

# Two Creations

Is It Possible to Reconcile the  
Biblical and Cosmological Ages of

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# Summary

- Cosmological age of the Universe
- The age of the world according to Jewish Calendar
- Quantum-mechanical approach: role of conscious observer
  - Collapse of the wavefunction in the Copenhagen interpretation of QM
  - Many-world interpretation of QM
  - Futurist interpretation of QM
- The nature of time
- Two stories of creation
- Sabbatical cycles
- Witnesses in Halaha

# Introduction

- One of the central points of controversy on the science/religion debate is the question of the age of the universe.
- Doubt – the motto for science.
- Faith – the motto for religion.
- Science and religion can complement each other but should not contradict each other.

A 1999 Hubble image, known as the Deep Field South, showing a 12 billion-light-year corridor filled with thousands of never-before-seen galaxies

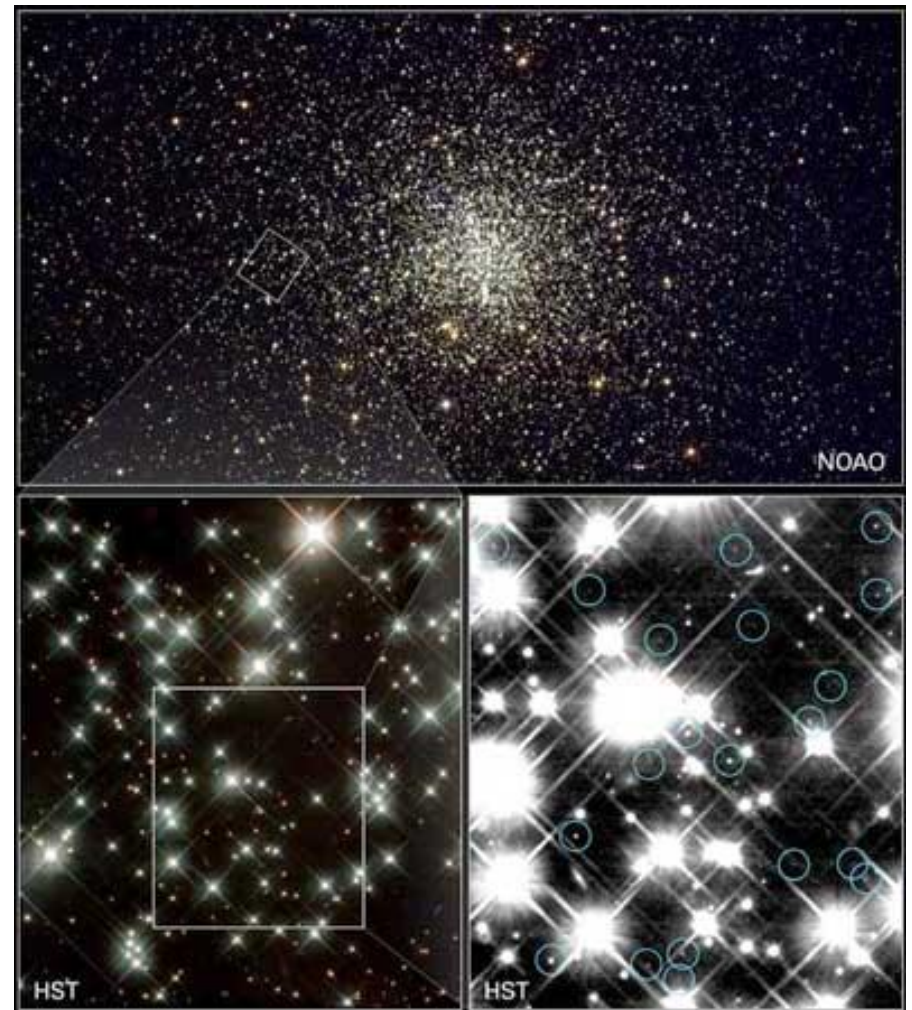


(NASA)

