

Wormhole-Stargates: Tunneling Through The Cosmic Neighborhood

Eric W. Davis, Ph.D., FBIS

**Aerospace Physics & Astrophysics Div.
National Institute for Discovery Science**

1515 E. Tropicana Ave., Ste. 400

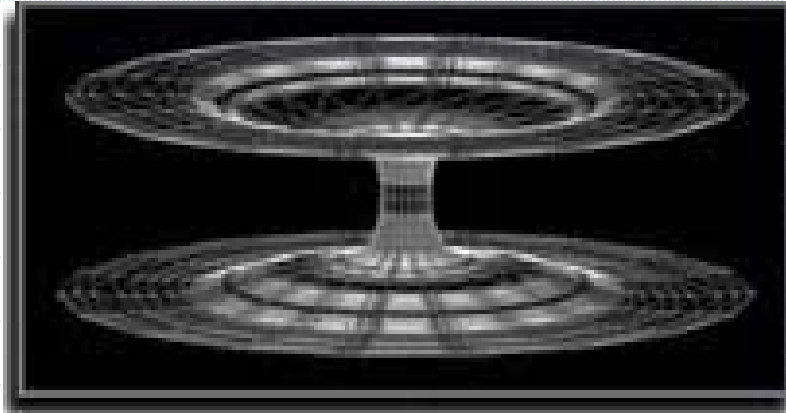
Las Vegas, NV 89119

ericdavis@nidsci.org

Wormhole History I

- ◆ Einstein's General Theory of Relativity (GTR, 1915): united special relativity with gravity plus other classical physics in a framework of spacetime geometry – physics is in the fabric of spacetime
- ◆ Einstein-Rosen Bridge (1935): in GTR a non-traversable wormhole formed from either collapsed stellar matter (black hole) or spherically symmetric vacuum regions – possesses a singularity and event horizon that are impenetrable
- ◆ John Wheeler (ca. 1957, 1962): Coined “wormhole” as representing the quantum mechanical fluctuation of spacetime geometry inducing multiple spacetime connections at 10^{-35} meter scale – not useable for space travel

Einstein-Rosen Bridge (is non-traversable, but it can be made traversable)

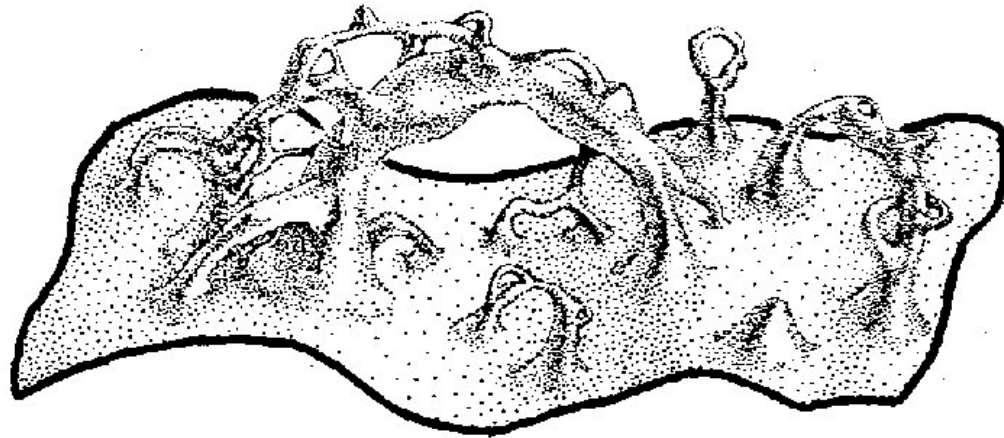


Wheeler's Spacetime Foam

1957: Wheeler

"Space 'resonates' between one foam-like structure and another."

"Spacetime foam"



1960's: "quantum higgledy-piggledy".

Wormhole History II

- ◆ Alan C. Holt (NASA-Johnson Space Center, ca. 1979-81): working with John Schuessler and others (VISIT, Inc.) on reverse engineering of UFO close encounter sightings/abduction data, he hypothesized that UFOs and hypothetical NASA spacecraft could utilize “field resonance spacetime tunneling” to cross interstellar space – Holt described the physical characteristics of a traversable wormhole for all intents and purposes
- ◆ Carl Sagan & Kip Thorne (1985-1988): Sagan’s novel “CONTACT” prompted a physics problem for Thorne & students to solve in developing a realistic “ETI” faster-than-light transport system – they ended up discovering a never-before seen exact solution to the Einstein GTR equation describing a large-scale traversable wormhole

A. C. Holt's Concept: Coherent Field Pattern Resonance Spacetime Tunneling

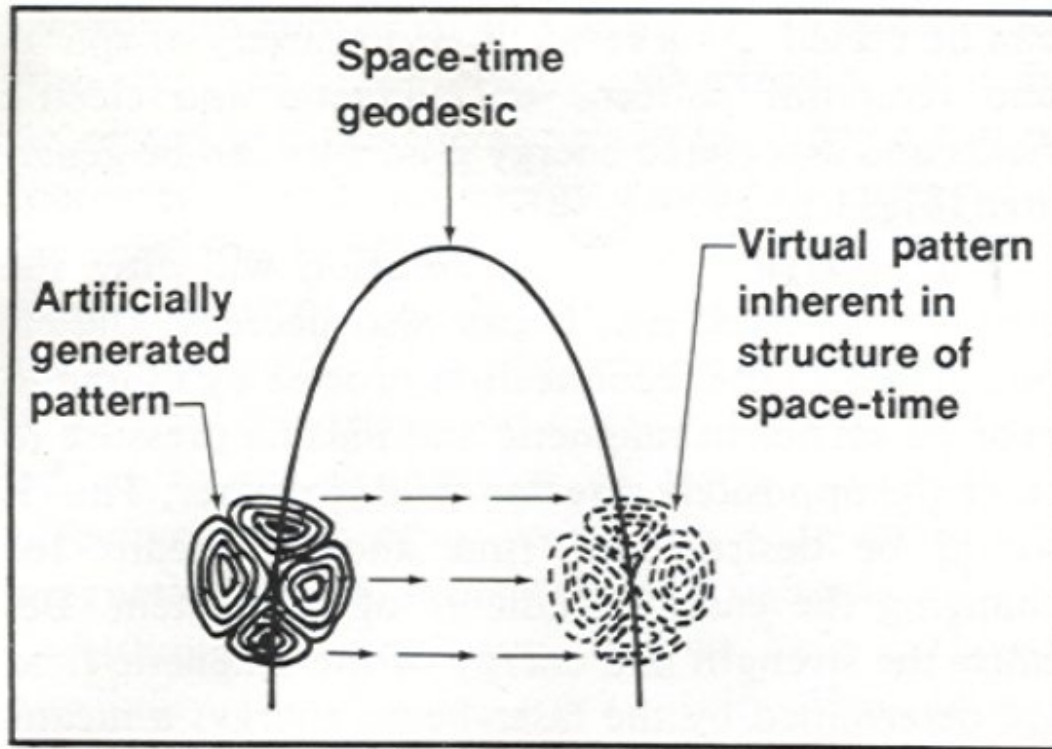


Fig. 5 Coherent field pattern resonance. By generating an extremely precise pattern of high energy magnetic and electric fields with specific spatial and temporal coherence, a resonance with a virtual pattern at a distant space-time point could be established leading to a space-time jump.

