HAUNTED QUANTUM ENTANGLEMENT

DOUGLAS SNYDER

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I AM GOING TO BE SPEAKING TODAY ABOUT HAUNTED QUANTUM ENTANGLEMENT. MY INTEREST IN THIS TOPIC GREW OUT OF READING ABOUT THE HAUNTED MEASUREMENT AND THE QUANTUM ERASER. I HAVE FIVE SLIDES THAT I INTEND TO USE TO ILLUSTRATE MY POINTS.

SLIDE 1 IS A DEPICTION OF:

- GREENBERGER AND YASIN’S HAUNTED MEASUREMENT

THERE IS A NEUTRON INTERFEROMETER WITH AN ISOLATED FLEXIBLE MIRROR APPARATUS ALONG ONE ARM.

WHILE THE NEUTRON PASSES THROUGH THE FLEXIBLE MIRROR APPARATUS, THERE IS WW INFORMATION REGARDING THE PATH OF THE NEUTRON. THE WW INFORMATION IS PRODUCED BY THE CHANGE IN MOMENTUM AND POSITION OF THE FLEXIBLE MIRROR APPARATUS THAT RESULTS FROM ITS INTERACTION WITH THE NEUTRON.
AFTER THE NEUTRON EXITS FLEXIBLE MIRROR APPARATUS, ALL WW INFORMATION IS ELIMINATED AND INTERFERENCE IS RESTORED AS IF THE WW INFORMATION NEVER EXISTED. THE ORIGINAL MOMENTUM AND POSITION OF THE FLEXIBLE MIRROR APPARATUS ARE RESTORED.

SLIDE 2 IS A DEPICTION OF:

- SCULLY, ENGLERT, AND WALTHER’S QUANTUM ERASER

AN ATOM ENTERS THE MICROMASER CAVITY SYSTEM, ON THE LEFT OF THE FIGURE, AND EMITS A PHOTON INTO ONE OF THE TWO CAVITIES. THE CAVITIES HAVE NO OTHER PHOTONS IN THEM, AND THEY ARE TUNED TO THE SAME FREQUENCY. THE CAVITIES ARE SEPARATED BY SHUTTERS. BETWEEN THE SHUTTERS IS A PHOTODETECTOR.


WHETHER OR NOT THE PHOTON IS DETECTED AT THE PHOTODETECTOR, WW INFORMATION IS LOST. THE RESULT IS
FRINGES AND ANTI-FRINGES WHEN ATOM DETECTION DATA AND PHOTODETECTION DATA ARE CORRELATED.

• THE AUTHORS OF THE ARTICLES ON THE HAUNTED MEASUREMENT AND THE QUANTUM ERASER ACKNOWLEDGED SIMILARITIES IN THEIR WORK.

• BOTH THE HAUNTED MEASUREMENT AND THE QUANTUM ERASER CREATE WHICH WAY INFORMATION THROUGH ENTANGLEMENT AND WW INFORMATION IS SUBSEQUENTLY ELIMINATED.

• THERE IS A DIFFERENCE BETWEEN THE HAUNTED MEASUREMENT AND THE QUANTUM ERASER:

  IN THE HAUNTED MEASUREMENT, INTERFERENCE IS RESTORED AS IF THE WHICH WAY INFORMATION NEVER EXISTED.

  IN THE QUANTUM ERASER, THERE ARE FRINGES AND ANTI-FRINGES THAT SUM TO AN OVERALL ONE WIDE HUMP INDICATIVE OF WHICH WAY INFORMATION.

• WHAT IS THE BASIS FOR THE DIFFERENCE IN THE DISTRIBUTION PATTERNS IN THE HM AND THE QE?

  IN A HAUNTED MEASUREMENT, THE ENTANGLEMENT IS LOST BEFORE ANY MEASUREMENT INFORMATION IS RELEASED TO THE
ENVIRONMENT. THE FLEXIBLE MIRROR APPARATUS IS ISOLATED.

IN THE QUANTUM ERASER, THE ENTANGLEMENT IS MAINTAINED. I SUSPECT THE ENTANGLEMENT IS MAINTAINED IN PART DUE TO THE RELEASE OF INFORMATION THAT A WW MEASUREMENT HAS OCCURRED WITH THE PASSAGE OF THE ATOM THROUGH THE DOUBLE SLIT. THE MM CAVITIES THEMSELVES ARE ISOLATED.

WITH THE OPENING OF THE SHUTTERS BETWEEN THE MM CAVITIES, INFORMATION REGARDING IN WHICH SPECIFIC MM CAVITY THE PHOTON WAS EMMITTED IS LOST. INFORMATION THAT A WW MEASUREMENT HAS OCCURRED IS PRESERVED DUE TO THE RELEASE OF THIS INFORMATION.

- IN A SETUP LIKE THE QUANTUM ERASER, CAN ONE OBTAIN INTERFERENCE AS IF THE WHICH WAY INFORMATION NEVER EXISTED AND WHERE THE WW INFORMATION WAS CARRIED BY THE PHOTON?