# The Oldest Star

Located in the globular cluster M4,  
white dwarfs are 12-13 billion  
years old

This observation places  
The age of the Universe  
In the range of 13-14 billion  
years



# Cosmological Age

- It is indisputable that the Universe is billions of years old
- This observation places the age of the Universe in the range of 13-14 billion years
- The current estimate of the age of the Universe is  $13.798 \pm 0.037$  billion

# Torah View

## The Jewish Calendar

- According to the traditional Jewish calendar we live now in the year 5775.
- Rosh HaShana is not the first day of creation. It is the fifth day of creation – the day on which Adam and Eve (Havah) were created.
- The calendar begins with the creation of Adam and Eve – the first human beings.

# Sabbatical Cycles

- According to Rabbi Nehunya ben HaKannah, at the time Adam was created the world was 42,000 years old.
- We live in the seventh cycle -- Shmita
- The Medrash states that there were 974 generations before Adam.



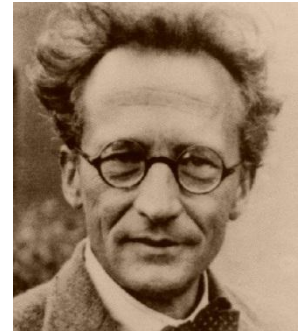
# Sabbatical Cycles

- “A Thousand years in Your sight are as a day”  
(Psalms 90:4)
- Divine year, equal to  $365\frac{1}{4}$  divine days, is  
365,250 terrestrial years.
- $365,250 \times 42,000 = 15,340,500,000$
- According to R. Nehunya ben HaKanah, as  
explained R. Isaac of Akko, at the time Adam  
was created, the universe was already more than  
fifteen billion years old!

# Quantum reality

## Particle-Wave Dualism

- In 1923, Louis de Broglie introduced wave-particle dualism.
- In 1926, Erwin Schrödinger formulated his famous equation for the wavefunction. This is the main equation of quantum mechanics.
- In 1926, Max Born noticed that the square of the amplitude of the particle wavefunction in a given region gives the probability of finding the particle in the given region.



# Collapse of the Wavefunction - The Measurement problem

- Schrödinger equation predicts probability distribution.
- When we make a measurement, we find a single value for the observable we measure.
- It looks as if the cloud of probabilities have collapsed into a single point – this is known as the *collapse of the wavefunction*.
- The collapse of the wavefunction doesn't follow from the Schrödinger equation.
- Copenhagen interpretation of quantum mechanics is to attribute the collapse of the wave function to the interaction of a microscopic particle with a macroscopic measurement apparatus.

