

Review Article

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The Creation & Potential of Metamaterial Wormholes for Two Points in Space and for The New Space Age

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ABSTRACT

Scholars and Researchers, such as Greenleaf have discovered and successfully described a range of new configurations of electromagnetic parameters, magnetic permeability and electric permittivity. This is intended to give rise to and allow the construction from metamaterials, to function as non-detectable tunnels in space-time, described as Wormholes. These discovered and harnessed processes have given rise to electromagnetic wave propagation between two points in space-time. The rise of the New Space Age, requires a new range of exploration requirements and capabilities within the solar system, galaxy and universe. The development of these potential Metamaterial Wormholes and the applications of current and advanced technologies, such as Quantum Drives, will provide extensive potential for exploration and eventual colonisation of space within the era of the New Space Age.

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Nomenclature

Nil to note. Rocket calculations – Online Calculator Used.

Acronyms/Abbreviations

Nil

Introduction

The rise of the New Space Age has created a whole range of exploration requirements and their associated capabilities within the solar system, galaxies and the universe. Thus, these demands flow onto the scientific community and thus, engineering outcomes. Scholars, Researchers and teams such as Greenleaf have worked to discover and describe a range of new configurations for experiments which focus on these required topics [1].

The scientific teams at CAPSA Group are unique and market leading. This results in successful R&D work, product submissions and development to meet the needs of the New Space Age. Our goals are with the development and submission of this paper and presentation, are to show how the development of sciences and technology that will meet and exceed the needs of the New Space Age.

Building on the research and work of Scholars, such as Greenleaf, we have discovered and have the opportunity to describe a range of new configurations for many aspects of the required science. These include electromagnetic parameters, magnetic permeability and electric. These required needs for science, have given rise to the construction from various metamaterials, whose outcomes will function as non-detectable tunnels in space-time, which are often described as Wormholes.

The discovery and harnessing of these metamaterials, have shown thus, that Wormholes are worthy of further investment and have a chance of great success of navigating electromagnetic wave propagation between two points in space-time. Hence, moving two objects in a potential 'Space Time Warp' Drive

Our goals with the development and submission of this paper, and its associated presentation, are to show how the utilization of the discovered science and theory, with enough investment, can generate potential 'Space Time Warp' Drives and can ensure further human exploration and colonization of Space to meet the demands of the evolving New Space Age. Hence, if humans want to continue to explore, like our ancestors, we need to develop this scientific breakthrough further to reach the stars.

Distance and Exploration Demands of The New Space Age

New Market Demands and Products. The evolution of the Space Age, to a 'New Space Age,' has created a whole suite of new market demands. These demands centre around enhanced distance and exploration requirements of spacecraft, people and future space exploration. Hence, this new industry requires more powerful, sustainable systems and people, that can reach further distances safely.

The very creation of these needs, will require further scientific research, necessary processes and outcomes, such as the development of metamaterial wormholes, space time drives and quantum drives. These outcomes and processes, will use a more sustainable power option, resource acquisition/processing system and sustainable supply chains. These sustainable outcomes and processes, will directly benefit the New Space Age. This is due to the fact that these will use fuels not fully reliant on fossil fuels and will directly benefit the environment, sustainable industries and associated economies. The development of metamaterial

wormholes, space time drives and quantum drives, can address these market needs. This is achieved by providing those associated with the New Space Age, with an enhanced space travel propulsion. Current technologies and scientific achievements allow for travel between near planets in the solar system, to be many months. In direct contrast, metamaterial wormholes, space time drives and quantum drives, will be able to travel that distance in a much lower time and even maybe instantly.

This specific potential can be seen in the capacity of metamaterial wormholes, space time drives and quantum drives to provide faster and more efficient access to the Solar System and beyond. This capacity is measured in these technologies' potential to provide unlimited performance gains for power density, thrust-to-weight ratios, specific impulses and thrust-to-power ratios.

