

# Particle Entanglement with the Observer's Polarized Dual Consciousness

A Modified Stern Gerlach Experiment, as proof

December 4, 2024

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### Abstract

Post-corpus callosotomy (split brain surgery) research has demonstrated that there exists two opposing minds within the single observer, which engage in a dynamic sequence of recursive information exchange, and ultimately collapse to one single polarized conscious state. It is therefore reasonable to hypothesize that **particle observation is dual**, and also involves two opposing minds, which engage in a similar dynamic, and ultimately collapse to one single polarized state, which then becomes entangled (in correspondence) with the observed particle, and subsequently becoming entangled with the observer's local environment. This novel theoretical concept of a **dialectic dual observation** is mathematically modeled with the resulting decreasing Shannon entropy, increasing potential energy, Jarzynski equality and random information exchange probability. The mathematical conjecture is compared with Von Neuman entropy during Quantum Entanglement and collapse. Section 2 shows how this sequence explains the logical inconsistencies of the two states experiments. Section 5 shows a **simple modified Stern Gerlach experimental as a proof**.

**Keywords:** Von Neuman entropy; quantum entanglement; Jarzynski equality; quantum decoherence; potential energy

## 1 Introduction

As the polarization from recursive information exchange translates across scales, ranging from neurological decision making to global information exchange, it's reasonable to assume that it also plays a fundamental role in quantum decoherence.

I ask you to consider how ubiquitous positive reinforcement loops and power-law distributions are in nature. In particular, how recursive information exchange (within the framework of reinforcement loops) translates across scales, ranging from local, regional, national, and global. However prior to any initial local exchange of information, there first exists an exchange within the conscious decision making of an agent, at the neurological scale. For example. The "Archduke Ferdinand moment" was not initiated by the pull of a trigger. The initial state began at the neurological scale, within the dual opposing consciousness of the assassin. So the Classic Space sequence of information exchange **escalated through successive scales of: neurological, local, regional, National and global**.

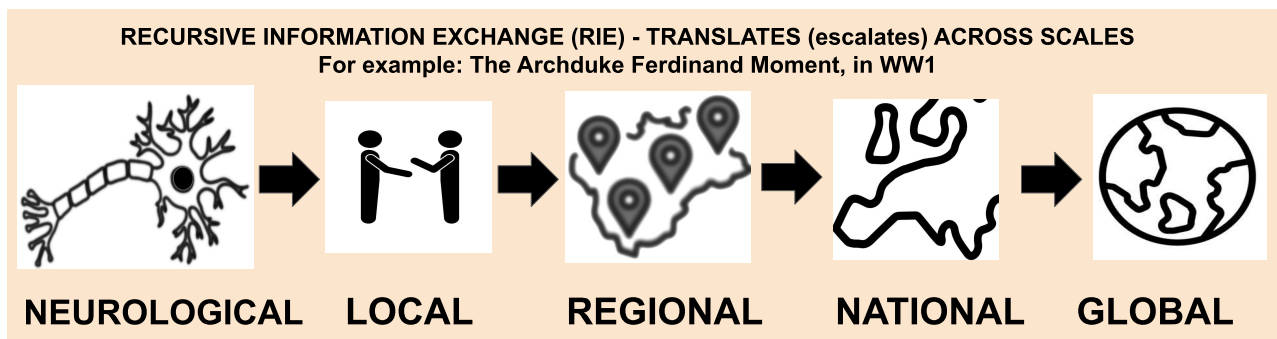
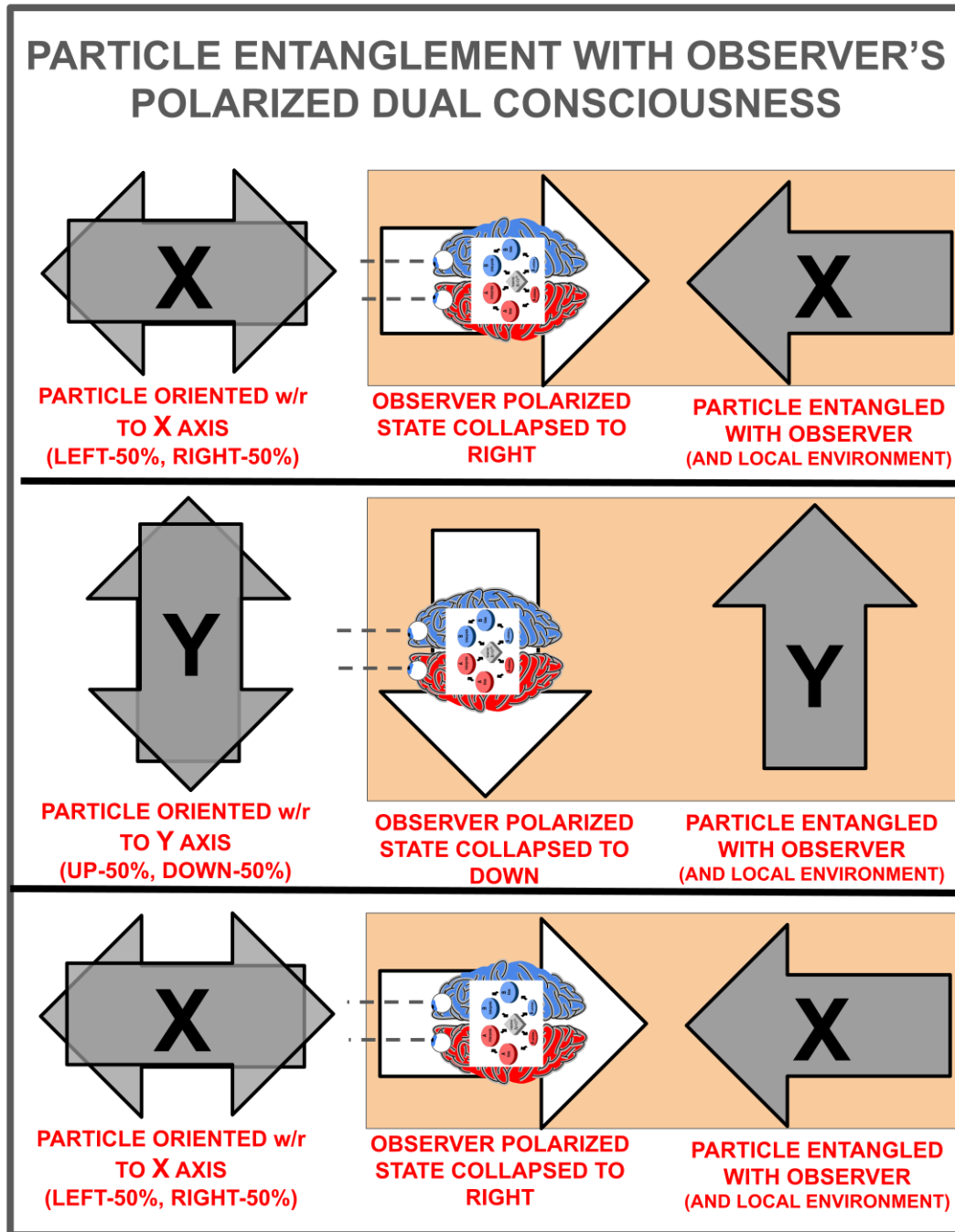


