TRANSMUTATION

Janet Galore
jgalore@t-minus.com

5-8-99 @ Speakeasy in Belltown.

transmutation research @ Los Alamos in 1992.

www.nonukes.org/w50trans.htm

Interview with Ed Fuller NSE.
He says transmutation of wastes could be online by 2020.

breeder reactors
actinid-burning reactors

www.oecdnea.org/html/trw/docs/villigen/

Proceedings of the Specialist Mtg. on Accel. Based Transmutation., Villigen 1992.

5-8-99 (same day) Heisenberg Uncertainty Principle - HUP.

HUP applies at the quantum mechanical level.

Let p = momentum, x = position. $\hbar = \frac{h}{\pi}$

$dp \cdot dx > \frac{h}{2\pi}$, where h = Planck's constant.
$(\Delta p \, \Delta x)$

→

(cont'd)

This indeterminism may be due to the incompleteness of quantum mechanics (QM).

$p = mv$

Light is an electromagnetic wave.

Ref: for the following —

The Page of Uncertainty.

[www.svsu.edu/~slaven/uncertainty/uncertainty1.html.]

excellent resource!

Thomas Young, ~1800 showed Light is a wave. (interference thru slit).

Then, in early 20th century, Max Planck. Light is a particle. was looking @ black body radiation & found that if you look @ whole spectrum, black bodies would theoretically emit ∞ amount of energy — contradicting exp. results, called the "ultraviolet catastrophe!" In 1900 he found a soln — if ~~Ele~~ light could only be emitted in small bursts, rather than a continuous wave, then the results matched.

→

Then Einstein observed the "photo electric effect" (when light is shown on metal surface, electrons are ejected from the surface). To explain the PE, Einstein proposed the existence of photons (consistent w/ Planck's bursts) + everything came together. Robt. Millikan later confirmed ∃ photons.

All of this implies light is a "quantum vector field" which ~~amounts~~ accounts for the "wave-particle duality."

Later DeBroglie asked about particles behaving like waves. Davisson + Germer showed the wave properties of electrons. This duality extends to all atomic or subatomic particles subject to QM — electrons, protons, α particles, etc. Also true for macroscopic particles + objects, but the wave properties are impossible to detect!

Planck derived the relationship between the frequency of a wave and the kinetic energy of the corresponding particle.

→

DeBroglie derived a relation between p (momentum) of a particle and the wavelength of the corresponding wave—

greater momentum ⇒ shorter wavelength

$$p \propto w$$

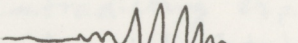
greater KE ⇒ higher frequency

$$KE \propto f$$

Now—what is the wave? What is the wave formed from? water, EMF, e.g....?

Soln: the amplitude of the wave tells the probability of a particle being there (at a position). So the wave is a wave of probability...

The amplitude of the wave determines the probability of where we'll find a particle when we do measure its location.

 wave packet.

particle is somewhere in there—just don't know exactly where.

→

How do you measure wavelength of packets?
Fourier — any wave is the sum of sin + cos.
(can have different wavelength, amplitude, etc.)

1. position depends on amplitude of the region (uncertainty)
2. wave packet has many momenta (combinations of wavelengths) so ∃ uncertainty in momentum.

So in these terms, the HUP becomes...

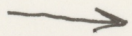
Suppose wave is confined to region Δx and
suppose the momenta (momentum distribution) that make up the wave fall within a range Δp.

Δx = Standard deviation of the wave fcn.

Δp = standard deviation of the momentum distribution.

Then $\Delta x \, \Delta p \geq \frac{\hbar}{2}$ $\hbar$ is very small!

$\hbar = 1.05 \times 10^{-34}$ Joule secs.



Copenhagen Interpretation —
not well defined. Concerns how much we can know about a particle and when.
Idea is that when we measure something, we collapse its wave fcn!
⇒ we determine its location.

Summary of Copenhagen interpretation of Quantum physics:

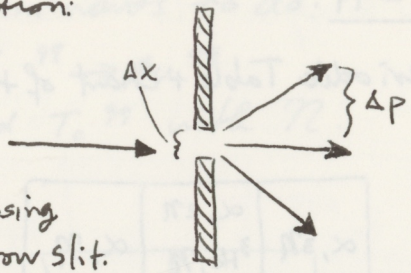
1. The wave fcn is a complete description of a wave-particle.