Metamaterial wormholes, space time drives and quantum drives, will use advanced propulsion concepts and space-time alterations. These will then aim to reach enhanced distances and sustain greater travel across these distances over a longer period of time. Hence, the capacity of these technologies, will contribute towards more

efficient space travel and allow users of the New Space Age to explore Space with improvements in mission success rates and allow enhanced crewed missions.

The ability of these technologies to make changes within the New Space Age, are also shown in their ability to provide the required changes a spacecraft must achieve. This is required for transport between many planetary orbits and is hence the required calculation benchmark. The capacity of these technologies to provide the calculations that can be applied into further technology options over time. Ultimately, metamaterial wormholes, space time drives and quantum drives, are thus presenting the truest path for enhanced and large scale explorations of Space.

Advances and Current State of Metamaterial Wormholes, Space Time Warp Drives & Quantum Drive Possibilities

The Current State of Metamaterial Wormholes, Space Time Warp Drives & Quantum Drive Possibilities.

Whilst we have discussed the potential of metamaterial wormholes, space time drives and quantum drives for the New Space Age, we must now examine the technologies themselves. Upon this examination, we must look at the outcomes of these advancements over time.

A whole range of collaboratives within the space industry and hence, the New Space Age, are working within the next decade to develop possible outcomes for the suggested technologies. This includes operational engines, applications of defined scientific breakthroughs, new or possible fuel systems and other associated innovative solutions. Successful progress in this field, will lead to successful and further advancements in Space exploration within the New Space Age.

'Foundation for real warp drive technology Faster-than-light communication for space missions. Quantum computing speed improvements. Potential for time dilation experiments. The bubble is microscopic (1mm across) and lasts only nanoseconds, but it proves the concept works. Scaling up requires energy levels comparable to small stars for now [2].

Advances in the State of Metamaterial Wormholes, Space Time Warp Drives & Quantum Drive Possibilities. The Scientific community has conducted rigorous debate over the considerable advancements, researched and tested the outcomes, surrounding

the discovering and advancement of the state of Metamaterial Wormholes, Space Time Warp Drives & Quantum Drive Possibilities [1,2]

The advances in the state of Metamaterial Wormholes must be discussed, once we have specifically defined the notion. Wormholes are a familiar concept within cosmology. However, the definition that will be used here, is the one defined by Greenleaf. Thus, the Metamaterial Wormhole is an object obtained by stretching and gluing together certain pieces of Euclidian Space.

Metamaterial wormholes are specifically generated by scientists using the models that these scholars proposed, by using metamaterials to create Electromagnetic wave propagation. Thus, we can show that there has been excellent advancements in the state and potential creation of Metamaterial Wormholes in the last few decades globally.

In addition to these breakthroughs, scholars and researchers at the University of Rochester, have made further advances in their use of Quantum Computing methodologies, to finalise their research and work with the creation of Space Time Warp [2].

Materials & Methods - Researcher Breakthroughs in Metamaterial Wormholes, Space Time Warp Drives & Quantum Drive Possibilities. Metamaterial Wormholes.

Greenleaf and his colleagues, begin their work using a range of materials and methods. These have generated a range of breakthroughs in Metamaterial Wormhole theory and construction. The first area of discussion, is the theory behind generating a Wormhole Manifold. Greenleaf start by making two holes in Euclidian space $R^3 = \{(x,y,z) \mid x,y,z \in \mathbb{R}\}$, also by removing the open ball $B_1 = B(O,1)$ with the centre at the origin of O and of the radius 1, and also the open ball $B_2 = B(P,1)$, where $P = (0, 0, L)$ is the point on the z -axis and having the distance $L > 3$ to the origin.