A. C. Holt's Concept (cont.)

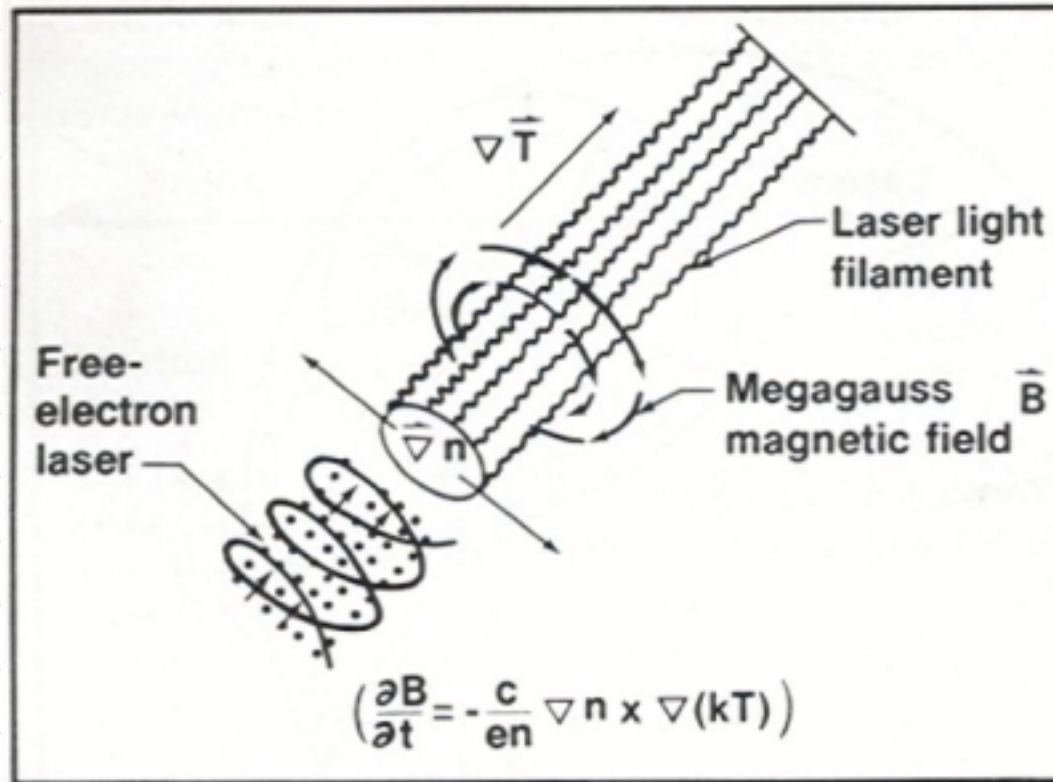


Fig. 7 Laser generation of a megagauss magnetic field. The perpendicular density and temperature gradients responsible for the field are caused by the interaction of a high powered laser with a stationary target or with a medium of suspended particulates and/or ionizable gas.

A. C. Holt's Concept (cont.)

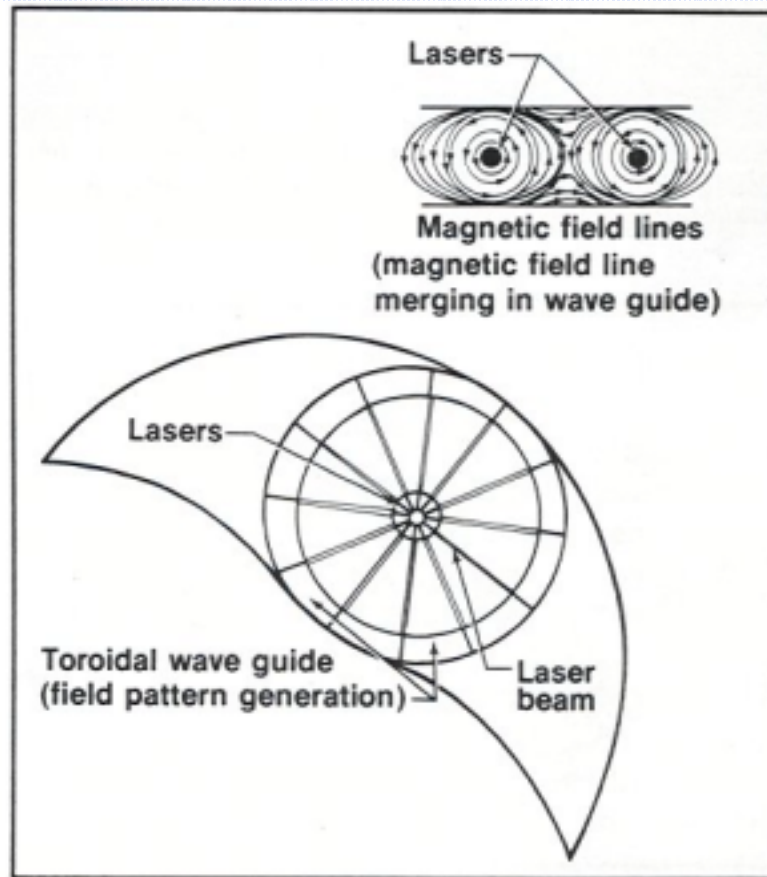


Fig. 9 Laser and field geometry. A spoke-like configuration of lasers shown here in a winged-disk spacecraft can be used to generate coherent patterns of magnetic fields via the magnetic field line reconnection process.