Figure 1: RECURSIVE INFORMATION EXCHANGE TRANSLATES ACROSS SCALES

## 2 The Two States Experiments are Explained by the Entanglement of Observer and Particle

The reason that the observer can not explain the logical inconsistencies of the "Two States Experiments" [1] is because the observer undergoes a profound change during each validation (I prefer to use validation, instead of "observation" or "measure", as it's more useful), such that the observer's opposing dual consciousness becomes polarized, through a sequence of recursive information exchange, that results in lower entropy, higher potential energy, and collapses to a single validated state (unconscious to the single observer). Subsequently, the particle becomes polarized and entangled with this single validated state (and subsequent local and remote environments). **Thus the observer becomes changed (polarized), in correspondence with the particle at each orientation.** Figure 2 shows the three stage sequence of  $x \rightarrow y \rightarrow x$  axis orientations and resulting percentages of possible binary states of angular momentum. **Note: conjecture to follow**

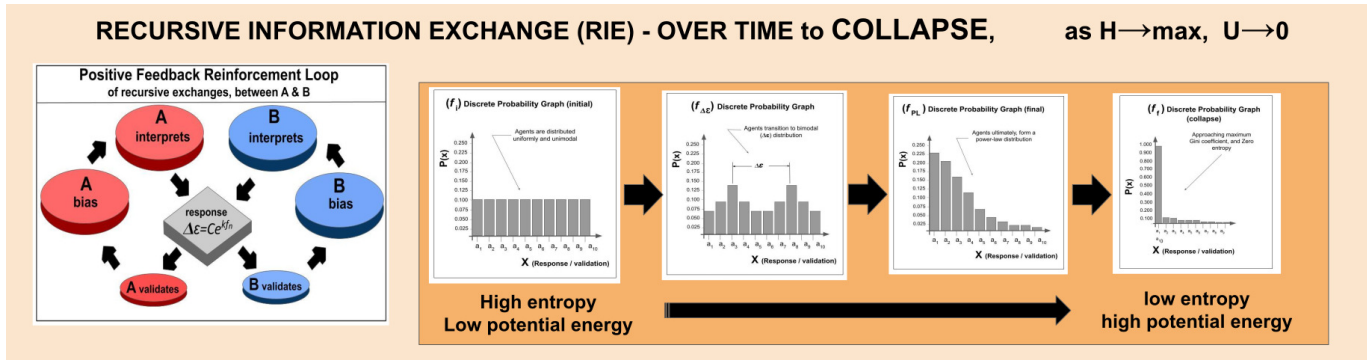


**Figure 2:** Two States Experiment, with three stages of  $x, y, x$  axis orientations and resulting percentages of possible binary states.

This model also explains the reason that repeated experiments tend to result in a 50 / 50 distribution of polarized particle orientations (to the tangent of the previous angle). The observer's dual mind naturally seeks balance over iterations. If this model is correct, a modified (two system) Stern-Gerlach experiment would provide proof of particle / observer entanglement.

### 3 Recursive Information Exchanges in Classic Space (Entropy Decreases and Potential Energy Increases)

Recursive information exchange over time, ultimately results in a collapse. This is true at all scales, from subatomic space to Classic space. Regardless of the scale, a transition from a high entropy/low potential energy state to a low entropy/high potential energy state, leads to the collapse into a single state.



**Figure 3:** A transition from a high entropy/low potential energy state to a low entropy/high potential energy state, leads to the collapse into a single state.

### An Analogy Between Polarization in Classic Space and Quantum Decoherence

Using a Classic Space analogue to Quantum Decoherence: Recursive information exchange (RIE), within the framework of reinforcement loops, between agents. From this dynamic system of information exchange, the resulting decreased Shannon entropy, increased potential energy, polarization and preferential growth (over scales) are compared with Von Neuman entropy during Quantum Entanglement and collapse.