2. When a measurement of a wave-particle is made, its wave-fcn collapses.

3. If two properties of a wave-particle are related by an uncertainty relation (e.g. HUP), no measurement can simultaneously determine both properties to a precision greater than the uncertainty relation allows.

→

Illustration:



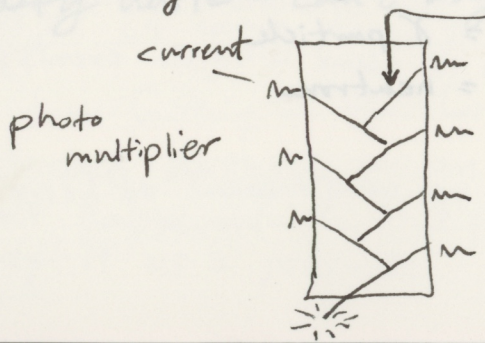
light passing thru narrow slit.

The smaller Δx, the greater Δp
The larger Δx, the smaller Δp.

Note: "Copenhagen" comes from its leading proponent, Danish Neils Bohr. It was defined during the Bohr-Einstein debate.

reference: Dave Slaven
Slaven@tardis.svsu.edu

5-13-99 mtg with J.L.A.



From 4-99

From Periodic Table + Chart of the Nucleides.

	$\alpha, 3n$	$\alpha, 2n$ $^3He, n$	α, n	
	p, n	p, γ α, n ^3He	α, np t, n $^3He, p$	
	p, pn γ, n $n, 2n$	n, n nucleus	d, p n, γ t, np	t, p
p, α	n, t γ, np n, nd	n, d γ, p n, np	n, p $t, ^3He$	
	nd $n, ^3He$	$n, ^3He$ n, pd		

d = deuteron

α = α particle

p = proton

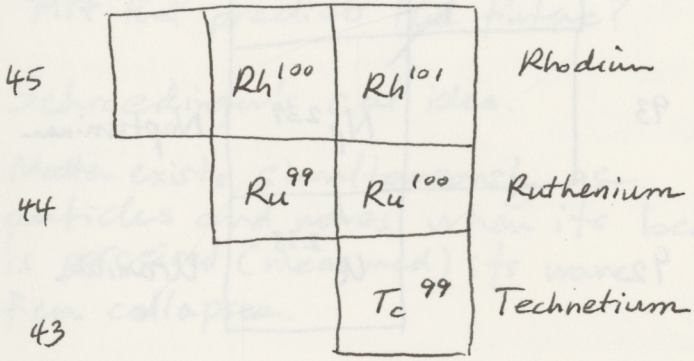
γ = γ particle

n = neutron

What Jim wants to do:

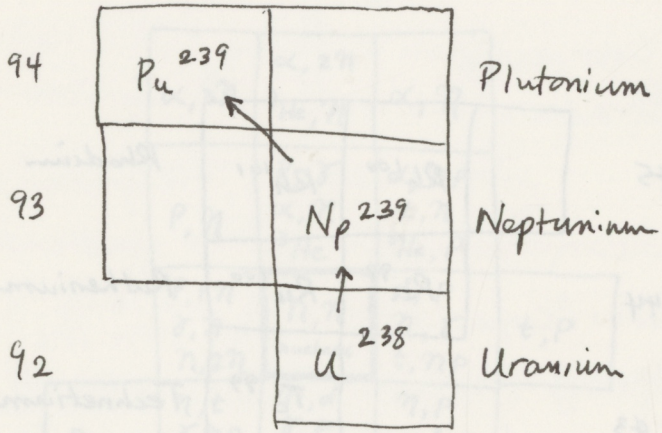
$Tc^{99} \rightarrow Ru^{99}$

bombard Tc^{99} with N.



Technetium ~1938. First man-made element. Occurs naturally, but had all decayed since the universe started. Big γ emitter — nasty waste — can't buy it.

Another example: U^{238} decays to Pu^{239}



Uranium fission by-products are Berium & Krypton.

Flux on the Silkwood Parle facility is about ~40,000 events/sec.

@ look up measurement of flux.

From 4-7-99.

Probability - fuzzy logic - shades of truth or existence.

Art that predicts the future?

Schroedinger's cat idea.

