

# SESSION 3

THE 8 THEORIES

10<sup>th</sup> MARCH 13.30

BY WAY OF REVISION:

A REALLY BIG TWO SLIT EXPERIMENT.

**BETELGEUSE**  
RED GIANT  
520 LIGHT YEARS

SINGLE PHOTON

STELLAR  
INTERFEROMETER  
NARRABRI

CELESTIAL MOUNT  
6 METRE MIRRORS

CORRELATOR  
ELECTRONICS

ACCURATE  
DRIVE SYSTEM

MATHS:

$$\Delta p \Delta x \gg \hbar$$

HEISENBERG SAYS

$\Delta p$  MUST BE VERY SMALL

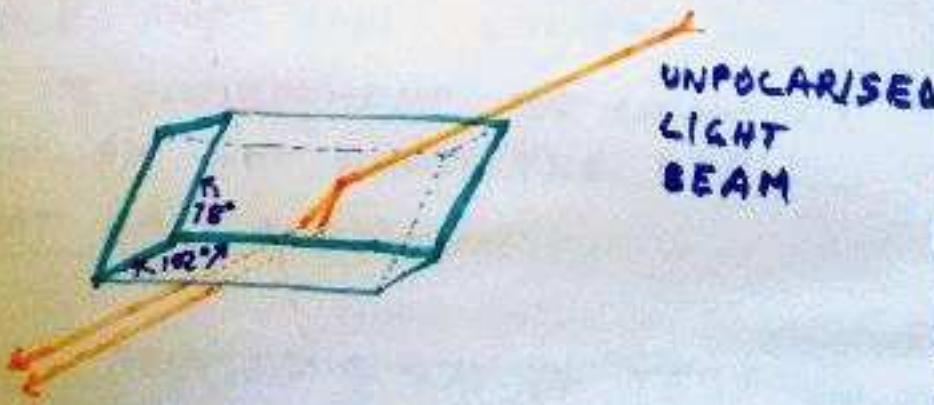
SO  $\Delta x$ , SIZE OF WAVEFUNCTION IS SURPRISINGLY BIG.

BACKGROUND: (FOR NEXT DIFFICULT SECTION)

CALCITE



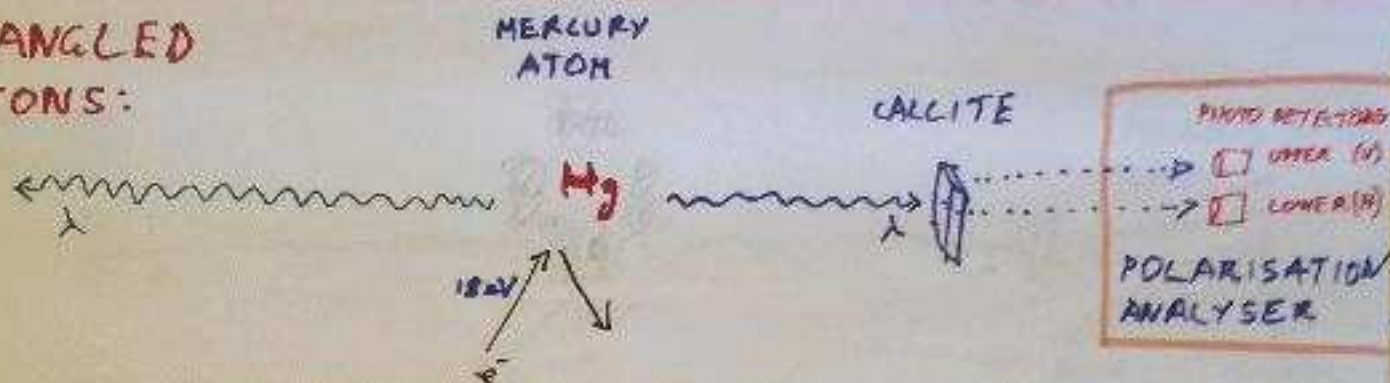
POLAR  
ANALYSIS  
CRYSTAL





# THE EPR PARADOX - EINSTEIN PODOLSKY ROSEN 1935

## ENTANGLED PHOTONS:



BLUE & GREEN PHOTONS CAN HAVE ANY POLARISATION, BUT THEY MUST AGREE FOR EACH PAIR - CONSERVATION OF ANGULAR MOMENTUM.