Further, Greenleaf and his colleagues also sought to obtain the first component of the wormhole. They denoted that by M_1 , the region thus obtained, $M_1 = R^3 \setminus (B_1 \cup B_2)$, is the first component needed to construct a wormhole. Please note, that the M_1 is a 3-dimensional manifold with a specific boundary. This boundary within the M_1 is $\partial M_1 = \partial B_1 \cup \partial B_2$. The specific disjoint union of the two, two-spheres, i.e. ∂M_1 , is considered to be $S^2 \times \{0\} \cup S^2 \times \{1\}$. The S^2 is used to denote various copies of the generated two-dimensional unit sphere. See Appendix 1.

The next component of Greenleaf research, surrounds, the creation of a 3-dimensional cylinder, using the theory $M_2 = S^2 \times [0, 1]$. The cylinder is able to be constructed by taking a closed unit cube $(0,1)$ in R^3 and for each value of; $0 < s < 1$, gluing together, or, identifying, numerous points on the boundary of the cube with $z = s$. Please note, that scientists would not attach or glue points at the top and bottom of the boundary, at both $z = 1$ and at $z = 0$. Action can then be taken to glue together the boundary $\partial B(O, 1)$ of the specific ball $B(O, 1)$, with the lower end $S^2 \times \{0\}$ of the M_2 and any specific boundary $\partial B(P, 1)$, with the upper end $S^2 \times \{1\}$. In doing this, scientists can then glue the point $(0, 0, 1) \in \partial B(O, 1)$ with the specific point $NP \times \{0\}$ and the point $(0, 0, L-1) \in \partial B(P, 1)$ with the point $NP \times \{1\}$, where NP is the north pole on S^2 (Greenleaf et al, 2007).

Greenleaf and his colleagues, then show that the resulting domain M , does not now lie with R^3 , but has taken the shape of Euclidian space with a 3-dimensional handle attached. Additionally and mathematically, M is a 3-dimensional manifold (without a boundary) that is the specific connected sum of the components M_1 and M_2 .

Please refer to Appendix 1 for further observations on how this handle makes travel from one point in M1 to another point in M1. This is also shown in the M2 calculation. Now this has been realized, we now need to consider Maxwell's equations on M and we will now start with these equations on R3 at the frequency $k \in \mathbb{R}$, given by;

$$\nabla \times E = ikB, \nabla \times H = -ikD, D = \varepsilon E, B = \mu H.$$

In this work, we can see that E and H are the electric and magnetic fields. D and B are the electric displacement field and the magnetic flux density, ε and μ are subsequent matrices corresponding to permittivity and permeability. Since the wormhole is topo-logically different from the Euclidian Space itself at R3, researchers need to consider using Maxwell's equations which correspond to a general Riemannian metric, $g = g_{jk}$, as apposed to the Euclidian metric of $g_0 = \delta_{ij}$. For the researchers' further purposes, as in [5,14] they have used ε, μ which are conformal, or, they are proportional as to scalar fields, the specific metric g . In the specific case here, researchers have engaged Maxwell's equations and these can be written using a specific coordinate invariant form, as;

$$dE = ikB, dH = -ikD, D = \varrho E, B = \mu H,$$

within M, where E, H are 1 forms, D, B are 2 forms, d is the exterior derivative, and ϱ and μ are functions which are scalar functions times the Hodge operator of (M, g). This then maps 1-forms to the 2-forms [15-16] which are corresponding Greenleaf

More specifically, within local coordinates, these specific equations are written by researchers within the same form as Maxwell's equations within Euclidian space, with the matrix valued ε and μ . For further simplicity, researchers can then choose a metric on the wormhole manifold, M which is Euclidian on M1 and on M2, which is the product of a provided metric g_0 on S2 and the metric δ_2 dx2 on [0, 1] to consider $\delta > 0$ is a 'length' of the wormhole itself.