Matter exists simultaneously as particles and waves. When its location is perceived (measured) its wave form collapses.

Jim's idea of a desktop transmutation device. Do we say something has happened when it is 100% probable, even if we don't (or can't!) measure it?

Like the tree falling in the forest?! Or is it? It comes down to philosophy.

BUT:

The tree falling in the forest is different. Because: we are told the event happened—the tree fell—we accept it as a premise.

→

(cont'd.)

The question isn't whether the tree fell at all, ~~or even~~ but if it made a noise.

My question: I'm asking if the tree fell at all, or even: given that we hear (or have evidence) that a tree fell — did it??

5-21-99

Or if we could measure everything about this situation (displacement of other trees, ground, other effects), can we know if the tree fell? Do we believe it?

Levels of perception, faith — what is the difference between seeing something with your own eyes and viewing with a microscope or other "augmentative prosthetic?" →

Live or memorex? Photographic + video evidence can be altered.

As we move levels away from "direct" perception, there enters the possibility that some outside influence skewed or changed the data coming through. The less direct the perception, the less trustworthy, and thus convincing, it is.

The level of immersion in perceptual processes is very important as well. Films in movie theatres affect us more than 13" TVs. More believable.

What does it take to persuade a person that something they can't directly perceive is actually happening? Hard question, and it depends on how familiar the object/event is. Everyday things are more trustworthy.

⊛ look up quantum vector fields —
what else besides photons?
How does macroscopic matter relate?

From a conversation with Jim.
The alchemists were actually trying to change <u>themselves</u> as much as transmute elements.

Idea of noble metals. Before he left for London (first time in 1999), Jim had dreams of the trans-uranic metals — they sang to him and demanded to be transmuted.

5-25-99 8:45 am on the bus to Redmond.

<u>Song of a noble metal.</u>

When we pull data off the device, we can change that data to sound-music. Would be nice to have music relate directly to the act of transmutation itself — not just the α-emissions from Be. →

If the metal "wants" to be transmuted, perhaps the signal could start as sounding angry ⊛ or unsettled or chaotic. Then as more and more atoms are transmuted, the signal becomes more ordered & peaceful.

If the data from the device has meaning/import, and the element is assigned "will," then the visualization of the data will be more believable. The apparatus and arrangement of materials has a purpose – to transform the unstable Technetium to noble Ruthenium. It carries out the will of the element.

⊛ look at enbropy and entropic processes.

Like water seeking its lowest ground, these atoms seek balance (or final form) determined by nuclear weak and strong forces.

⊛ look @ weak + strong forces.
⊛ music of the spheres. ⟶

Don't want to over-anthropomorphicize the metal. Define its "will" using the models of radioactive decay. Assigning will is just an interpretation of a natural process. Also, Jim's dream supports the concept.

Did the alchemists recognize this?
(yes of course)

Need to resolve the issue of amplification of data (what is formal def. of "signal"?), and in particular, what ways can we directly detect the change occuring in the Technetium foil? Ideally we can do it in real time, while the process if occuring. Would not work as well to have to take apart the device + measure after the fact.

5-26-99 ———————————————

- "Shriek of tin" - crystalline structure of tin sliding against itself when bent.
- vibrates @ certain harmonics.

6-6-99

Books -

Carl Jung's alchemical volume.

Prelude to Chemistry, survey from alchemy to chemy.

Paracelsus - selected writings

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tin - stannum.

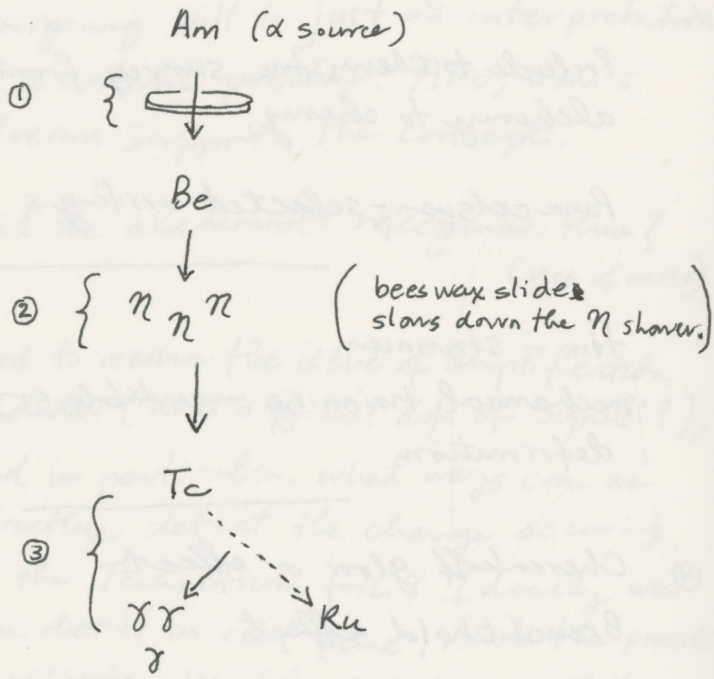
mechanical twinning - audible cry deformation