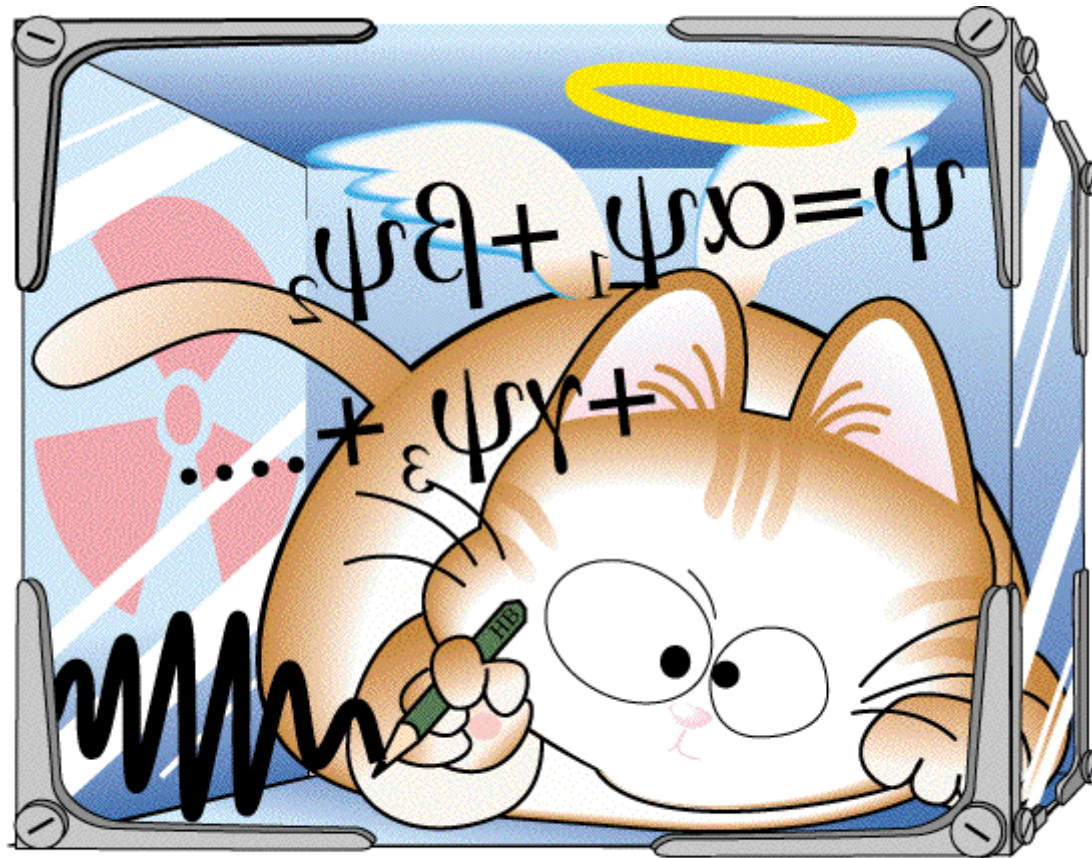
# Superposition

- Superposition. Quantum mechanical systems are described by their states. There are pure states, such Spin Up or Spin Down; Polarization is vertical or Polarization is horizontal.
- In classical physics only pure states are allowed. In QM, superposition of pure states is allowed:
- $C = A + D$
- Spin can Up and Down at the same time.