Universal set  $U$  contains ten agents as noted:  $U | \{a_1, a_2, a_3, a_4, a_5, a_6, a_7, a_8, a_9, a_{10}\} \in U$

Using a modified version of Shannon entropy for convenience,

$$H(X) = - \sum_i^n (p(x_i) * \log_2[p(x_i)]),$$

Modified version of entropy equation:

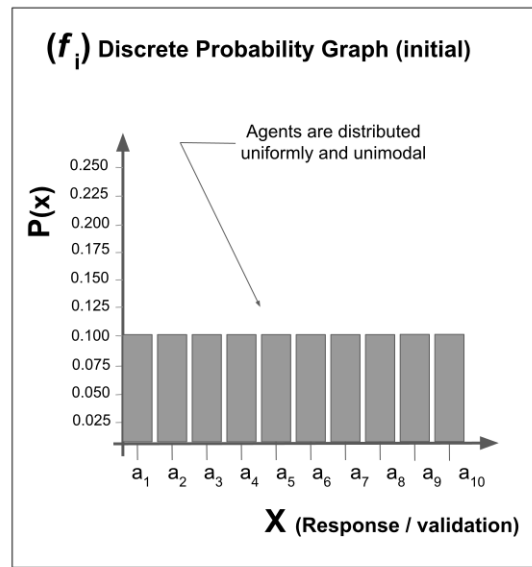
$$I(a_i) = - \log_2(p(a_i)) \tag{1}$$

$$H(X) = \sum_i^{10} (I(a_i) * p(a_i)) \tag{2}$$

figure 4 shows the discrete probability graph of set  $U$  at initial state  $f^i$ , along with it's associated information ( $I(a_i)$ ) and Shannon entropy ( $H(X)$ ): [2]

Note: Entropy in the initial state is at maximum

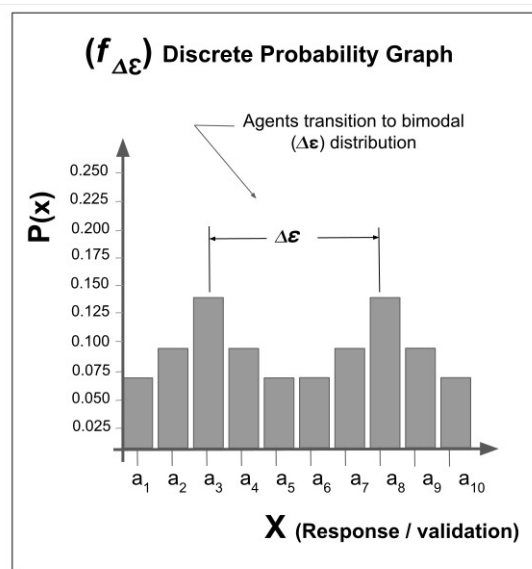
$$H(X) \rightarrow max$$



$x_i$	$P(x_i)$	$I(x_i)$	$P(x_i) * P(x_i)$
$a_1$	0.100	3.322	0.332
$a_2$	0.100	3.322	0.332
$a_3$	0.100	3.322	0.332
$a_4$	0.100	3.322	0.332
$a_5$	0.100	3.322	0.332
$a_6$	0.100	3.322	0.332
$a_7$	0.100	3.322	0.332
$a_8$	0.100	3.322	0.332
$a_9$	0.100	3.322	0.332
$a_{10}$	0.100	3.322	0.332
	1.000		$H(x) = 3.322$

Figure 4: Discrete probability graph at initial state  $f^i$

At initial iteration  $f^i$ , the distribution is uniform with high entropy of  $H(x) = 3.322$ . However in the natural world, recursive information exchange tends to result in variance and division. Thus, subsequent iterations tend to transition to a bimodal distribution of two subsets  $A$  and  $B$ :  $A$  and  $B \subseteq U$ , and lower associated entropy (see figure 5).



$x_i$	$P(x_i)$	$I(x_i)$	$P(x_i) * P(x_i)$
$a_1$	0.075	3.737	0.280
$a_2$	0.100	3.322	0.332
$a_3$	0.150	2.737	0.411
$a_4$	0.100	3.322	0.332
$a_5$	0.075	3.737	0.280
$a_6$	0.075	3.737	0.280
$a_7$	0.100	3.322	0.332
$a_8$	0.150	2.737	0.411
$a_9$	0.100	3.322	0.332
$a_{10}$	0.075	3.737	0.280
	1.000		$H(x) = 3.271$