When researchers consider $\delta \ll 1$, the end of the wormhole should resemble a specific fisheye lens, or mirror ball image. The mirror itself being from the other end of the wormhole. Once researchers utilise the concept $\delta \ll 1$, a number of images and further distortions can occur. Within Figure #2 of the Appendix, researchers have shown specific examples of how the ends of wormholes would appear. The next area of this work, is where researchers will show how to construct, by specifying the appropriate ϱ, μ , a device within R3 that functions as a wormhole.

Space Time Warp Drives & Quantum Drive Possibilities

The primary purposes of both Space Time Warp and Quantum Drives, is to enable successful travel from one celestial body to another, within space. This capability, can be accomplished through simple modes of both Space Time Warp and Quantum Drives, or 'Quantum Travel.' If these types of drives use this mode of transport, they will be able to achieve the highest efficiency and speed, to reach great distances within shorter timeframes. Hence, these technologies and their applications, will provide humanity with an enhanced capability to explore space. This will greatly improve our capacity to explore and successfully colonise space [3].

Space Time Warp and Quantum Drive, generate a bubble in space time, surrounding the spacecraft which deploys it. This bubble in space time, successfully contracts the space preceding it and expands it which follows behind. This specific process involves the very manipulation of the energy density surrounding the spacecraft. A significant advantage of these technologies, is the

outcome which surrounds the reduction in the effects of extended travel, for the Astronauts within the spacecraft. If these drives are engaged correctly, the frame of reference for the users stays the same. This is due to the contraction and expansion of space around the user. Hence, the Astronaut will not feel the effects of acceleration and thus, they are very likely to not suffer the ill effects of extended space travel.

The specific processes of Quantum Travel for these drives is also worthy of note. The Astronaut using these drives, and then initiating Quantum Travel, must maintain the defined course for a defined period of time. This will enable the creation of the defined Quantum Bubble, which will then stabilise. Then, defined new systems will provide navigation support for the spacecraft's destination. The Astronaut will need to secure the bubble's integrity, or failure will make the spacecraft towards real-space speeds, until recovery and recalibration can occur.

Since we now know that these drives are possible and useful for the New Space Age, we must now consider the smaller work being done within dark elements of Space Time. Physicist John Nichol and colleagues, have conducted a range of experiments and work, which shows direct evidence of a specific quantum state, called a 'nuclear-spin dark state.' This discovery will be able to lead to the generation of more advanced and efficient quantum technologies. These goals are achievable due to the subsequent reduction of instability in quantum systems. This is achieved by the focus of researchers, on the quantum state of, nuclear-spin dark state.

Since these scientists have subsequently confirmed the existence of dark state, their properties and operations, there is serious potential for its application and development of more advanced quantum systems. The researchers focused on using quantum dots or tiny semiconductor particles that work to snare single electrons and use their 'spin', to store information and to thus, create a nuclear-spin dark state. This evolution is considered to be a special quantum state, where the nucleus of the atoms become, hidden from relevant observers. Within this nuclear-spin dark state, tiny magnetic properties, known as spins, of the atomic nuclei line up and synchronize in specific methods. These methods stop the atomic nuclei from disturbing the related electron's spin and assist in keeping the electron spin stable.

Further, scholars were able to develop and use a technique called, 'dynamic nuclear polarization' to align relevant nuclear spins. These then created conditions for nuclear-spin dark state to form. This created effects which were found to show that the dark state significantly reduced interactions between spinning electrons and normal nuclei. This reduction has allowed quantum and other associated devices, to store information at greater length and perform calculations with enhanced levels of accuracy. These nuclear-spin dark states are often very stable and can be used in quantum systems and other technologies to store long term components of information. These outcomes could be used to calculate highly accurate measurements, through their detection of tiny changes within magnetic fields, pressure and temperature. This outcome is useful in regards to the work of Space Time Warp Drives & Quantum Drives within Space.

This usefulness surrounds specifically the capacity of detection of changes and state within magnetic fields, pressure and temperature. This will be useful for Space Time Drives and Quantum Drives, as they are used by Astronauts within spacecraft. This capacity will form the basis for future calculations for the Drives and for the capacity of humans to generate Metamaterial Wormholes in Space Time.