THE PARADOX: WHEN BLUE IS MEASURED GREEN BECOMES KNOWN.

GREEN ACQUIRES A POLARISATION ATTRIBUTE WHEN BLUE IS MEASURED  
 $\therefore$  IT MUST HAVE HAD IT ALL ALONG.

VON NEUMAN PROVED IN 1932 THAT THIS WAS IMPOSSIBLE.

ALSO HE EXTENDED THE ACT OF "MEASUREMENT" TO SEE OBSERVERS LIKE MICE AND CAMERAS AS ONLY PART OF A "CHAIN" LEADING TO CONSCIOUSNESS

BUT IN 1952 BOHM INVENTED A "HIDDEN VARIABLE" THEORY WITH INVISIBLE PILOT WAVES WHEREBY AN ELECTRON COULD SENSE ITS ENVIRONMENT AND CHANGE ITS ATTRIBUTES. EINSTEIN DID NOT WANT THE EPR PARADOX RESOLVED THAT WAY.

FINALLY JOHN BELL DEvised A WAY OF TESTING





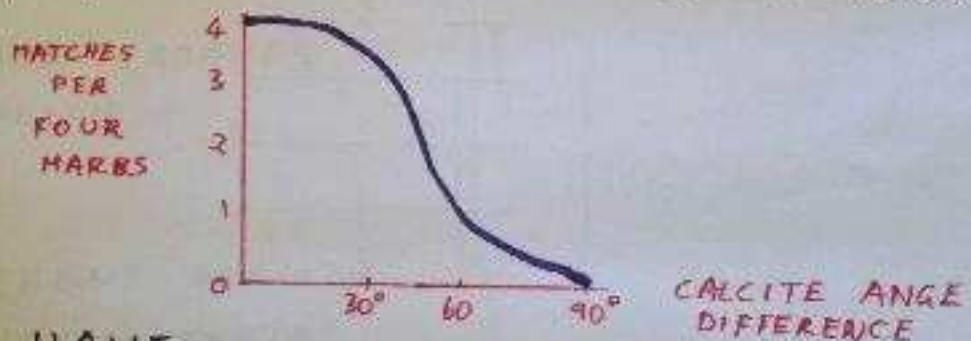


SO THE 'TAKEAWAY' FROM BELL'S THEOREM IS THAT TO BE SO RECALITRANT, BLUE PHOTON HAS TO KNOW WHERE THE GREEN CRYSTAL WAS POINTED, EVEN IF IT COULD HAVE MOVED WHILE BLUE WAS FLYING.  
∴ NON-LOCALITY IS INDICATED.

1972: CLAUSER DOES BELLS EXPERIMENT TO HIS SURPRISE BELL WAS RIGHT :-L

1982: ASPECT DOES A BETTER EXPERIMENT TO CLOSE LOOPHOLES CRITICS POINT TO

QUANTUM MECHANICS STICKS TO ITS PREDICTION:



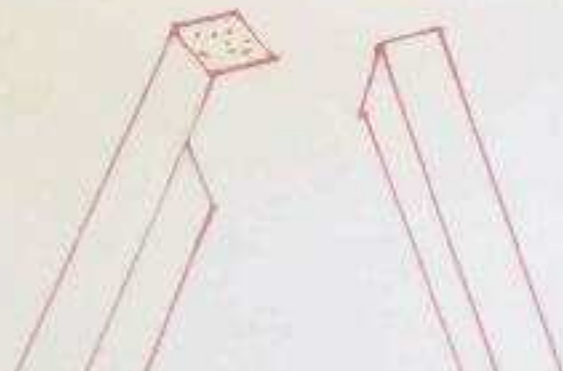
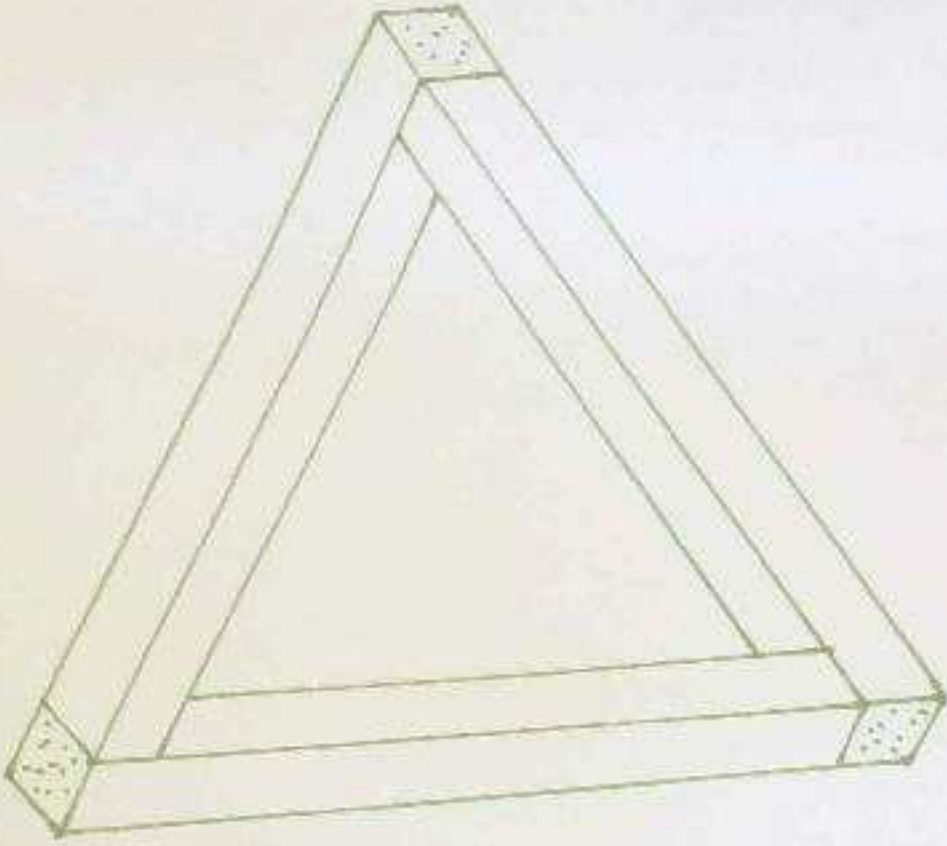
SO WE HAVE FASTER THAN LIGHT SIGNALLING, BUT WE CANT SEND MESSAGES.

SO AFTER ALL THIS  
HOW DO THE 8 THEORIES STACK UP?

- 1/ COPENHAGEN #1:  
NO REALITY, JUST FUNCTIONAL  
MATHS ✓
- 2/ COPENHAGEN #2:  
PARTICLES EXIST  
WHEN MEASURED |
- 3/ ONE REALITY... PARTICLES  
KNOW |
- 4/ MANY WORLDS ||
- 5/ QUANTUM LOGIC
- 6/ NEOREALIST  
A BETTER THEORY MIGHT EVOLVE ||||
- 7/ CONSCIOUSNESS CREATES  
REALITY |
- 8/ TWO DIFFERENT REALITY  
PHENOMENON & POTENTIAL |



AND WHAT NEXT? ARE WE A  
PROJECTION OF A BIGGER PLACE?



..... END OF COURSE ....