⊛ Cherenkoff glow or effect

Brenchthold effect.

One is in water, one in atmosphere. The water effect is closer to the element actually "glowing"

Detection & Measurement



① doped phosphorus disk

② parafin or bees wax slide ± 50% accuracy??

③ a) can measure γ coming off the transmutation itself (±300% or so)

b) spectrographic analysis
commercial lab, or ask Kurt / Lonie.

6-7-99 @ the N.O. after work. with Jim.

Variables to measure (or consider measuring)

1. rate of α particles coming off Am
   1.a) # of atoms of Be at I_o.
2. rate of n coming off ionized Be
   - will n be too fast to interact with Tc? is there an optimal speed?
   - ⇒ need to use beeswax or parafin.
3. rate of γ coming off Tc
   This will decrease over time, as $Tc \rightarrow Ru$.
   3.a) # atoms of Tc at I_o.
4. directly demonstrate existence of Ru
   → using spectrographic analysis? maybe
   → weight? no
   → some other property ?? perhaps a chemical RX unique to Ru?

(For each (1-3), need to also calculate possible error bounds (±%), and give the rationale.)

4.a) Based on 1-3, calculate the rate of transmutation in atoms/time.

→

Variables cont'd.

We don't <u>have</u> to measure 1-3, if we can do #4. But 1-3 can be used to generate audible/visual confirmation of the process. (music/photons/sound)

What if we can't do #4? Then the impact is <u>greatly</u> diminished — need a new game plan.

It's ok if we have to disassemble the apparatus to verify Ru.

Using estimated rates of decay, we can predict how long it will take to create a certain amount of Ru. The main thing is to figure out how long we need to run the thing!

Then, as Jim mentioned, we'll have to calculate how compromised the Be and sheilding materials have become, and determine proper disposal/storage!

→

Part of the security procedures should deal with how to store the materials until they're safe.

"Disposal" is really just deep storage.

Visualization

Virtual representation of the apparatus.

Aspects:

- physical characteristics
- logical flow
- process as represented by equation
- process as represented by chart of the nuclides
- emotional flow
  - perspective of the element
  - perspective of the alchemist.
- chronological flow – numerical representations of variables (ebb and rise) over time.

(need to get a feel for the duration needed – the ways to visualize it will be different if the time is short or long...)

- physical model of what is happening subatomically. animated? user "fires" α at η source, sets off Rx? → list continues

physical model cont'd.

α causes Be to release η which interacts with Tc...
can we show this model in 3D? user can rotate it, move through time? World be interesting to denote momentum, angles, etc. hm.

- change in sound over time.

⊛ what is a macroscopic or animalistic metaphor for the transmutation? How did the alchemists characterize it?

Triumph of the Will.

6-10-99 mtg. with Xtopher + Jim + Edward at our house

Brian Eno's random music generator.

Note: radioactive decay (detection of the decay) is the best random number generator known to man.

Our signal to noise ratio is too low. Even if we amplify measurements, there will not be enough meaningful data to drive a perceptual engine.

We're trying to re-cast the process, "explain" rather than quantify.

Science can only quantify and show models.

Suppose
- activity level of Tc^{99} of 100 nC.
- bombard it with n for 100 days
- say this converts between 1 and 5%.

$\Rightarrow$ 100 nC becomes 99-95 nC
- also have the instability of inst.
- background radiation.

$\therefore$ This makes detection of activity of Tc^{99} not a good option.

We have all four events occuring:

$\underbrace{\alpha, \gamma, \beta, n}$

we could calculate relative percentages of radiation sources from the whole apparatus.