# Entanglement

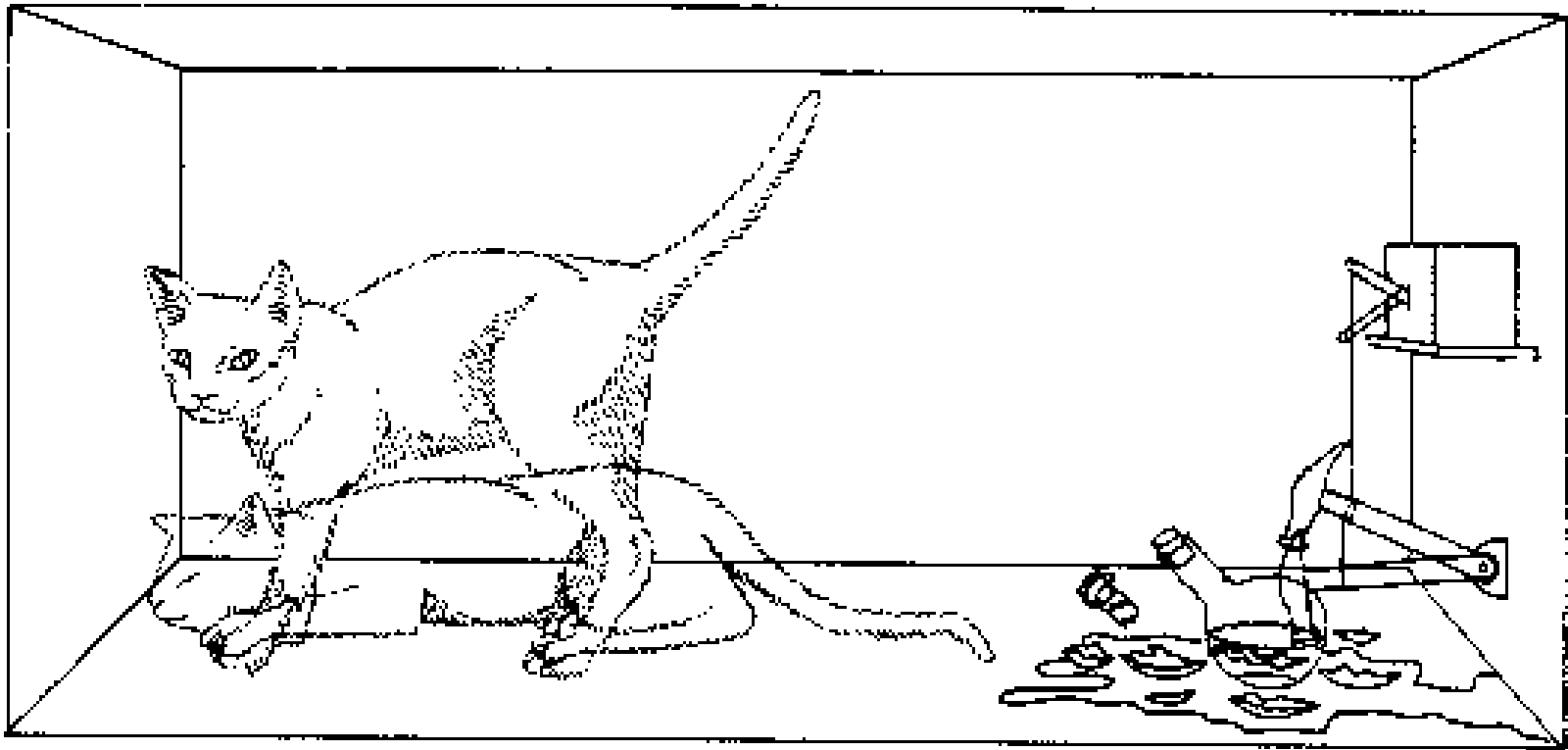
- Two particles that have interacted are entangled.
- Entangled particles are described by the same wavefunction or the same state
- If we fix the state of one particle in the entangled pair, the state of the other particle is fixed immediately.

# Schrödinger's Cat



*JPS*

# Schrödinger's Cat



# Role of a Conscious Observer

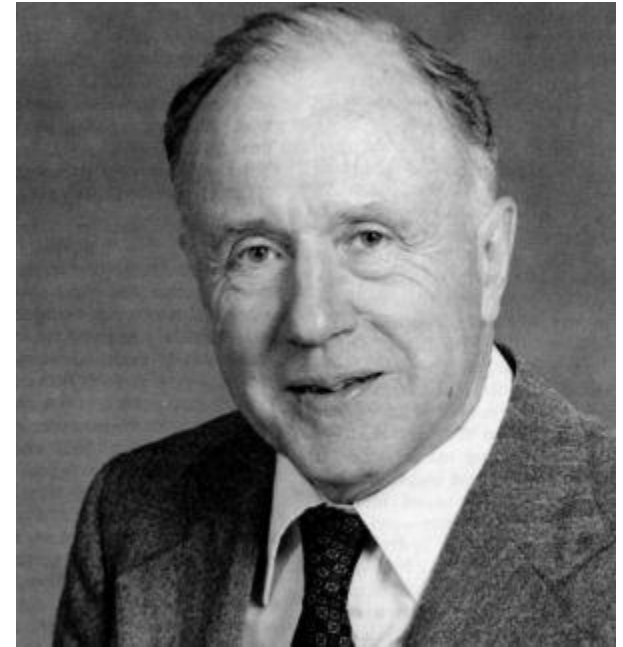
- In 1932 Von Neumann made a startling suggestion that it must be a conscious observer who causes the wavefunction to collapse.
- In 1961, Eugene Wigner posed a question: whose mind exactly collapses the wavefunction?