Revised and Proposed Theory and Calculations

New Theory for Metamaterial Wormholes and Space Time Warp Drives. Necessary Calculations and Extensions.

Now that the pervious elements of this work have covered the capacity of Space Time and Quantum Drives to provide the necessary platform for creation and maintenance of Metamaterial Wormholes, revision and creation of proposed theories and calculations must be completed. These calculations will provide future Astronauts and colleagues to ensure that they can perform necessary calculations and achieve defined goals.

This new theory that will be proposed here, will be described as the '*Theory of Space-Time Adjustment*.' This paper will provide a simple introduction for the theory behind this concept and its' potential deployment. This theory and its' future applications, can provide an excellent foundation for Astronauts and scientists that are seeking to create Metamaterial Wormholes and manipulate space time.

To assist the development of this theory, researchers have developed a range of foundational concepts within Quantum matter. A first provision, could be a concept called 'quantanium', which is the possible fuel source, used to generate required elements of negative energy density around space ships. It has been discovered that a large amount of energy is required to convert Quantum Matter into a required negative energy field. This energy field is very likely to generate a significant amount of heat. This can be factored into design and development of various drives and spaceships throughout this work and within the future. These engines and craft will be able to ensure that they can generate various processes to enact cooling and to counteract the subsequent heat generation. Further, for the use of Quantum

Technologies to generate Metamaterial Wormholes, we must also consider the harnessing of dark states and matter. This harnessing can be achieved by the utilization of dark states and matter, to manipulate qualities within space time, and to generate and control the required Metamaterial Wormholes. Hence, the theory that we are proposing, will provide future Astronauts and scientists with a chance to develop Metamaterial Wormholes for future space exploration.

Theory of Space Time Adjustment & Calculations for Space Time Quantum Drives. The following introduction to theory and calculations, form the foundational aspect of the Theory of Space Time Adjustment. The central aspects of these proposed theory and calculations, rely heavily on the excellent work of Alcubierre, Greenleaf, and through Bernoulli's Equation, Central to this Kumari Banita [4-6].

The goals of generating the required theories, will first rely on the excellent work by the prementioned scholars and researchers. The first theory that is being used here, is the Metric of Spacetime;

$$\begin{aligned} ds^2 &= -d\tau^2 = g_{\alpha\beta} dx^\alpha dx^\beta \\ &= -(a^2 - \beta_i \beta^i) dt^2 + 2 \beta_i dx^i dt \\ &\quad + \gamma_{ij} dx^i dx^j \end{aligned}$$

This theory will provide us with the foundations of understanding spacetime and will contribute to the final development of our theory [4,6]

The theory that follows, that will lay necessary foundations, is a revision and use of Bernoulli's work with flow. Bernoulli's work can assist us with the work used to analyse the applications for flow within the specific Space Time and Quantum Drives. The adjusted theory that will be used here is; v^2

foundational work, is the precursive work of Albert Einstein, with his Theory of Relativity [7]. Given this excellent foundation, we can now develop the $P + r \times (P + r \times 2 = Pt V^2) 1 = (P + r \times 2V^2) 22$

concept behind the Theory of Space Time Adjustment & conduct the calculations for the Space Time Quantum Drive. The next theory that lays a foundation for our overall submission, is the theories surrounding space time alterations and Quantum Drives themselves. The first of these is our use of Alcubierre work with a proposed warp drive, whilst consulting Einstein's theory of relativity. Alcubierre was able to alter the previously noted theory of space time. His suggestion was;

$$ds^2 = -dt^2 + (dx - v f(rs) dt)^2 + dy^2 + dz^2$$

Hence, we know that the warp drive concept, is able to make alterations within space time. Thus, these types of drives can indeed alter space time and hence, generate Metamaterial Wormholes as needed. Refer to Appendix #3 for a visual representation.