A. C. Holt's Concept (cont.)

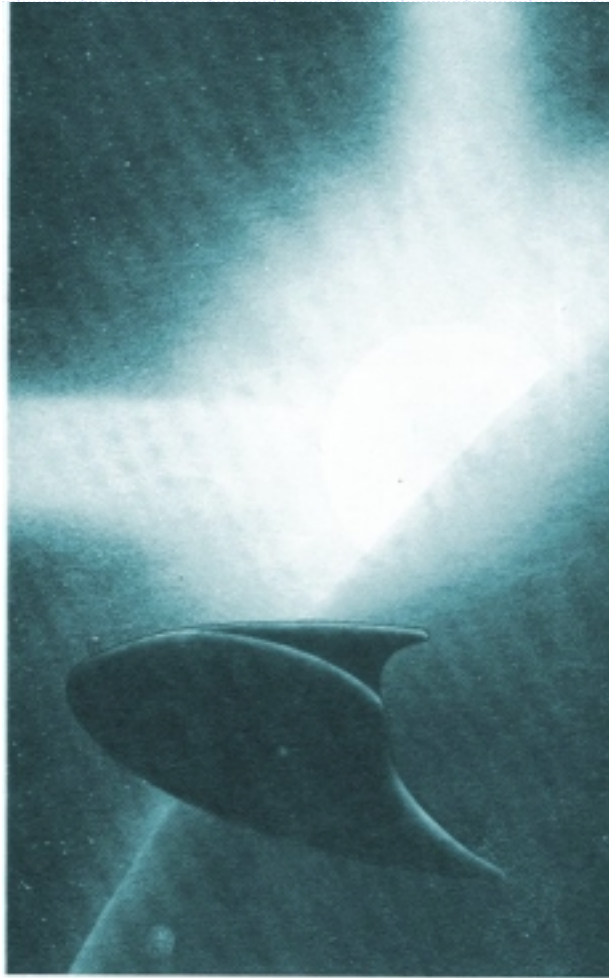


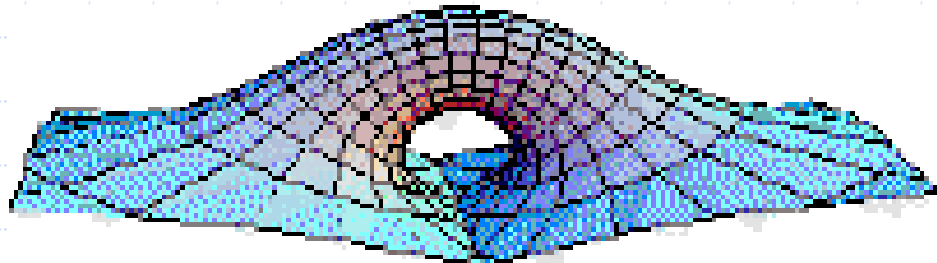
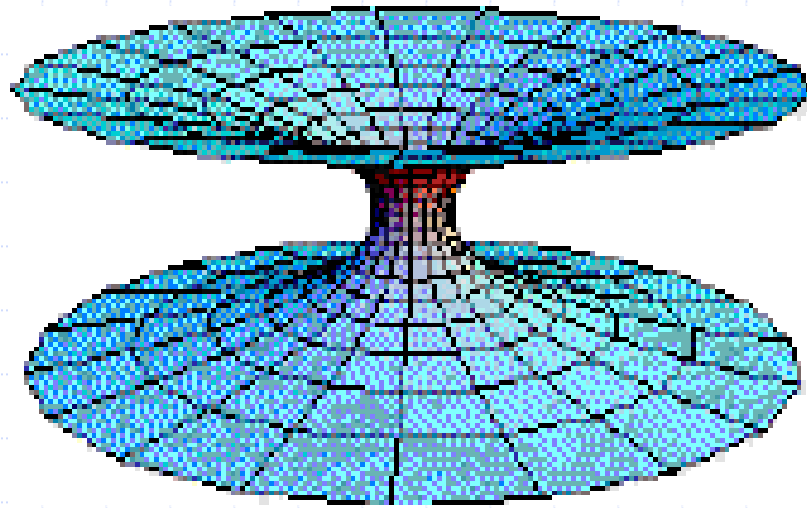
Fig. 4 Field Resonance Spacecraft. The winged-disk spacecraft is shown orbiting a planet around some distant star following a space-time resonance jump (painting by Mark Dowman, Houston, Texas).

What is a Traversable Wormhole?

Pt. I

- ◆ They are hyperspace (3-dimensional) tunnels through spacetime (4-dimensional) which can:
 - connect together remote regions within our universe
 - connect together different universes
 - connect together different space dimensions (for higher dimensional wormholes)
 - connect together different chronological periods within the same space region (backwards time travel!)

Traversable Wormholes



What is a Traversable Wormhole?

Pt. II

◆ Traversable Wormholes possess:

- normal or backwards time flow
- normal or nonexistent gravitational stresses on space travelers
- entry/exit openings (or throats) that can be made to be spherically shaped, cubic shaped, polyhedral shaped, generic shaped, etc.
- flat entry/exit openings are possible – a true STARGATE or flat doorway through spacetime & dimensions!

What is a Traversable Wormhole?

Pt. III

◆ Traversable Wormholes DO NOT possess:

- a singularity of infinitely collapsed matter/energy with crushing gravitational stresses – this blocks everything from getting through the tunnel
- an event horizon – a region of high gravitational field strength around black hole separating the inside space surrounding the singularity from the outside universe

Why Traversable Wormholes for travel thru space, time & dimensions?

- ◆ Standard space propulsion engineering is based on Newton's law of mechanics:
 - dependent upon expenditure of propellant kinetic energy to induce thrust generating momentum transfer
- ◆ Sub-relativistic/relativistic Newtonian propulsion modes suffer from:
 - light speed limit
 - enormous mass ratios $> 10^5 - 10^{100}$ for cruise velocities $> 0.05c$ ($c = \text{speed of light} \cong 3.0 \times 10^8$ meters/sec)

Def: mass ratio = (payload+structure+propellant at launch) divided by (payload+structure at engine "burnout")

 - relativistic speeds lead to exponentially increasing mass ratios
 - large mass ratios = rockets consisting mostly of propellant to propel tiny payloads → an ugly engineering problem
 - crews will experience intolerable interstellar travel times
 - multigenerational human lifetimes for sub-relativistic flight
 - relativistic flight leads to time dilation effect

Wormholes as Time Machines

- ◆ It is very easy to build a real time machine given a traversable wormhole – one can go backwards in time

- ◆ Classical General Relativity Theory (GTR) is seriously infested with time machines

GTR both allows for and demands time travel in order to preserve self-consistency of dynamic spacetime solutions

- Forget Hawking's arguments against backward time travel paradoxes, they were disproved by Visser, Novikov & Thorne, et al. – there are no time paradoxes, just poor understanding of how time works – we need to revise our model for time

Engineering Wormhole-Stargates pt. I

◆ Start with the Einstein GTR Equation:

$G_{\mu\nu}$ = spacetime geometry term

$T_{\mu\nu}$ = matter-energy term

c = speed of light

G = universal const. of gravitation

$$G_{\mu\nu} = \frac{8\pi G}{c^4} T_{\mu\nu}$$

Engineering Wormhole-Stargates

pt. II

- ◆ Spacetime Characteristics & Mass-Energy Prescription:
 - Travel time thru wormhole tunnel/throat ≤ 1 year as seen by both space travelers & outside static observers
 - Proper time as measured by travelers should not be dilated by relativistic effects
 - Gravitational/tidal-gravity accelerations between different parts of traveler's body should be $\leq 1g_{\oplus}$ (g_{\oplus} =Earth gravity) when going thru wormhole
 - Travel speed thru tunnel/throat should be $< c$
 - Travelers (made of ordinary matter) must not couple strongly to material that generates wormhole curvature
 - No event horizon at wormhole tunnel/throat
 - No singularity of collapsed matter-energy residing at wormhole tunnel/throat

Engineering Wormhole-Stargates: Negative Energy pt. I I a

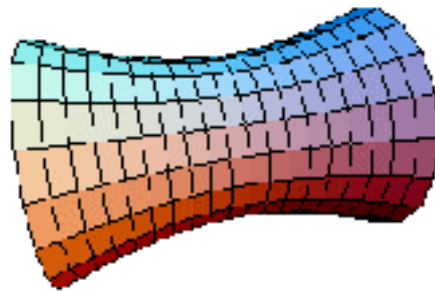
- ◆ Energy density of material required to create & thread a traversable wormhole must be “negative”
 - Negative in the sense that material must have $mass-energy \leq stress-energy$ → this is called “exotic matter” & violates the Hawking-Ellis energy condition hypotheses
→ “negative” is just a misnomer
 - ordinary matter has $mass-energy > stress-energy$ and obeys the Hawking-Ellis energy condition hypotheses
- ◆ Mathematical theorems guarantee that exotic matter-energy is present at a wormhole throat
- ◆ All the energy condition hypotheses have been experimentally tested in the laboratory & experimentally shown to be false – 25 years before their formulation
 - further investigation showed that violations of the energy conditions are widespread for ALL forms of classical & quantum matter-energy

Engineering Wormhole-Stargates: Negative Energy pt. IIb

- ◆ Examples of energy condition violating “exotic” (or “negative”) matter-energy:
 - static radial electric or magnetic fields are borderline exotic if their tension were infinitesimally larger than a given energy density
 - squeezed states of the electromagnetic field & other squeezed quantum fields
 - squeezed vacuum electromagnetic zero-point energy (more about this later)
 - Casimir (vacuum electromagnetic zero-point) energy
 - other quantum fields/states/effects

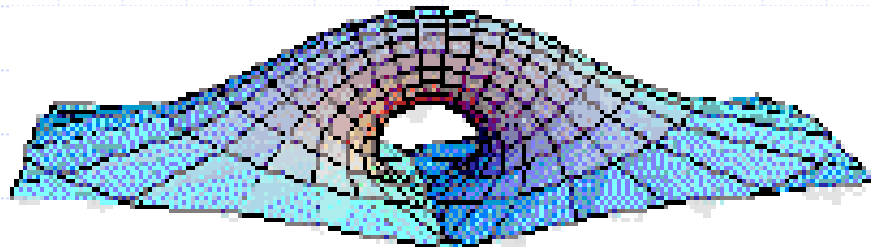
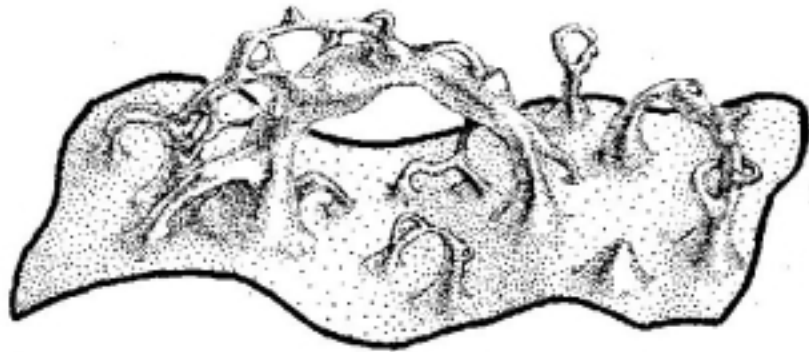
Engineering Wormhole-Stargates pt. III

- ◆ Embedding wormhole geometry in surrounding spacetime geometry
 - we are free to place our wormhole anywhere in spacetime we want because only the geometry near the throat matters for physics
 - no symmetry or asymptotically flat spacetime assumptions needed



Engineering Wormhole-Stargates pt. IVa

→ How many throats do we want, how much negative energy do we need?