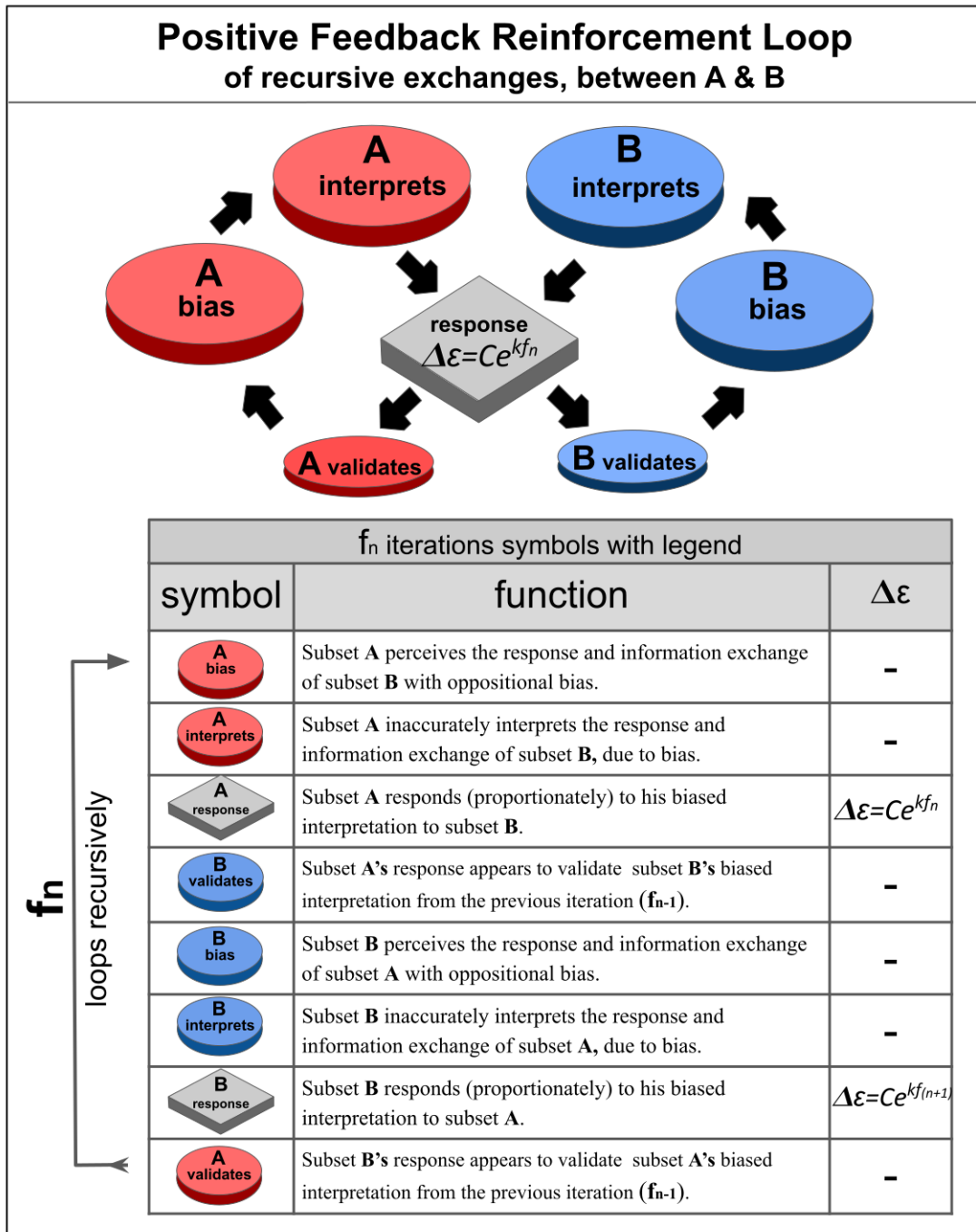
Figure 5: Discrete probability graph transitioning to a bimodal distribution

Note: Entropy decreasing over iterations  $f_n$   
 $H(X) = 3.271$

### How Distributions Become Separated over Recursive Iterations of Information Exchange. A Dialectical Development

The diagram in figure 6 shows the flow of incremental recursive information exchanges, within the framework of positive reinforcement loops. The observational components (of bias, interpret, response and validation) are mutually mirrored between

agents *A* and *B*, and follow a figure eight pattern. Typically, divisions tend to escalate over time in this format. A real world example might be the polarization which occurs during dysfunctional political rivalry. Note the Dialectical Development



**Figure 6:** Division develops within positive feedback reinforcement loops, of recursive information exchange

### Self-Validation of Subjective Observation,

The separation  $\epsilon$  escalates between the agents in subsets *A* and *B* during each iteration, as a result of oppositional dynamics (biased interpretations and responses from opposing perspectives). Note that their mutual responses only seem to validate their interpretation. However, the outcome is merely confirmation bias. In other words, their subjective observations are **self-validated**. This concept of self-validation is referenced in section 4, as it relates to validation in Quantum Decoherence.

## How Separation $\Delta\epsilon$ Increases over Iterations

Subsequent iterations follow the same sequence, and result in an incremental positive feedback loop. As separation escalates over iterations,  $\Delta\epsilon$  increases exponentially with each iteration ( $f^n$ ), per the following differential equation and exponential solution. **Note**, that interpretations become increasingly distorted over iterations. This is demonstrated in the children's game "Chinese Whispers", [3] where an original message becomes unrecognizable, after multiple recursive information exchanges between players of the game,

$$\frac{d\epsilon}{df^n} = K\epsilon \quad (3)$$

$$\frac{1}{\epsilon}d\epsilon = kdf^n \quad (4)$$

$$\int \frac{1}{\epsilon}d\epsilon = \int kdf^n \quad (5)$$

$$\ln|\epsilon| = kf^n + c \quad (6)$$

$$|\epsilon| = e^{kf^n+c} \quad (7)$$

$$\epsilon = Ce^{kf^n} \quad (8)$$

## Critical Stage of Iteration $f_i$ Power-law Distributions

Per the law of preferential attachment, a power-law distribution (a functional relationship between two quantities, where a relative change in one quantity results in a relative change in the other quantity proportional to a power of the change, independent of the initial size of those quantities: one quantity varies as a power of another) will develop. Power-laws occur ubiquitously throughout nature. Some obvious real-world examples are: The largest trees tend to dominate to sun rays, and thus grow at proportionately higher rates. The most massive planets in a stellar system attract more space debris, and thus grow at proportionately higher rates.

The discrete probability graph in figure 7 is approaching a power-law distribution, with a much lower entropy of  $H(x) = 2.818$ . Of course, distributions of individual sets of agents will vary.