Now that we have consulted previous theories and shown that the alteration of spacetime is possible, we must now examine Quantum capabilities in terms of the Casimir Effect. This effect is theorised to be the physical forces which are created by a quantized field. The typical example of this effect, is where two uncharged metallic plates exist within a vacuum and are placed a few micrometres apart and without any external electromagnetic field. This lack of an external field, also means that there is no specific field between the plates and thus nil force would be measured between them. See Appendix #4. When we study this field using quantum electrodynamics, we often find that the plates do not affect the virtual photons. These will constitute the field and create a net force, either by attraction or repulsion. This depends on the specific arrangement of the two plates [8].

Advancing from this outcome, we have seen scholars suggest that the Casimir effect can be used to produce locally mass-negative regions of space time and thus, this negative effect could be used to stabilize a wormhole to allow faster than light travel.

The final stages of these arguments, surrounds the ability to draw elements of either magnetism or other components, from dark states and matter, to make alterations and to create a Casimir effect within Quantum states. This allows relevant engines or spacecraft to successfully move through space time efficiently. Scholars such as Varsha have generated a potential wormhole solution to this option, using Einstein field equations and within the frameworks of general relativity. These scholars specifically generated a solution, which describes wormholes, which are supported by dark matter density and influenced by the Casimir effect. The very combination of these effects, creates the theoretical possibility of generating traversable wormholes

For us to investigate the Casimir wormhole possibility, we have accessed Varsha suggestion. The wormhole density formula is; $2332800\pi^4/3\rho^2r^6$

Given the previously noted foundational arguments and suggested

theories, we can now generate proposed theories for successful calculation, which support our final conclusions. The three central test components are 1. Spacecraft, 2. Space Time Warp Drives, 3. Quantum Drives. First, we will assign the previous formula to the assigned standard test components. Then, we will assign these component concepts to a Tsiolkovsky rocket equation. This provides us with successful analysis and discovery tools. Maximum change of velocity of the vehicle is;

$$\Delta v = v_e 1n \frac{m_0}{m_f} = I_{sp} g_0 1n \frac{m_0}{m_f},$$

Where;
 v_e = is the effective exhaust velocity.
 I_{sp} = specific impulse in dimension of time.
 g_0 = standard gravity.
 $1n$ = natural logarithm function.
 m_0 = initial total mass.
 m_f = total mass without propellant.

(Tsiolkovsky via Wikipedia, 2025).

Calculations

Space Craft, Space Time Warp Drives and Quantum Drives are the standard benchmarks for these calculations. Tsiolkovsky rocket equations will be calculated with provided or assumed values. Then, these benchmarks will be processed through the provided formulae in future works. Unfortunately, calculation capacities at this time of this work being published, is not an option. Hence, Tsiolkovsky's rocket equation, is the initial calculation for this work.

Thus,
1. SpaceCraft.

$$\Delta v = v_e 1n \frac{m_0}{m_f} = I_{sp} g_0 1n \frac{m_0}{m_f},$$

v_e = is the effective exhaust velocity.
 I_{sp} = specific impulse in dimension of time.
 g_0 = standard gravity.
 $1n$ = natural logarithm function.
 m_0 = initial total mass.
 m_f = total mass without propellant.

Space Craft Solution:
{(800 45)} 10000/7000 =8p 90 45 10000/7000. P=1.11216...

Space Time Warp Drives;
(700 35) 6000/5000 =4p 35 6000/5000, P = 1.32201...

Quantum Drives;
(800 35) 6000/5000 =3p 35 6000/5000, P = 1.133801...

Table 1: Results of Necessary Calculations

	1– SpaceCraft	2 – Space Time Warp Drives	3 – Quantum Drives
Δv	P=1.11216...	P = 1.32201...	P = 1.133801...

Δv Calculator Used.