Engineering Wormhole-Stargates pt. IVb

◆ What kind of wormholes can one make with less effort?

$$U \leq \frac{\chi_e}{4} \text{ surface energy}$$

Gauss-Bonnet Theorem relating local (WH) geometry (LHS) to the global topological (Eulerno.) invariant of the spacetime (RHS).

$$\chi_e = 2(1 - g) \text{ Euler number}$$

g is genus (number of handles / throat)

$$G = c = 1$$

1-handle H (flat torus or spherical topology)

$$g = 1 \rightarrow \chi_e = 0, U \leq 0$$

$$2\text{-handle}, g = 2 \rightarrow \chi_e = -2, U \leq -\frac{1}{2}$$

$$3\text{-handle}, g = 3 \rightarrow \chi_e = -4, U \leq -1$$

* Inequalities mean we exclude degenerate wormholes

Engineering Wormhole-Stargates pt. V: How much negative mass-energy?

Table 1. Negative Mass Required to Create Wormhole of Given Size

Wormhole throat radius, r_{throat} (meters)	Required mass, M_{wh}
1000	-709.9 M_J
100	-71 M_J
10	-7.1 M_J
1	-0.71 M_J
0.1	-22.6 M_E
.01	-2.3 M_E

$M_J = 1.90 \times 10^{27}$ kg, mass of planet Jupiter

$M_E = 5.976 \times 10^{24}$ kg, mass of planet Earth

Engineering Wormhole-Stargates pt. VI: How much negative (outward) tension?

Table 2. Wormhole Throat Size Induced by Applied Outward Tension

Wormhole throat radius, r_{throat}	Tension, τ (x 5.0 N/m ²)
10^{18} (105.7 ly)	10^6
10^{16} (1.06 ly)	10^{10}
10^{15} (0.11 ly)	10^{12}
10^{13} (66.7 AU)	10^{16}
10^{11} (0.67 AU)	10^{20}
10^9 (1.44 Solar Radii)	10^{24}
10^6 (0.16 Earth Radii)	10^{30}
10^3 meters	10^{36}
1 meter	10^{42}

ly = light-year = 9.460×10^{15} meters

AU = Astronomical Unit = 1.496×10^{11} meters

1-Solar Radius = 6.960×10^8 meters

1-Earth Radius = 6.380×10^6 meters

Engineering Wormhole-Stargates pt. VIIa: The Stargate Solution

- ◆ A traveler encountering a flat face wormhole will feel no tidal forces and see NO matter, exotic or otherwise - the traveler will simply be shunted into the other remote spacetime region or universe (used Einstein junction condition formalism, assumed ultrastatic wormhole with exotic matter confined to a thin layer, discarded spherical symmetry)

$$\sigma = \frac{-c^4}{4\pi G} \left(\frac{1}{\rho_1} + \frac{1}{\rho_2} \right) \quad \text{surface energy density}$$

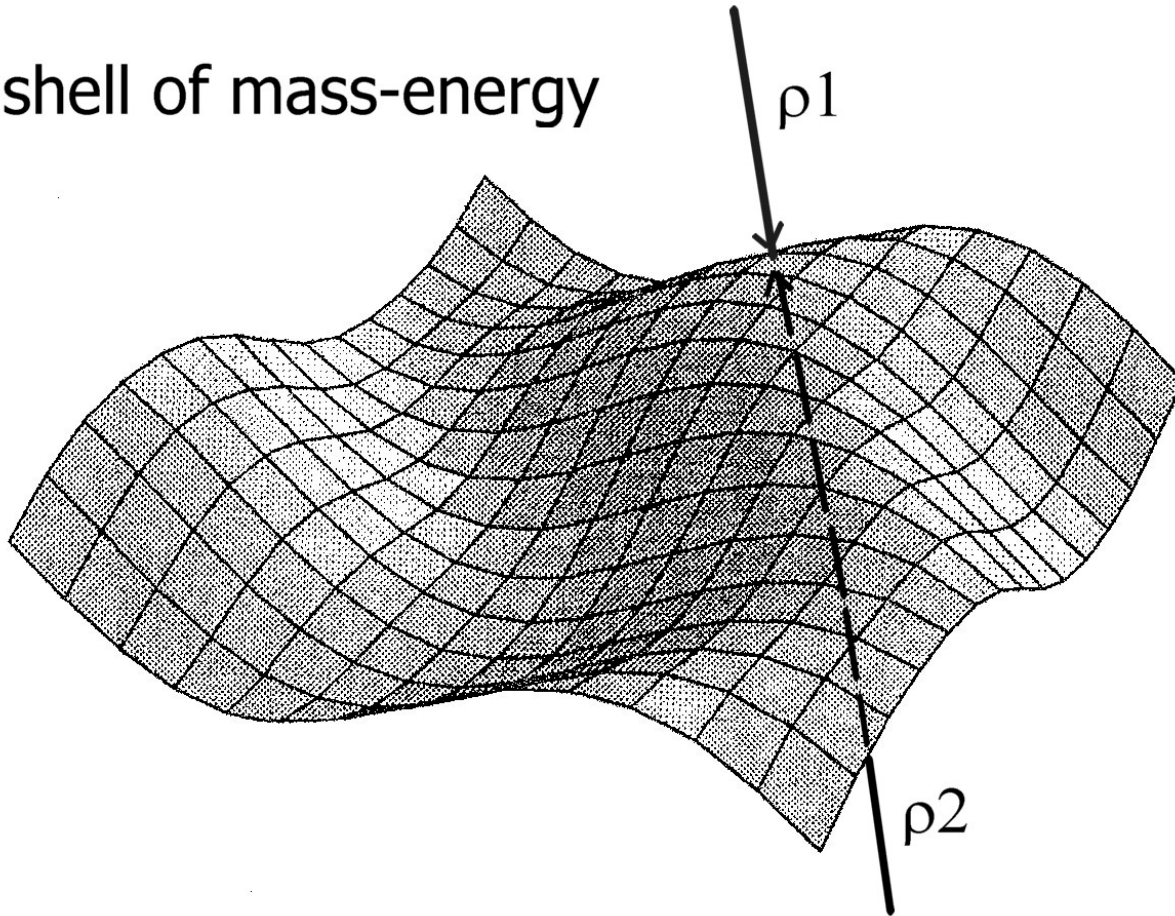
$$\theta_{1,2} = \frac{-c^4}{4\pi G} \frac{1}{\rho_{2,1}} \quad \text{surface tensions}$$

