hawking and George Ellis explored the profound implications of Einstein's theory for the origin, structure and ultimate fate of the universe. During the 1980s, Alan Guth, joined by Andrei Linde, Paul Steinhardt and many others, developed increasingly sophisticated accounts of the universe's earliest moments through the theory of inflation. From the mid-1980s, Edward Witten and his colleagues investigated whether gravity might ultimately be understood within a broader mathematical description of the fundamental forces, while, from the late 1980s onwards, Abhay Ashtekar pursued new ways of bringing together gravity and quantum theory. At the same time, Julian Barbour began re-examining the nature of time itself, asking whether some of the assumptions that had long underpinned physics might themselves require reconsideration.

It has been a remarkable period. Never before had so many brilliant minds devoted such ingenuity to understanding the universe, and never before had mathematics reached so deeply into questions that observation was only just beginning to illuminate. Cosmology became a meeting place for astronomers, physicists and mathematicians, each bringing different perspectives to the same enduring questions.

The richness of these ideas, however, has presented a challenge of its own. Many describe phenomena that lie beyond the reach of contemporary observation. Some propose new particles, others new fields, others new dimensions or new properties of space and time itself. Their mathematical structure can be explored with great precision, but decisive observational evidence remains elusive if not entirely beyond expectation. As theory advances, it becomes increasingly difficult to know which of the many elegant possibilities, if any, nature follows.

This is not a failure of science. It was the inevitable consequence of exploring questions at the limits of present knowledge. When observation cannot yet provide a decisive answer, theory naturally advances ahead of experiment, mapping possibilities that future discoveries may eventually confirm or reject. It is precisely in this way that science has often prepared itself for its next great advance.

A different kind of question

Yet another possibility also remains. Throughout the history of science, progress has not always come from adding new layers of explanation. Sometimes it has begun by questioning an assumption so familiar that it had almost ceased to be noticed. The Earth had once appeared self-evidently stationary. Space and time had once appeared entirely separate. In each case, the decisive step had not been the invention of a more elaborate theory, but the recognition that one of the starting assumptions itself deserved to be re-examined.

The purpose of the pages that follow is neither to defend an established doctrine nor to advocate a speculative alternative. It is to examine whether a single geometric constraint that may previously have been overlooked can account for a wide range of astronomical observations while remaining fully exposed to empirical test. The proposal makes no claim to immunity from falsification. On the contrary, its value depends entirely on its willingness to be confronted by observation and, if necessary, to be proved wrong.

The Time-Symmetric Parity Constraint

Rather than modifying Einstein's field equations, introducing new particles, postulating additional forces or enlarging the dimensions of spacetime, TSPC asks whether the admissible geometries of spacetime may themselves be subject to a simple algebraic constraint that has previously been overlooked. The idea is deliberately economical. Rather than enlarging the inventory of the universe, it asks whether the set of admissible geometries has been too generous. *Nothing is added to the physical contents of the universe.* Instead, attention is directed towards the possibility that one of the assumptions governing spacetime itself may have been incomplete. Modern cosmology typically assumes a large-scale geometry and then asks what sort of universe that geometry produces. TSPC reverses the question, asking whether a prior geometric constraint may determine which geometries are admissible in the first place. If supported by data from the multiplicity of observatories now operating or under construction, the theory may challenge the ΛCDM model at its foundations.

An architectural analogy may help. A well-designed building is not created by adding more and more structural elements until it finally stands up. It begins with a clear set of constraints that eliminate countless unsuitable possibilities before the first line is drawn. The finished building often appears simpler, not because less thought has been given to it, but because the correct constraints were recognised before the design began. TSPC explores whether the universe might exhibit a similar economy. Instead of explaining every unexpected observation by introducing another unseen ingredient, it asks whether a single overlooked geometric constraint might already account for phenomena that have previously been treated as independent problems. Whether that possibility survives comparison with observation is for evidence alone to decide. Like every scientific proposal, TSPC must remain fully exposed to falsification. That has been the story of science from the Greeks to the present day.

It’s time to turn to the maths.

Back to the Home Page