Results & Discussion

Calculation Results

Due to time and resource constraints, this work was only able to complete the simple Tsiolkovsky's rocket equation. However, this has provided an excellent benchmark for future research. Further, our future work will be able to use the defined formula, from a range of achieved scholars in our field, to successfully use our benchmark calculations and hence, generate the full calculation set to ensure successful proof of evidence. Hence, we can still prove that the theories proposed here are correct.

In relation to the calculations conducted here, we have chosen a tested benchmark for propulsion via Tsiolkovsky's rocket equation. This was applied to a range of products within our intended marketplace. The first of these is the standard concept of a Space Craft. This was chosen as the control concept. The second of these are the Space Time Warp Drives. Thirdly, Quantum Drives are the final option for our applications of the chosen theory. Future research should extend onto these three products. This will provide continuity into further work and.

Since we can see from these calculations, that indeed these craft and drives are likely to produce positive results for the space industry, further expansion of these results can be examined for future use. These usages can alter what type of craft is used, their fuel line system and even adjust calculations with other process options. The additional and later formula proposed here are by no means the final option for this type of research. This is largely due to the changing demands of the New Space Age. This New Space Age, will require will demand more advanced systems, which can reach further into space. These technologies will be able to achieve these goals and the successful completion of future research, will show how they can meet the needs of this New Space Age.

Discussion

The role of Metamaterial Wormholes and Space Time Warp Drives within the New Space Age.
The role of Metamaterial Wormholes and Space Time Warp Drives is fundamental to a New Space Age that requires sustainable, powerful and proficient propulsion. The New Space Age is currently undergoing a need for further and more sustainable space travel. Scholars, researchers, authors and groups aforementioned within this paper, have shown that these drive technologies are viable, possible and capable in providing the required meet of need for the sustainable New Space Age.

These drive technologies, thus, given the appropriate funding and support from government and industry, will be able to meet this advancing need and assist humans to travel further into the stars. Scholars and researchers could work with industry and government to generate appropriate milestones for this development and work to ensure complete success in their development and deployment. This shows that the New Space Age will have advanced from Gravitational and standard engine propulsion, to the development and deployment of these new drives. Since we know that things like the Alcubierre drive are possible and likely to be developed within the next 20 years, hence we can show that this technology is viable, has a good future and meets the evolving needs of the New Space Age.

'If we can clean up our world, I bet we can achieve Warp Drive.'
William Shatner
'The past is written, but the future is left for us to write'
Jean-Luc Picard
[9].

Numerous space industry groups and scholars are now seeking to generate solutions within warp drives. Groups which successfully design, develop and deploy the world's first warp drives, will have access to products which can send them further and faster than humans have travelled ever before. More specifically, a roadmap with significant useful milestones, funded and supported by both the private and public sector, will fastrack development over the next 20 years. We have access to the research, fuel systems and possibilities to make this technology work. This planning will make the technology viable and deployable within defined timeframes

Combination of Metamaterial Wormholes and Advanced Quantum Drives. The very combination of Metamaterial Wormholes and Advanced Quantum Drives provides a great opportunity for the future researcher to develop a concept and technology, that will meet the needs of the New Space Age. If, for example, a technology is created, using Quantum Drives, which can successfully use elements of Dark State and Dark Matter, to generate and work within Metamaterial Wormholes, then this will provide humanity with enormous capabilities for travel an exploration of space. Astronauts and others using this combined technology will be able to successfully explore space with great advantage and do so, with sustainable and efficient technologies [9].

The New Space Age demands a whole new range of power and distance demands. This is related to elements of sustainability, which is worthy of further examination. The aforementioned drives and technological capabilities have a high sustainability capability and thus, meet the current and evolving needs of the marketplace. Industry groups now need to ensure their resources, those of national economies' and various supply chains, need to be geared to develop this world-changing technology and sustainable resource. The development and dedication of various labs, staffing, supply chains and other capabilities are paramount.