Let wormhole have flat face / throat $\rightarrow \rho_1, \rho_2 = \infty$

$$\sigma = 0, \theta_{1,2} = 0$$

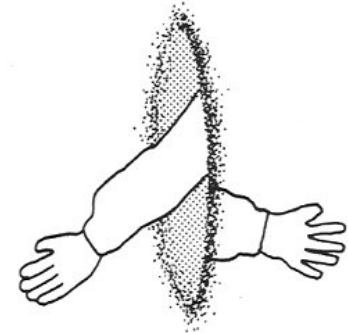
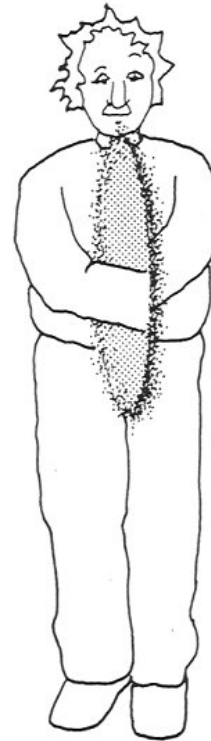
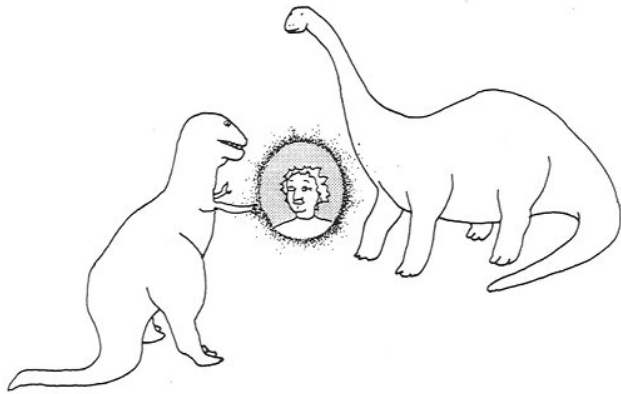
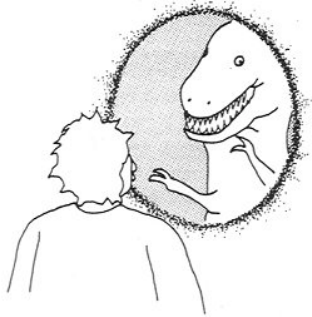
Engineering Wormhole-Stargates pt. VIIb: The Stargate Solution

thin shell of mass-energy



What A Flat Wormhole-Stargate Looks Like

(M. Kaku, Hyperspace, Oxford U. Press, 1994)



Engineering Wormhole-Stargates pt. VIIa: Generating Negative Energy

- ◆ Morris, Thorne & Yurtsever, 1988: Construct (spherically symmetric) wormhole using Casimir Effect – construct two closely spaced (10^{-9} to 10^{-10} meters), concentric thin electrically charged hollow spheres the size of Earth's orbit ($\sim 10^8$ km) to create negative Casimir energy
→ an engineering nightmare!
- ◆ E. W. Davis, 1997: Generate wormhole-inducing ultrahigh-intensity magnetic field (borderline exotic) by nuclear magnetic-compression explosion
→ prevented by nuclear test ban treaty
- ◆ E. W. Davis, 1999: Utilize naturally occurring negative vacuum energy densities, which arise from distortion of the EM zero point fluctuations due to interaction with a gravitational field
→ gravitationally squeezed EM zero point energy creates negative energy → viola!

Engineering Wormhole-Stargates pt. VII Ib: Generating Negative Energy

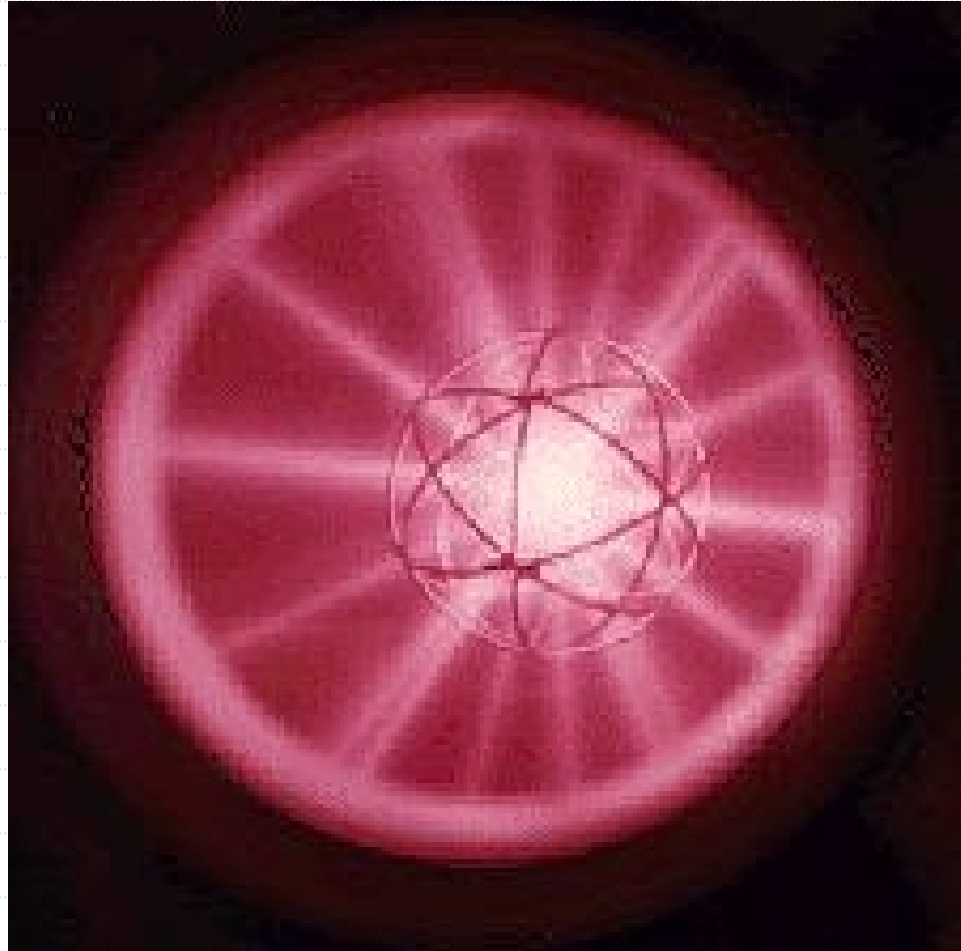
Table 3. Substantial gravitational squeezing occurs when $\lambda \geq 8\pi r_s$ (for electromagnetic ZPF)

Mass of body	Schwarzschild radius of body, r_s	ZPF mode wavelength, λ
Sun = 2.0×10^{30} kg	2.95 km	≥ 78 km
Jupiter = 1.9×10^{27} kg	2.82 m	≥ 75 m
Earth = 5.976×10^{24} kg	8.87×10^{-3} m	≥ 0.23 m
Starship $\sim 10^8$ kg	1.48×10^{-19} m	$\geq 3.9 \times 10^{-18}$ m
Human ~ 68 kg (average)	1.01×10^{-25} m	$\geq 2.7 \times 10^{-24}$ m
Proton = 1.673×10^{-27} kg	2.48×10^{-54} m	$\geq 6.5 \times 10^{-53}$ m

Engineering Wormhole-Stargates pt. VIIc: Side Note

- ◆ We can tweak Einstein-Rosen metric & make it completely traversable in principle by injecting a small amount of negative energy into an arbitrary vacuum region – anywhere we want to
 - this wormhole metric is experimentally indistinguishable from the ordinary Schwarzschild black hole metric until one gets very close to where one would have expected to find the event horizon, and instead finds a traversable throat

Engineering Wormhole-Stargates: Can we do it? How hard?