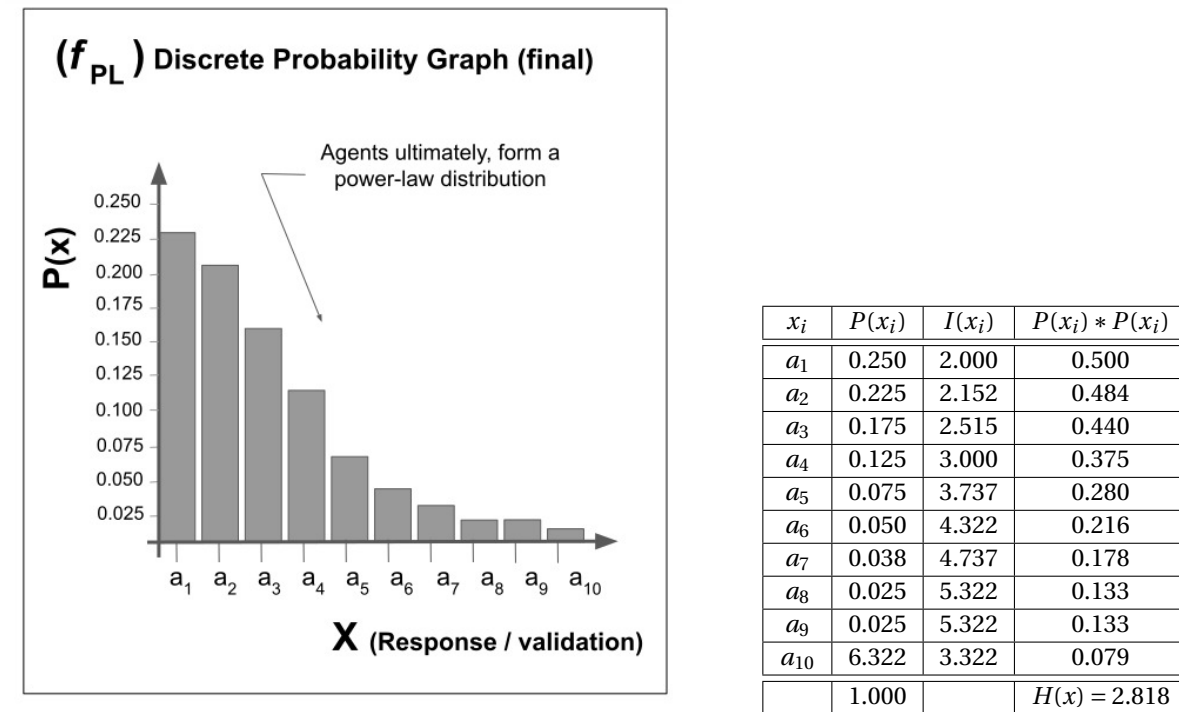


Figure 7: Discrete probability graph transitioning to a power-law distribution

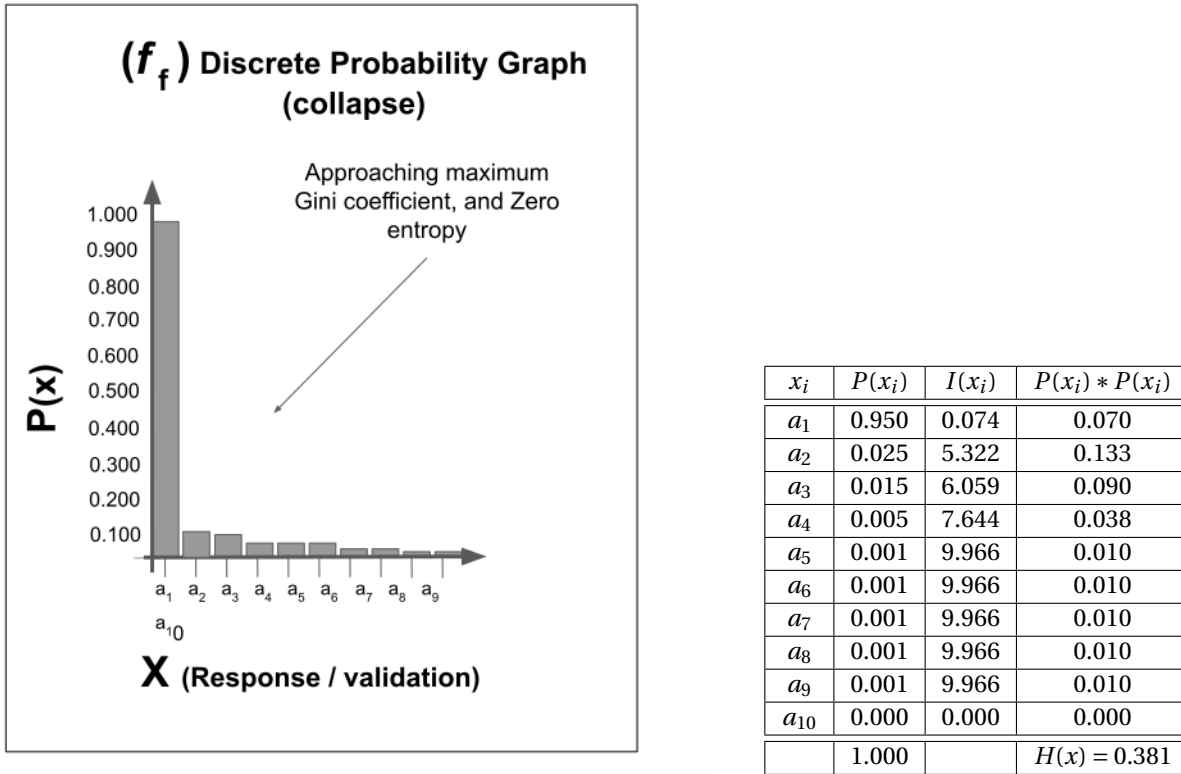
Note: Entropy decreasing over iterations  $f_n$   
 $H(X) = 2.818$

## Asymptotic Entropy of Open Systems with Power-law Distributions

At a critical Gini coefficient, power-law distributions tend to collapse and then reform. Some real world examples include: The collapse of stars (capable of becoming nova) act as a catalyst to the birth of new stars in a nebula system. The sinusoidal economic cycles, between growth and recession. Note, that such systems tend to maintain their ordered state asymptotically in an open system, regardless of the universal direction of entropy.