Tc^{99} becomes Tc^{100} before decaying to Ru. Tc^{100} also decays (.00018 %) to Mo^{100} (molybdenum). Lots of stuff going on - source of noise.

Safety work permit
- gloves
- survey in + out
- dust mask? no...
- restricted access.

"street legal" now impossible?

Van Waters & Rogers chemical + scientific supply.

Beryllium crystals - watermelon tourmaline

void transition & neutron transfer.
⊘ radiation embrittlement

10-9-99

From "Kabbalistic Theosophy"
Commentary on the Ten Sefirot:

"... the Sefirot, which are so to speak the essence of God, like the elements of man are within man. Understand this, for to this Ezekiel referred in saying, 'as the appearance of a man above upon it, the image of all the glory... For all these Sefirot are separated forces, of an utmost simplicity, and they are all one glory, without any division or separation, save through the actions that reach us from them. All these Sefirot were created by God, blessed be his name, for his glory, and one harmonious union is formed from them, and all are called 'soul' and God — 'the soul of all Souls.'"

→

essence → 'azmo → 'azmut
(classical form)

The ten Sefirot are like the chakras — 10 essences within the body, but not essential "patticles."

11-23-2000 HISTORY OF ALCHEMY

From Prelude to Chemistry, by John Read c. 1936.

"In its broadest aspect, alchemy appears as a system of philosophy which claimed to penetrate the mystery of life as well as the formation of inanimate substances."

"Hermetism, or its synonym Alchemy, was in its primary intention and office the philosophic and exact science of the regeneration of the human soul from its present sense-immersed state into the perfection and nobility of that divine condition in which it was originally created." — Mrs. M.A. Atwood, A Suggestive Inquiry into the Hermetic Mystery, 1920.
(elevating life-essence)

Modern chemistry derives not from alchemy, but from the erratic work of the "Puffers" - gold seekers.

esoteric alchemy - philosophic

exoteric pseudo-alchemy - gold seekers.

Alchemy ~~roots~~ in Egypt -

Egypt = Khem = country of dark soil

∴ art of the dark country = al Khem

= alchemy in the Western world.

(chemi = black (coal))

Hermes Trismegistos (the thrice-great)

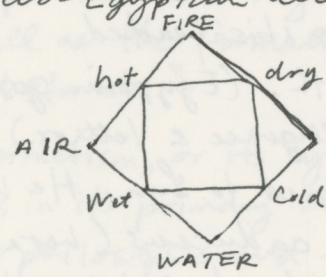
Hermes is regarded as the Greek equivalent of the ibis-headed moon-god, Thoth. (Egyptian god of healing, intelligence & letters.) Sacred # 4 assigned to him. He has winged boots, a caduceus (herald's staff, winged wand entwined by two serpents).

Chinese alchemy, pursued from 300 BC onwards, closely bound with Taoism. Taoist Canon has many alchemistic writings. →

Tenth century: exoteric alchemy (wai tan) merged into esoteric (nei tan), according to which the 'souls' or 'essences' of mercury, sulphur, lead, etc., bear ~~the~~ to the common metals the same relationship as the Taoist, adept, or perfected man, bears to common mortals.

A further evolution came in 11th cent. → transcendental metals became identified with various parts of the human body.

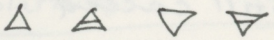
Greco-Egyptian alchemy -



the Four Elements

All bodies were held to be composed of the 4 elements in different proportions. As a corollary, one body could be changed, or transmuted, into another by altering the proportions of the elements present; further, this supposed transmutation was correlated with the idea of a prima materia, or primordial matter, from which all things came and ~~to~~ which →

they all reverted. An 'eternal principle' was recognized also in ancient India under the name of Brahma, and the 'primal matter' of the ancient Chinese was known as t'ai-chi. (prelude p 10)


fire air water earth

"the alchemists held that metals pass through a cycle of growth, culminating in the perfection of gold, and that in these ~~[illegible]~~ changes, art can assist Nature: this belief is clearly related to Aristotle's dictum that Nature strives toward perfection..." p. 11

Four fundamental Greek beliefs which influenced alchemy: (Hopkins)

"(1) Hylozoism: all Nature is like men, alive and sensitive.
(2) The great universe of sun & stars, the "macrocosm", is guided by the same laws which obtain on the earth, the "microcosm."
(3) astrology: the stars influence and forfell the course of events on this earth
(4) Animism: any event apparently spontaneous is really due to some personality - fairy, wood, spirit, hob goblin, etc."