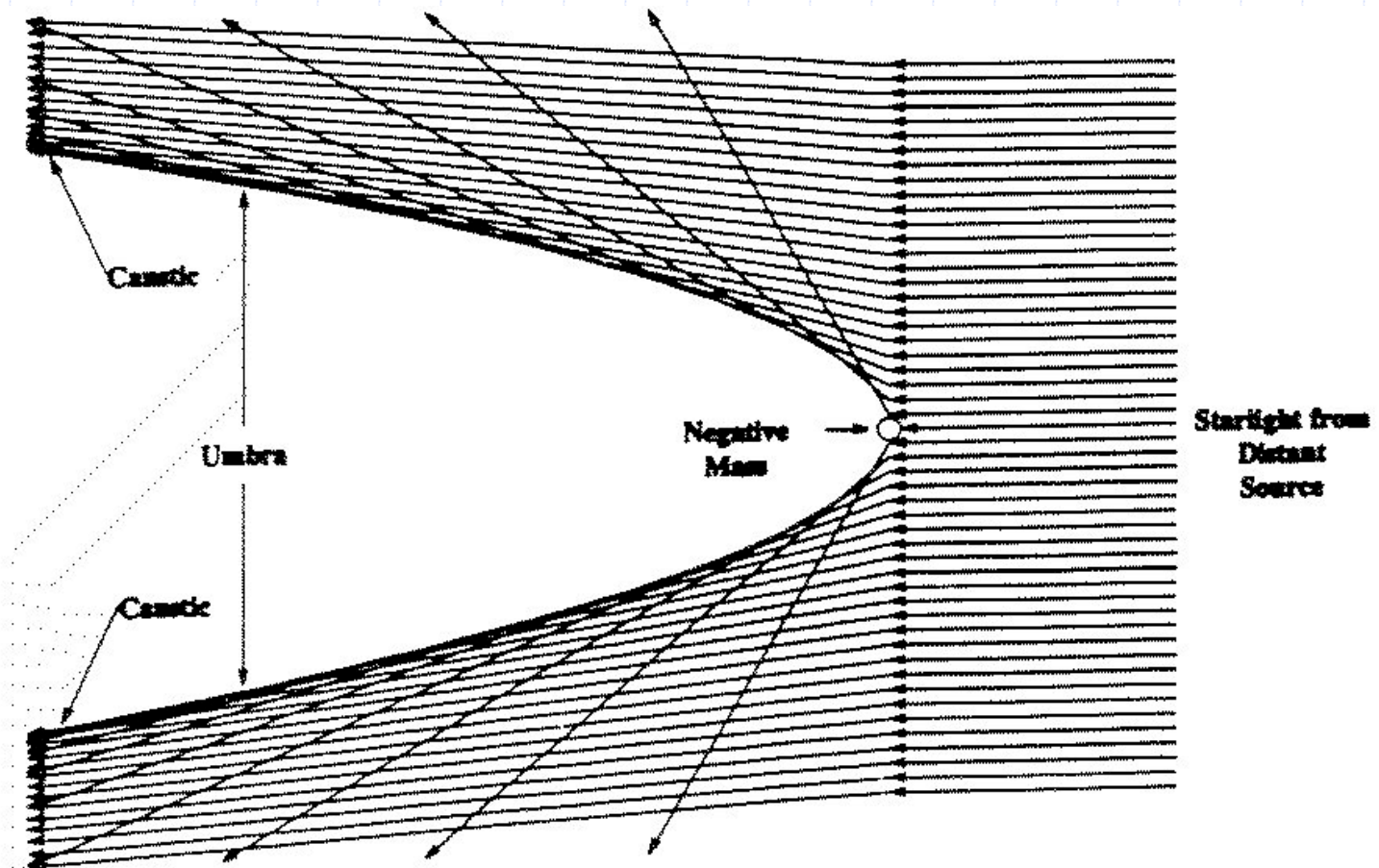
Engineering Wormhole-Stargates pt. IXa: What a Wormhole-Stargate Looks Like

- ◆ Negative energy density threading a wormhole throat generates repulsive gravity, which will deflect light rays going thru & around it
 - Starlight from distant sources surrounding the wormhole or stargate is deflected into a rainbow-like caustic of enhanced light intensity surrounding immediate vicinity of the throat
- ◆ Entrance/exit to (spherically symmetric) wormhole looks like a sphere containing the mirror image of a whole other universe or remote region within our universe, incredibly shrunken and distorted – behaves like a spherical mirror
- ◆ Flat-faced wormhole-stargate would not distort the mirror image of the other universe or remote space region seen thru it because negative energy density at the throat is zero as seen/felt by light & matter passing thru it

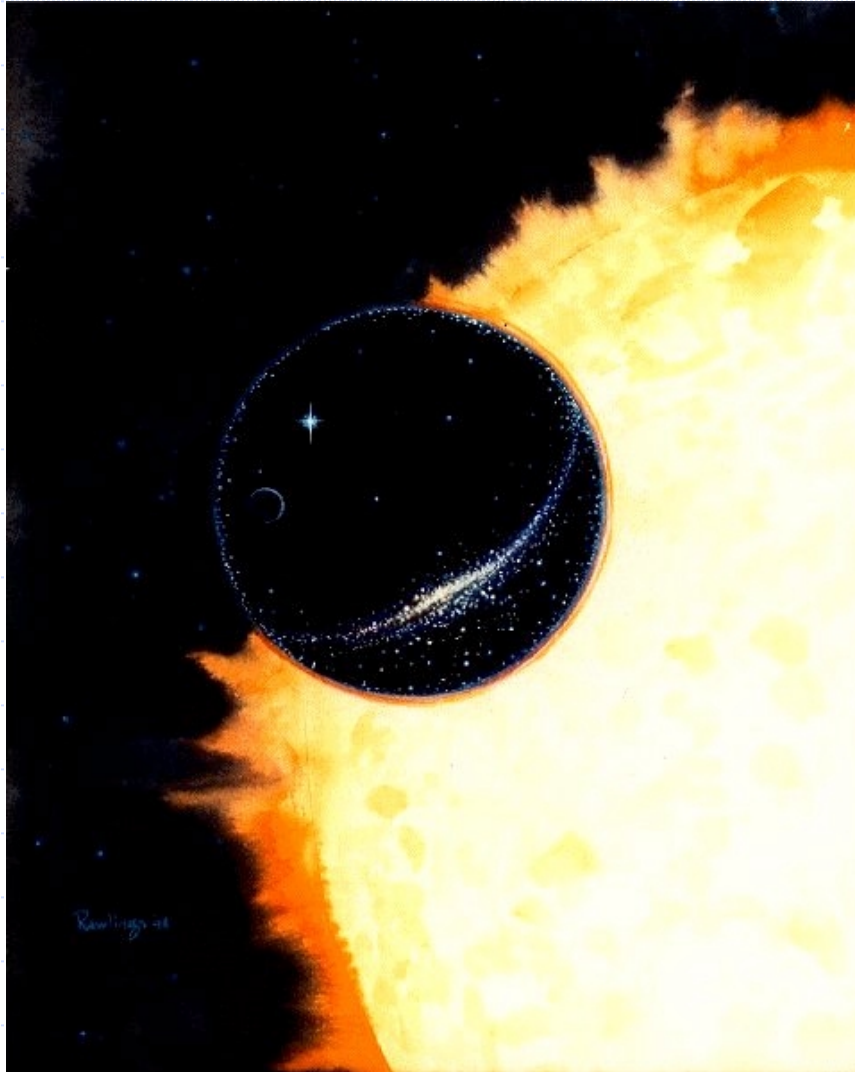
Engineering Wormhole-Stargates pt. IXb: What a Wormhole-Stargate Looks Like

- ◆ If a small wormhole-stargate were to begin to appear or bump into our local space we would perceive this process as the occurrence of an unusually bright spot in the sky
- ◆ Blue and red Doppler shifting of this bright spot would manifest when the intersection of the (3-d or multidimensional) wormhole with our local space grows or recedes, respectively
- ◆ Wormholes can trifurcate or merge together under certain conditions with resulting optical manifestations encompassing the above properties but with additional complex features