TO ACCOMPLISH THIS TASK, THE QE SCENARIO NEEDS TO BE CHANGED SO THAT THE ENTANGLEMENT BETWEEN THE PHOTON AND THE ATOM IS LOST BEFORE THE ATOM REACHES THE DOUBLE SLIT SCREEN.

SLIDE 3

THE ATOM ITSELF CARRIES WW INFORMATION BECAUSE THE MICROMASER CAVITIES ARE TUNED TO DIFFERENT FREQUENCIES. AT ONE EXIT OF THE MM CAVITY SYSTEM, AN RF COIL IS PLACED SO THAT IF THE ATOM PASSED THROUGH THE CAVITY ASSOCIATED WITH THAT EXIT, THE ATOM IS PLACED IN THE SAME STATE IT WOULD BE IN IF IT HAD EXITED THE OTHER CAVITY. THE RESULT IS AN INTERFERENCE PATTERN LIKE GREENBERGER AND YASIN’S, AS IF THE WW INFORMATION HAD NEVER EXISTED.

SLIDE 4

TO ACCOMPLISH THE GOAL OF OBTAINING INTERFERENCE AS IF WW INFORMATION NEVER EXISTED AND WHERE THE PHOTON CARRIED THE WW INFORMATION, A SINGLE WALL SEPARATES THE MICROMASER CAVITIES. THERE ARE RESERVOIRS OF CLASSICAL MICROWAVE RADIATION ADJACENT TO EACH MM CAVITY. IF THE CLASSICAL MICROWAVE RADIATION IS NOT RELEASED INTO THE MM
CAVITIES, THE RESULTING DISTRIBUTION OF THE ATOMS IS THE ONE WIDE HUMP CHARACTERISTIC OF WW INFORMATION.

- [SHOW SLIDE 2 AND POINT OUT ONE WIDE HUMP.]

SLIDE 5


ANY POSSIBILITY OF THE ATOM ITSELF CARRYING WW INFORMATION IS ELIMINATED BY PLACING AN RF COIL THAT EXTENDS A FIELD OVER BOTH PATHS FROM THE EXITS OF THE MICROMASER CAVITIES THAT PLACES THE ATOM IN THE STATE IT HAD BEFORE IT EMITTED THE PHOTON.

- THIS IS HAUNTED QUANTUM ENTANGLEMENT WHERE INTERFERENCE IS OBTAINED AS IF THE WW INFORMATION NEVER EXISTED AND THE PHOTON CARRIED THE WW INFORMATION FOR THE ATOM THAT IS DISTANT FROM IT. THE WW INFORMATION CARRIED BY THE PHOTON IS ELIMINATED AT A DISTANCE FROM THE
ATOM WITH THE LOSS OF THE ENTANGLEMENT BETWEEN THE ATOM AND THE PHOTON.

GREENBERGER AND YASIN DEMONSTRATED HAUNTED QUANTUM ENTANGLEMENT IN THEIR EXPERIMENT WHERE THEY OBTAINED INTERFERENCE AS IF THE WW INFORMATION PROVIDED BY THE FLEXIBLE MIRROR APPARATUS HAD NEVER EXISTED. WW INFORMATION IN THEIR HAUNTED MEASUREMENT, THOUGH, IS ELIMINATED BY A DIRECT INTERACTION BETWEEN THE FLEXIBLE MIRROR APPARATUS AND THE NEUTRON INSTEAD OF AT A DISTANCE BETWEEN THEM AS OCCURS IN THE HQE SCENARIO PRESENTED HERE.

PROVIDE REFERENCES –


Total recoil of 4-mirror device due to interaction with neutron is 0; total displacement of 4-mirror device is 0.

All of neutrons detected at F due to interference from recombining component wave functions. Arm lengths of the interferometer may be adjusted to support interference.

Figure 1: Interferometer with 4-Mirror Device Separated from the Environment: Component Wave Functions Are Recombined to Demonstrate Interference
cross section of double-slit screen
distribution patterns along screen

maser cavities with two shutters and photodetector

slit L
slit R

shutters
photodetector

collimators

laser

plane atom wave

Figure 2

Sub-interference pattern 1
Sub-interference pattern 2
Sample shape of distribution where micromaser shutters are closed and atoms have passed through the two-slit screen. This distribution is the sum of sub-interference patterns 1 and 2 where there is quantum erasure.
Basic features of experiment using a carefully tuned rf coil along one path proposed by Scully and colleagues where passage by coil changes state of atom on path to slit A to the same state the atom would have were it on path to slit B.

Figure 3
Distribution pattern for classic Young-like interference
Expected shape of distribution of atoms with one photon emitted by atom passing through cavity system and no injection of other photons of similar character (one-hump characteristic of which-way information).
Expected distribution associated with Young-like interference pattern where single photon emitted by atom passing through cavity system and classical microwave radiation injected into each cavity before atom reaches 2-slit arrangement.