Mary the Jewess – prepared a fusion of lead-copper alloy with sulphur, called "Mary's Block." Also invented the water bath, still called "bain-marie."

---

cinnabar = red sulphide of mercury.
(mercuric sulphide)

Yin	Yang
☿	☥
mercury	sulphur
moon	sun
Isis	Osiris
female	male
⊖	⊕
electron	proton
metallicity	inflammability

Harmonies of the Tria Prima (Paracelcus)

mercury	sulphur	salt
metallicity, fusibility, volatility	inflammability	uninflammability and fixity
volatile, and unchanged in the fire	volatile, and changed in the fire	found in the ashes
(spirit)	(soul)	(Body)
water	air	earth

Paracelcus was essentially a propagandist of a new order, both in alchemy & medicine. (was a contemporary of Luther, 1520). Gradually alchemy turned into chemistry over the next few generations.

"Henceforth, chimiastrie [iatrochemistry], or the art of transforming bodies and substances from a medical point of view, and metallurgy, or the art of extracting + purifying metals for the use of industry — two sciences having many points of →

(cont'd.)

contact and of difference — advanced in parallel lines on the road of progress. Alchemy, ceasing to be experimental and becoming merely psychological, was abandoned to the study of a few adherents, and finally disappeared altogether from the enlarged domain of positive science."

Prelude p. 30.

Then c. 1550–1650

Libavius
van Helmont
Glauber

furthered existing knowledge of gases, metals, acids, salts...

also successor Robert Boyle.

All shared the alchemical belief in transmutation, but gold-making was no longer the main goal.

"Alchemical mysticism and ~~obscurantism~~ obscurantism were gradually fading away, and although alchemical traditions lingered until late →

in the eighteenth century, the long age of alchemy virtually ended with Robert Boyle's abolition of the systems of the 4 elements and the three hypostatical principles, and his introduction of the modern chemical idea of an element, as expanded in his celebrated book published in London, 1661, under the title of "The Sceptical Chymist." "

Note that about 4 generations passed between Boyle & Lavosier's Traité Élémentaire de Chimie in 1789. This was the era of phlogiston, explanation of combustion. "swan song of alchemy"

11-24-2000 More from "Prelude to Chemistry"

Early Greek manuscript by Zosimos of Panopolis.

Formula of the Crab →

(embodies the secret of transmutation, probably a cipher used by Egyptian craftsmen engaged in making imitative gold.)

(1) message begins

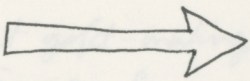
(2) contraction of τὸ πᾶν - "the all" or the universal matter, here referring to an alloy of Lead + copper, Mary's Blacke

(3) verdigris - "rust of copper"

(5) crab is a symbol of fixation,

(10) reference to philosopher's ~~stone~~ egg

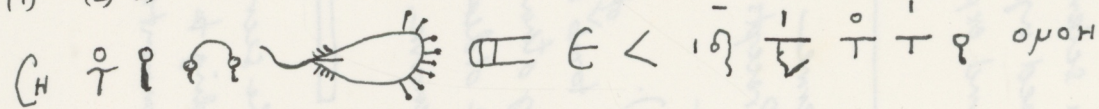
(14) means "blessed is ~~the~~ he who gets understanding"



FORMULA OF THE CRAB

(Prelude p. 40)

(1) (2) (3) (4) (5) (6) (7) (8) (9) (10) (11) (12) (13) (14)



σαδ μαλαφιοσ

(14)

"Roger Bacon was the first exponent of the inductive method in science, that is, of reasoning based upon accurate observation and experiment."
prelude p. 43.

The Emerald Table of Hermes
also called the Thirteen Precepts of Hermes
or The Smaragdine Table
(Tabula Smaragdina).

Supposedly discovered in a tomb of Hermes by Alexander the Great. Many other stories. Nevertheless it's one of the oldest alchemical fragments known.

The sentences embodied either the fundamental principles of alchemy or the secret of transmutation, according to the predilections of the commentator.

THE PRECEPTS OF HERMES, ENGRAVED
UPON THE EMERALD TABLE.