### Collapse stage $f_{fin}$

Figure 8 shows a power-law distribution approaching maximum Gini coefficient.



**Figure 8:** As the Gini coefficient of a power-law distribution increases to maximum, the entropy approaches zero.

Again, per the law of preferential attachment, a power-law distribution will develop in the form of:

$$p(x) = C(x)^{-\alpha} \quad (9)$$

if we regard random information exchange to be connections between nodes,

$k$  = connections

$p$  = the probability of a an isolated random connection

$(1 - p)$  = the probability proportionate to accumulating connections

$C$  = fraction of nodes

$L$  = the fraction of nodes with connections

then,

$$L = Ck^{-\alpha}, \quad (10)$$

where

$$\alpha = 1 + \frac{1}{1 - p} \quad (11)$$

As the Gini coefficient of a power-law distribution increases to maximum, the entropy approaches zero..

This final stage can be regarded as a collapse, which is analogous to the transition from positive to the zero state in Von Neumann entropy.

$$H(X) \rightarrow 0 \text{ as } G \rightarrow \text{max}$$

### Potential Energy Increases

Note: As entropy  $H(x)$  goes to zero, potential energy  $U$  goes to maximum

This gain of potential energy, from negentropy is real in classic space, if you consider how a Demagogue divides and polarizes a population, then uses the doped energy within this divided population to suit his own purposes

$$U \rightarrow \text{max as } H(X) \rightarrow 0$$

### Polarization Emerges, Becomes Entangled, and Escalates

Figure 9 shows Classic Space polarization over iterations  $f_n$ . This natural result is commonly observed between polar opposites (political, etc). **It's important to note that polarization becomes entangled with it's local environment and subsequently escalates over scales (neurological decisions, local, regional, national, global) in the natural world**

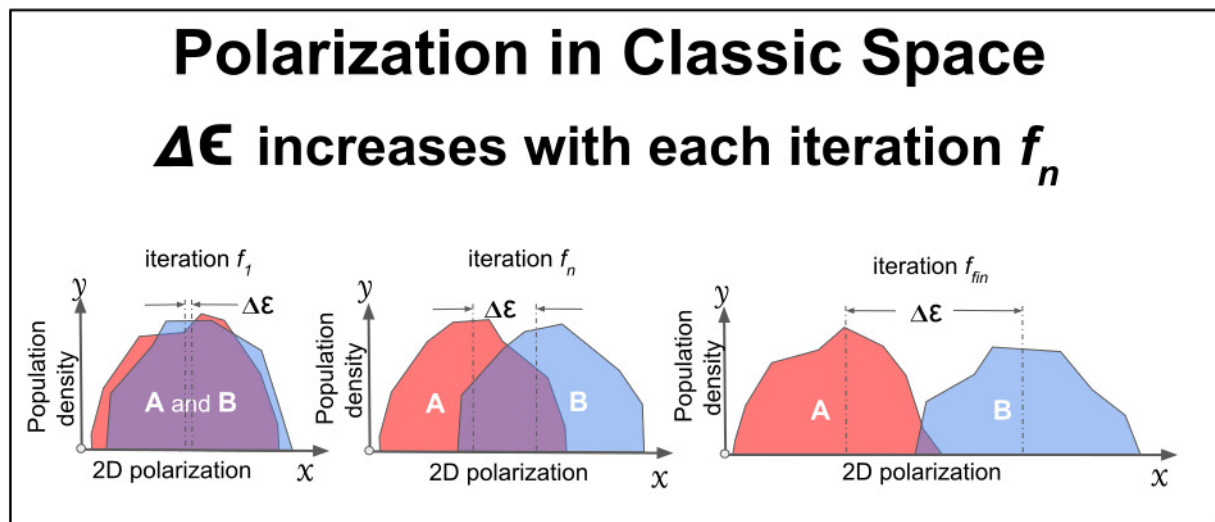


Figure 9: Polarization tends to emerges in the natural world (classic space) over iterations  $f_n$

Note: Polarity becomes entangled with it's local environment, and tends to escalate over scales

$$X_e \rightarrow \text{max}$$



## Negentropy as Potential Energy

The probability of negentropy  $P(J)$  of a set is proportionate to its polarization  $|\rightarrow\rangle$ , over recursive information exchanges,