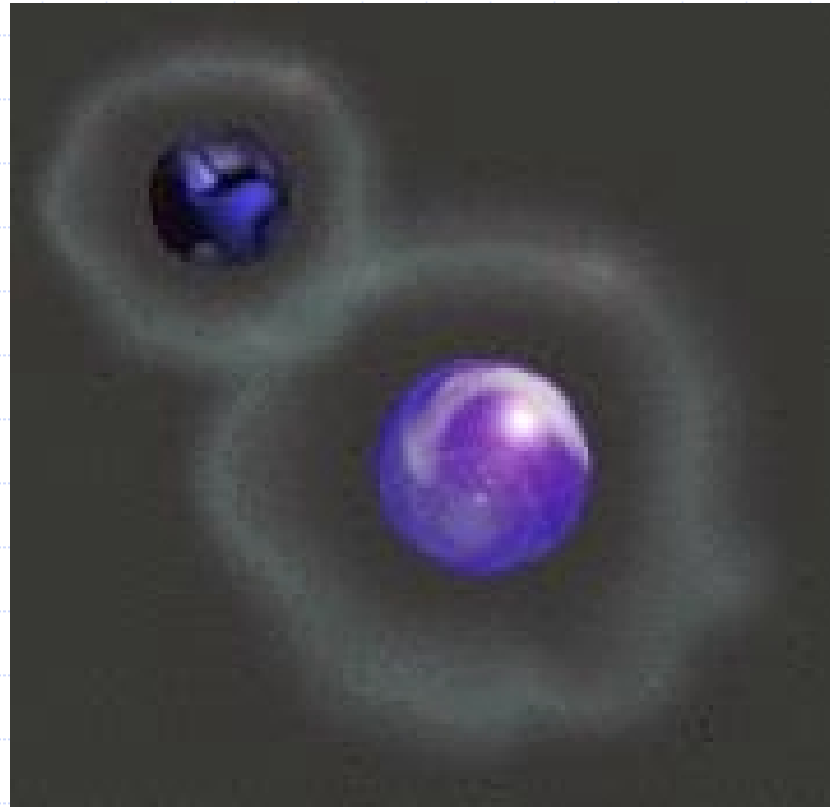
Engineering Wormhole-Stargates pt. IXc: What a Wormhole-Stargate Looks Like



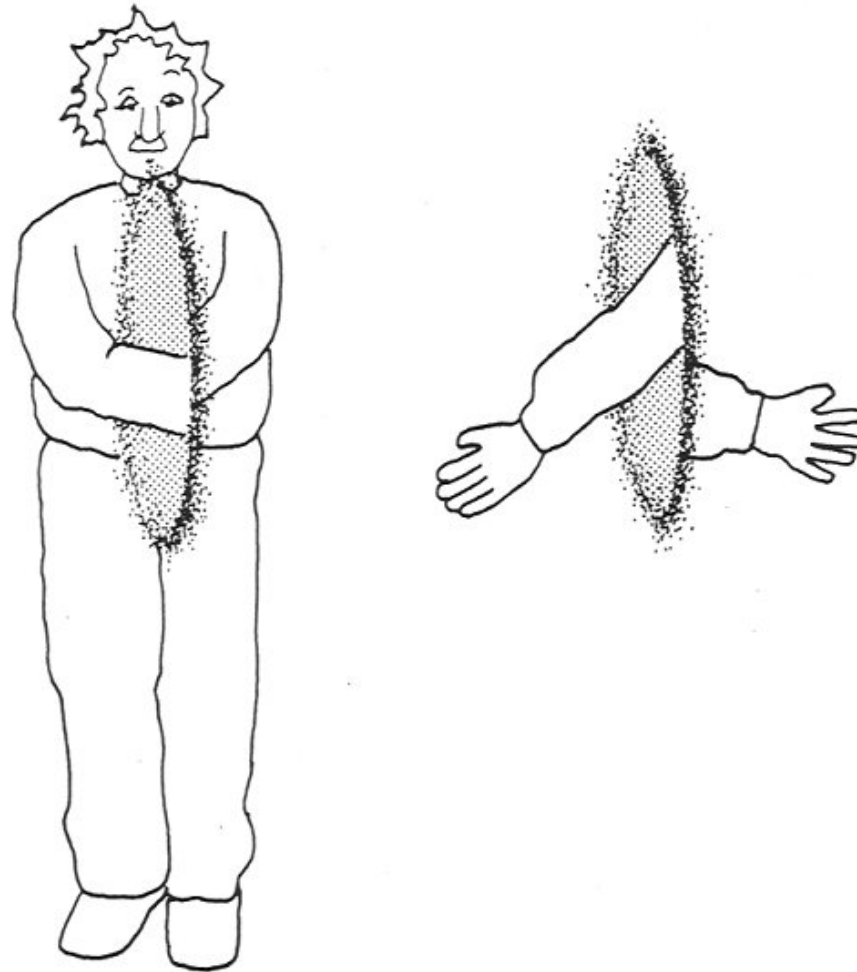
Engineering Wormhole-Stargates pt. IXd: What a Wormhole-Stargate Looks Like



Engineering Wormhole-Stargates pt. IXe: What a Wormhole-Stargate Looks Like



Engineering Wormhole-Stargates pt. IXf: What a Flat Wormhole-Stargate Looks Like



Implications for the UFO-Extraterrestrial Intelligence Hypothesis (ETH) pt. I

- ◆ Application of wormhole-stargates to the UFO problem does NOT necessarily support the ETH as being the only viable one
- ◆ Wormholes have unique property of connecting together different universes, different times, different dimensions and different space locations within our universe
- ◆ Any sufficiently advanced intelligence capable of deploying a wormhole can do so from near the Earth's surface while existing in another dimension or time WITHOUT having to come from another exoplanetary system within our own spacetime

Implications for the UFO-Extraterrestrial Intelligence Hypothesis (ETH) pt. II

- ◆ Current ETH for UFOs is NOT strange enough to explain the facts of the phenomenon → wormhole manifestations can
- ◆ *WARNING:* There is NO experiment that can distinguish between phenomena manifested by visiting interstellar (arbitrarily advanced) ETI and intelligent entities existing near/on Earth within a parallel universe or in different dimensions or who are (terrestrial) time travelers
- ◆ Technology exploited by such intelligences would appear to present-day human race as being indistinguishable from magic
- ◆ One of the primary objections to the UFO phenomenon by scientists is that UFO observations indicate such utterly nonsensical, bizarre (or absurd) behavior that they just could not possibly be real phenomenon
 - It has been suggested that ETI visitors just would not pull such disreputable antics as have been reported in the literature

Implications for the UFO-Extraterrestrial Intelligence Hypothesis (ETH) pt. III

- ◆ This argument is essentially an anthropocentric self-selected observation resulting from our being Homo sapiens when trying to draw conclusions about the nature of the universe
- ◆ On the other hand, UFOlogists claim that the ETH is the only acceptable explanation for UFOs and their occupants
- ◆ However, UFOlogists historically have ignored or avoided the data of absurd UFO behaviors, which contradicts the ETH, by selectively extracting data that best fits their agenda or version of the ETH
- ◆ The UFO-ETH is also based on anthropocentric self-selection
- ◆ Overlap is occurring between both the SETI and UFO paradigms, each of which excludes consideration of the other when laying claim to the legitimate search for and contact with ETI
- ◆ Synthesis can be found by examining the full context of the UFO phenomenon in terms of its six-dimensional characteristics within the framework of the incommensurability problem and semiotics

UFO Phenomenology pt. I

- ◆ Paul Hill delineated & characterized UFO performances and dynamics
- ◆ Hill's rigorous aeronautical & physics analysis of many UFO cases concluded that UFOs are craft utilizing an engineered "acceleration-field" technology
- ◆ "Acceleration-field" is old fashioned term for spacetime metric
- ◆ Traversable wormholes & Alcubierre warp drive metrics are examples of modern spacetime metric engineering concepts – both require engineering of the vacuum to mine negative energies needed to generate such metric modifications

UFO Phenomenology pt. II

- ◆ Jacques Vallee has analyzed UFO cases for over four decades – lots of field work & world-wide site visits
- ◆ Vallee concluded that UFO phenomenon is consistent with a technology centered on a craft using a very revolutionary propulsion system
- ◆ UFO phenomenon is the product of a technology in the sense that it is a real, physical material object
- ◆ NIDS investigations are ongoing & support this view
- ◆ Vallee-NIDS Hypothesis: Let us consider the characteristics of the sightings that are not explained by trivial causes; we can recognize six major “dimensions” in terms of our perceptions of these characteristics