Global, national and local societies will hence benefit from the development of this technology and this has been shown to be completed with sustainable methodologies. Further, regulation frameworks will need to be developed by various industry bodies and government groups. These frameworks will likely need to be built to ensure successful development, resourcing and safe completion of this technology.

Conclusions

A range of conclusions can be made from the arguments and evidence provided within this paper. These conclusions arise from the central emerging market needs of the New Space Age. The central concept, The Theory of Space Time Adjustment, ensures the development of an overarching theoretical framework. This framework has allowed us to develop concepts for the development of the Metamaterial Wormhole, Space Time Warp and Quantum Drives. This development is entirely possible, necessary and capable to meet the needs of The New Space Age.

The new era within the vast history of human exploration, demands more powerful and sustainable exploration methods. The technology and scientific methodology that has been described here, can meet all of these needs. Any development of these processes, will provide enormous benefits towards both micro and macro economies and throughout many levels of human society. This benefit includes environmental and industrial standards. Government groups, universities and institutions, must invest enough time, resources and funding. This will provide successful

sustainable solutions for humanity for the New Space Age and into the future

Throughout this work, it has been shown that the development of this science and associated technologies, will provide sustainable and successful outcomes for the exploration needs of the New Space Age. Given the correct industry support, funding and development processes, the science of Metamaterial Wormholes and Space Time & Quantum Drives, will carry humans on their journey of exploration further into the Galaxy and beyond [10].

Acknowledgements

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Appendix

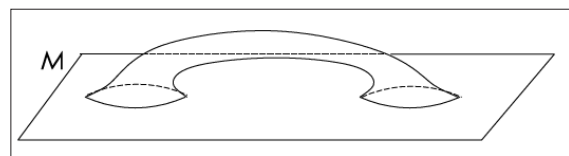


Figure 1: Schematic Image. Wormhole Manifold is attached from two components, the 'handle' and space with two holes. Components are 3d dimensional within the specific construction.

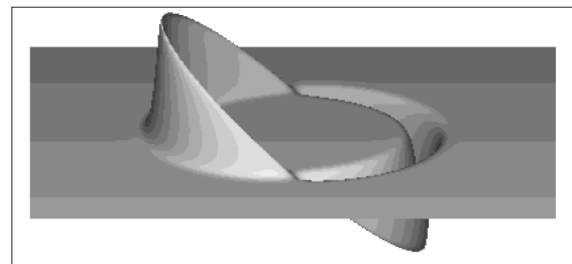


Figure 2: These images show the Ray tracing simulations of how the end of wormholes appear, when the other ends are higher than an infinite chess board, under a blue sky. The left figure, $\delta \ll 1$. The right figure, δ_1 . Please note that blue is used for clarity and the wormhole construction is monochromatic.

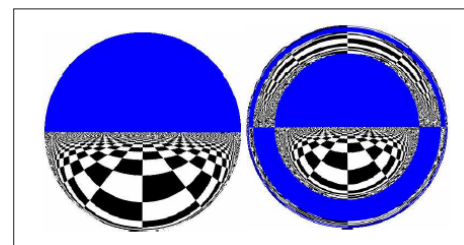


Figure 3: Alterations of Spacetime

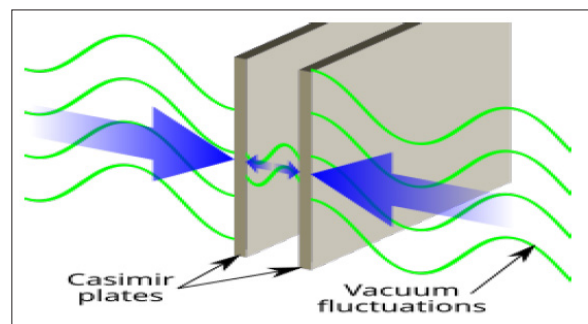


Figure 4: Casimir Effect

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