$$P(J) = k \frac{|\rightarrow\rangle}{f^n} \quad (12)$$

Where  $k$  is a constant or proportionality

## 4 Recursive Information Exchanges in Quantum Decoherence

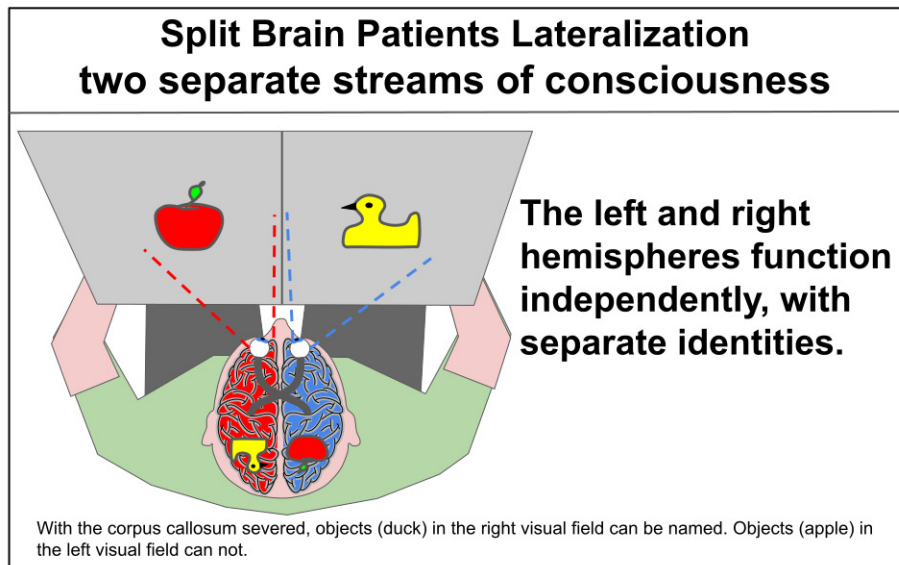
### Information as Energy

An experiment in 2010, by a team of Tokyo scientists, [4] demonstrated that a non-equilibrium feedback manipulation of a Brownian particle on the basis of information about its location achieves a Szilárd-type [5] information-to-energy conversion, using real-time feedback control. In thermodynamics, the Jarzynski equality [6] (free energy difference)  $\Delta F = F_B - F_A$  between two states A and B is connected to the work  $W$  done on the system through the inequality:  $\Delta F \leq W$ . In microscopic systems, thermodynamic quantities such as work, heat and internal energy do not remain constant but fluctuate. Nonetheless, the second law [7] still holds, on average, if the initial state is in thermal equilibrium:  $\langle \Delta F - W \rangle \leq 0$ , where  $\Delta F$  is the free-energy difference between states,  $W$  the work done on the system and  $\langle * \rangle$  the ensemble average. However, the feedback control enables selective manipulation of specific fluctuations that cause  $\Delta F - W > 0$ , by using the information about the system. The feedback control can increase the likelihood of occurrence of such an event. This is the crux of the control in the thought experiment: "Maxwell's Demon". [8] Thus, it is concluded that the particle is driven by the 'information' gained by the measurement of the particle location.

### The Measurement Problem

In quantum mechanics, a matter wave collapses as it interacts with a macroscopic photographic plate, seemingly at the point where an intelligent agent observes the plate. [9] This seems to defy a logical explanation, as the matter wave is in a superposition of several eigenstates and evolves deterministically, yet the resulting single eigenstate is determined by the state at the point of interaction (measurement). For any observable, the wave function is initially some linear combination of the eigenbasis  $\{|\phi_i\rangle\}$  of that observable. When an external agency (an observer, experimenter) measures the observable associated with the eigenbasis  $\{|\phi_i\rangle\}$ , the wave function collapses from the full  $|\psi\rangle$  to just one of the basis eigenstates,  $|\phi_i\rangle$ , that is:  $|\psi\rangle \rightarrow |\phi_i\rangle$ .

### The Key to the Measurement Problem: Two Minds of Observation in the Single Observer.



**Figure 10:** Split Brain Patients Lateralization two separate streams of consciousness

Neuroscience has theorized the duel (two minds) model of the human brain from research on post-surgery consciousness of split-brain patients. [10] Following surgery, **these two minds are typically opposing, such that both minds simultaneously perform opposing functions** (see figure 10).

Thus, Hypothesis ?? implies the following, in the Measurement Problem,

- The observer's opposing dual consciousness exchange information about the particle being observed, and follow an essentially similar process (components of bias, interpret, response and validation) as the figure 8 flow diagram shown in figure 6.
- The two opposing observables ultimately collapse into one of two (polarized) states

$$|\psi\rangle \rightarrow |\phi_i\rangle. |\psi\rangle \rightarrow |\phi_i\rangle.$$

- The collapsed state corresponds to either a "spin up" or "spin down" state.



- The evolution of a particle in the wave function is actually deterministic. However, the single measurable result (eigenvalue)  $\lambda_n$  is in correspondence with the polarized state of the observer's dual consciousness  $|\otimes\rangle$ , for the measurable  $\hat{H}$  of of the measured state  $|a_n\rangle$ , in the Hermitian equation,

$$\hat{H}|a_n\rangle = \lambda_n|a_n\rangle$$

Such that the observer's polarized dual conscious is entangle with

$$|a_n\rangle, |\otimes_1\rangle \otimes |a_1\rangle + |\otimes_2\rangle \otimes |a_2\rangle$$

- This entanglement, between both the observer and particle, provides the missing deterministic feature, which Einstein objected to, as being "incomplete" in his equation, where he concludes that the entanglement of two particles, which are widely summed, can not be divided into two separated wave functions. Can be expressed as,

$$\Psi(x_1, x_2) = \sum_{n=1}^{\infty} \psi_n(x_2) U_n(x_1) \neq \chi(x_1) \theta(x_2) \quad (13)$$