UFO Phenomenology pt. III – Physical Effects Dimension

- ◆ witnesses describe an object that occupies a position in space*
- ◆ moves as time passes*
- ◆ interacts with the environment through thermal effects as well as light absorption and emission*
- ◆ produces turbulence*
- ◆ when landed, leaves indentations and burns from which approximate mass/energy figures can be derived*
- ◆ gives rise to photographic images*
- ◆ gives rise to electric, magnetic and gravitational disturbances*

UFO Phenomenology pt. IVa – Anti-physical Effects Dimension

- ◆ sinking into the ground*
- ◆ shrink in size, grow larger, or change shape*
- ◆ becoming fuzzy and transparent on the spot*
- ◆ divide into two or more craft, several of them merge into one object at slow speed*
- ◆ disappearing at one point and appearing elsewhere instantaneously*

UFO Phenomenology pt. IVb – Anti-physical Effects Dimension

- ◆ remaining observable visually while not detected by radar or sometimes detected by radar*
- ◆ missing time/time dilation*
- ◆ topological inversion/space dilation (UFO was estimated to be of small exterior size/volume, but witness(s) saw a huge interior many times the exterior size)*
- ◆ balls of colored, intensely bright light under intelligent control*
- ◆ Doppler blueshifting and redshifting effects of moving and motionless UFOs*

UFO Phenomenology pt. Va – Physiological Reactions Dimension

- ◆ burns**
- ◆ sounds (beeping, buzzing, humming, sharp/piercing whistling, swooshing/air rushing, loud/deafening roaring, sound of a storm, etc.)**
- ◆ vibrations*
- ◆ partial paralysis**
- ◆ extreme heat or cold sensation*
- ◆ odors (powerful, sweet or strange fragrance, rotten eggs, sulphurous, pungent, stinking, musky-like, etc.)**
- ◆ metallic taste**

UFO Phenomenology pt. Vb – Physiological Reactions Dimension

- ◆ pricklings**
- ◆ temporary blindness when exposed to the objects' light*
- ◆ nausea**
- ◆ bloody nose and/or ears; severe headache**
- ◆ difficulty in breathing**
- ◆ loss of volition**
- ◆ drowsiness in the days following a close encounter**

UFO Phenomenology pt. VI – Psychic Effects Dimension

- ◆ impressions of communication w/o direct sensory channel†
- ◆ levitation of the witness or of objects and animals in the vicinity*
- ◆ poltergeist phenomena: motions and sounds w/o a specific cause, outside of the observed presence of a UFO†
- ◆ maneuvers of a UFO appearing to anticipate the witness' thoughts†
- ◆ premonitory dreams or visions†
- ◆ personality changes promoting unusual abilities in the witness†
- ◆ healing†

UFO Phenomenology pt. VII – Psychology & Cultural Dimensions

◆ Psychology & Social Dimension

- Human observers tend to see UFOs while in their normal environment and in normal social groupings. They perceive the objects as non-conventional but they try to explain them away as common occurrences, until faced with the inescapable conclusion that the object is truly unknown

◆ Cultural Dimension

- Concerned with society's reactions to the reports, the way in which secondary effects (hoaxes, fiction and science-fiction imagery, scientific theories, cover-up or exposure, censorship or publicity, sensationalism, etc.) become generated, the attitude of members of a given culture towards the concepts that UFO observations appear to challenge
- Greatest impact of the phenomenon has been on general acceptance of the idea of life in space and a more limited, but potentially very significant, change in the popular concept of non-human intelligence

UFO Phenomenology pt. VIII – notation

- ◆ * = items explainable as manifestations of a wormhole opening up and intersecting our local space, the negative energy used to generate the wormhole, and/or of effects from the scout craft/probes that came through the wormhole
- ◆ ** = items explainable as reactions triggered by the scout craft/probes that come through the wormhole
- ◆ † = items can only be explained as consciousness-related effects that are triggered on purpose or as a side effect of the presence of the intelligence controlling the wormhole and scout craft/probes - goes to the heart of the incommensurability or cognitive mismatch problem that exists between the human race and the intelligence responsible for UFO phenomenon

UFO Phenomenology pt. IXa – NIDS Database

- ◆ Intensely bright, colored balls of light under intelligent control
 - either monochromatic or changing color
 - possessing either smooth or variable liquid turbulence-like surface/internal texture
 - maneuvering/hovering near people and around property
 - brightening or fading and blue/red Doppler shifting when appearing or disappearing

- ◆ Very large, very bright orange-colored opening in the daytime sky
 - a completely different or foreign looking sky was seen through the opening
 - an object was seen (through rifle spotting scope) moving through the opening at rapid speed

UFO Phenomenology pt. IXb – NIDS Database

- ◆ Faint light appears in the air a few feet above a dirt road
 - light grows in intensity becoming very bright
 - bright light then becomes a hole that opens up (growing from 1 - 3 feet diameter) and from within which another light is emanating
 - a large, black creature (~ 400 lbs., 8 to 9 feet tall) is seen crawling out of the hole (as seen through 3rd generation military night vision, hole appeared 3-dimensional with tunnel-like interior), it stood up and ran away into the surrounding dark of night
 - the brightly lit hole closed and faded away
- ◆ Psychic, anti-physical, physical, physiological, psychological/social & cultural dimensions present in all cases investigated by NIDS to date (~ 750 cases)

Alternative Physics Theories and their Application to UFO Phenomenology pt. I

- ◆ Dr. Hal Puthoff's Polarizable Vacuum-General Relativity model treats metric changes in terms of equivalent changes in the ϵ , μ vacuum constants of the electromagnetic field
- ◆ PV-GR approach treats measures as light speed, ruler lengths, clock frequency, particle masses, etc. in terms of a variable vacuum dielectric constant K in which vacuum permittivity transforms to $\epsilon_0 \rightarrow K\epsilon_0$, vacuum permeability to $\mu_0 \rightarrow K\mu_0$
 - K becomes space & time components of metric
 - in planetary or solar gravitational potential $K > 1$ while $K = 1$ in "empty" remote space $\rightarrow K$ is like a vacuum index of refraction
 - in the former case, the speed of light is reduced, light emitted from an atom is redshifted as compared with a remote static atom ($K = 1$), clocks run slower, objects/rulers shrink, etc.
- ◆ Apply the PV-GR prescription to wormhole/warp drive metrics and find the values of K that represent FTL motion
 - We claim $K < 1$ in this regime of GR
 - Clues from Scharnhorst (1990) and squeezing of vacuum ZPE

Alternative Physics Theories and their Application to UFO Phenomenology pt. II

- ◆ Puthoff's PV-GR model is the only alternative theory of gravity that has been successfully applied to explain the physical, anti-physical and physiological characteristics & performances of UFOs
- ◆ J. Corum, J. Dering, Sarfatti, et al. (1999-2001): Spacetime torsion added to General Relativity – torsion is a crinkle or defect in spacetime allowing for quick jumps across space
 - H. Ringermacher (GE-Kronotran), B. Cassenti (United Tech.), et al. (2001): Null result for torsion in charged particle clock experiments
- ◆ Sarfatti, Sirag, Gray, et al. (1999-2001): quantum modification of General Relativity via hyperdimensions - ongoing research
- ◆ J. Corum, J. Dering, et al. (1999-2001): EM Stress-Tensor Space Drive
 - Puthoff and others falsified concept

Conclusion

- ◆ Traversable Wormholes are based on plausible physics derived from Einstein's classical general theory of relativity or viable alternative theories
- ◆ Traversable Wormholes are strange enough to explain much of the UFO phenomenon
- ◆ UFO Phenomena possess six dimensional characteristics
- ◆ SETI & UFOlogy suffer from overlapping anthropocentric self-selection leading to failure to recognize the "projectionist"
 - Synthesis can be found in adopting semiotics & grasping the consequences of the Incommensurability Problem
 - UFO-ETH is not viable given strangeness of UFOs & lack of ability to experimentally distinguish UFOs as being very advanced ETI
 - UFOs can come from any realm other than 4-d spacetime via traversable wormholes