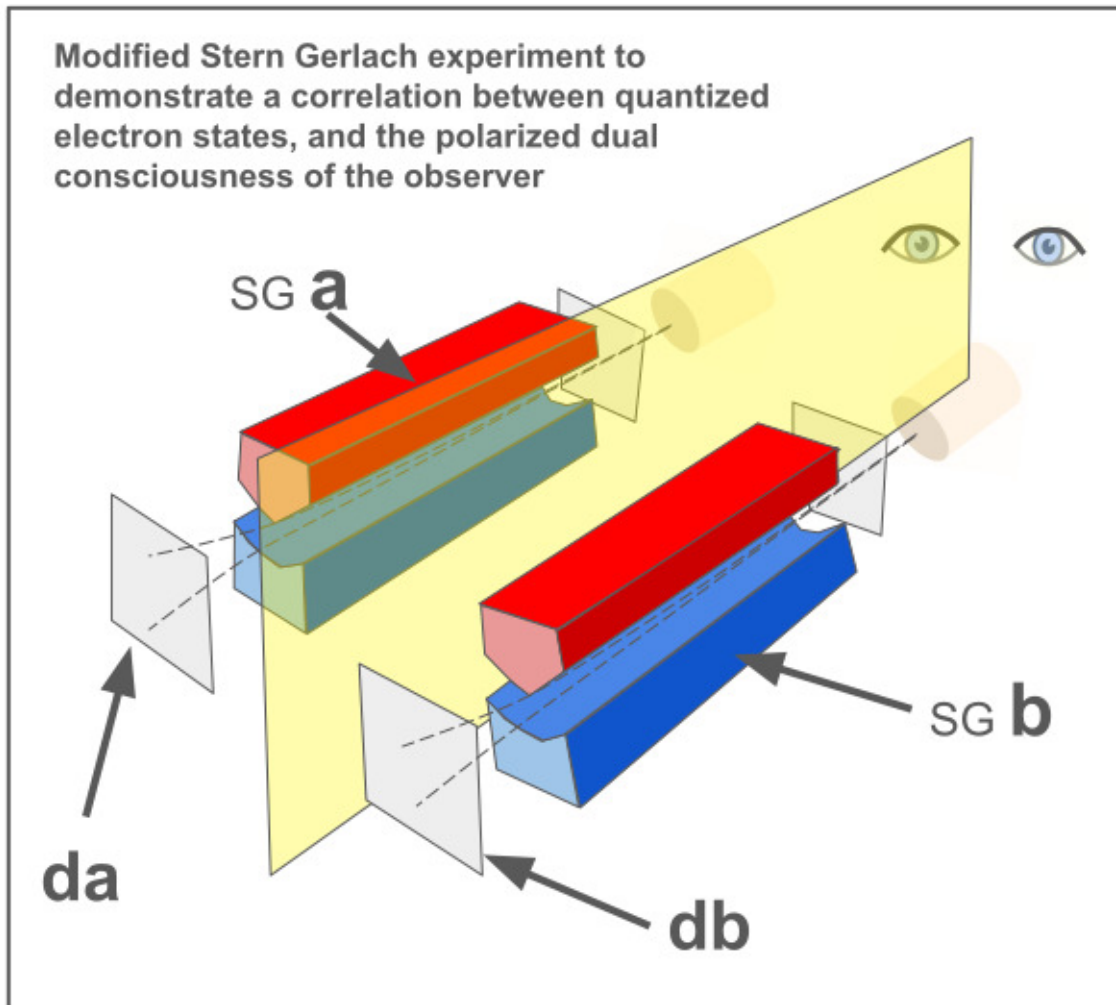
- This process of exchange between the observer's dual consciousness **occurs instantaneously to the single observer, who is unaware of the subconscious dynamics.**
- Hypothesis ?? can be experimentally verified, by demonstrating a correspondence between the observer's dual consciousness, the observer and the local environment, at any single moment. (See section 5).

## 5 Proposed Experiment to Prove that Decoherence is Influenced by the Polarized State of the Observer

An entanglement between the polarized observer's dual consciousness and the particular angular momentum of an electron, implies a correspondence with the observer, particle and local environment, at any single moment. Thus, a statistical correlation can be demonstrated between two independent detector systems, as viewed by a single observer. The following experimental is proposed, as empirical evidence of observer influenced particle collapse, to a measurable state (figure 11),

- Two parallel Stern Gerlach [11] electron deflector systems (*a and b*) emit respective single unpaired electrons (*e<sub>a</sub> and e<sub>b</sub>*), at regular intervals through an inhomogeneous magnetic field, toward their respective detector screens (*d<sub>a</sub> and d<sub>b</sub>*).
- The two separated and parallel electrons (*e<sub>a</sub> and e<sub>b</sub>*) are emitted in sync, such that they strike their respective screens (virtually) simultaneous.
- A single observer is oriented to view both detector screens (*d<sub>a</sub> and d<sub>b</sub>*), with the following constraints,
- Detector *d<sub>a</sub>* is viewed exclusively, by the observer's left field of vision, and detector *d<sub>b</sub>* is viewed exclusively, by the observer's right field of vision.

- The null hypothesis would expect a weak correlation of  $\pm \leq R 0.3$ , between the two systems spins. A reasonable sample size might be 500 unpaired electrons.
- A correlation value of  $\geq \pm R 0.5$  would demonstrate a **significant observer influenced particle bias. If proven, deterministic particle evolution would be of great benefit to science, and the field of Quantum Mechanics, in particular.**



**Figure 11:** Modified Stern Gerlach experiment to demonstrate a correlation between quantized electron states, and the polarized dual consciousness of the observer.

## 6 Conclusion

Recursive information exchange and the resulting low-entropy power-law distributions, are ubiquitous in Classic Space. **As RIE translate across scales of human conscious, ranging from neurological decision making to global information exchange, it's reasonable to assume that they also play a fundamental role in quantum decoherence.** Hypothesis ?? suggests that matter which is separated in  $\mathbb{R}^3$  spatial dimensions is actually connected in within a higher  $\mathbb{R}^4$  dimensional space, which provides a basis for entanglement at a remote distance. Conceivably, it could provide a radically alternate model of gravity as a repellent force of separation.

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### Declaration of Interests

The author declares that I have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

### Data Availability Statement

The author declares that no independent research data is included in this article.

### Funding Sources

The author declares that no institutional funding source exists for the publication of this article. The author is solely responsible for publication charges, from private resources.