# Human Observer as a Midwife In the Birth of the Universe

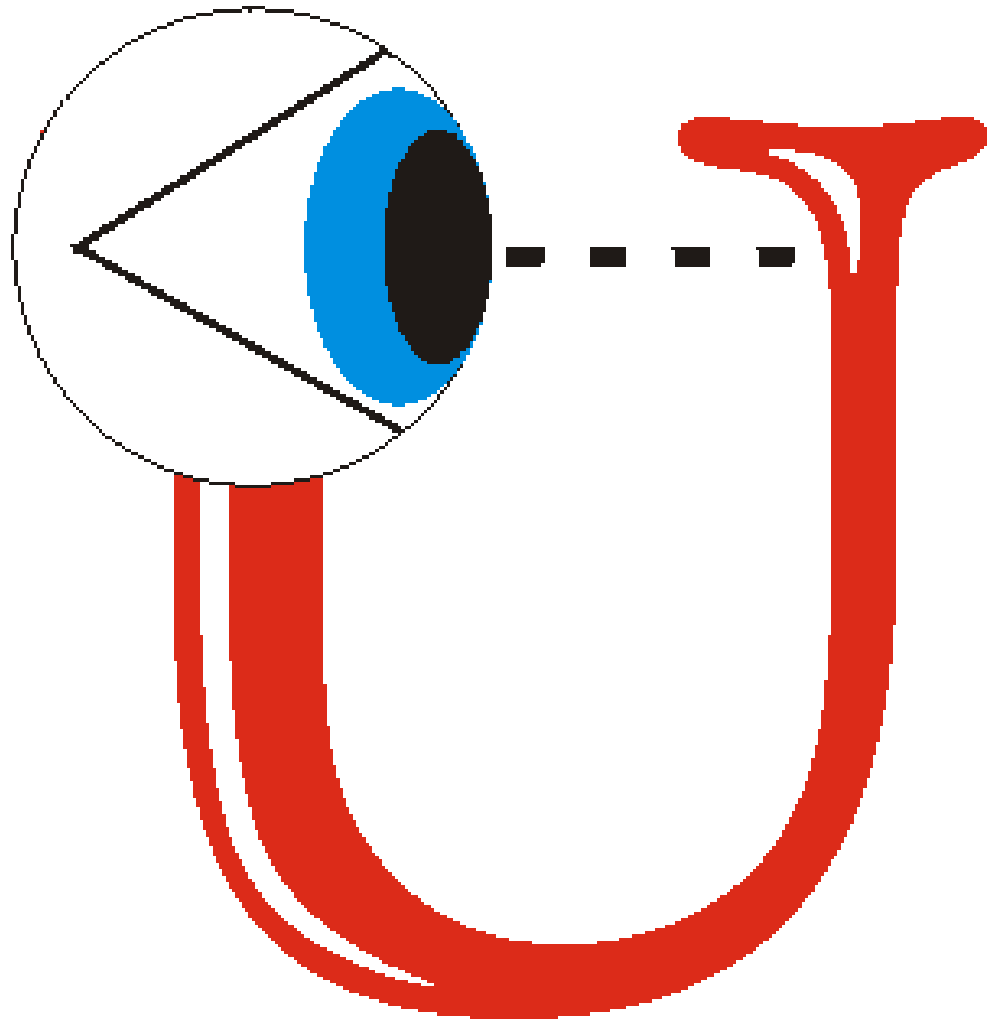
- John Wheeler proposed that the universe needs a human observer in order to come into existence.
- The universe is like a giant Schrödinger cat who is awaiting its observer to find out whether it is alive or dead.
- Man brings the universe into existence from its undefined state of mathematical probabilities.
- The great paradox of the Creation is that if the universe was ever born, it needed a human for a midwife.



## The Universe Looks Back at Itself Through the Eyes of Conscious Observer Who in Turn Sees the Universe into Existence

“Acts of observer-participancy in turn give tangible reality to the universe not only now but back to the beginning.”

J. Wheeler

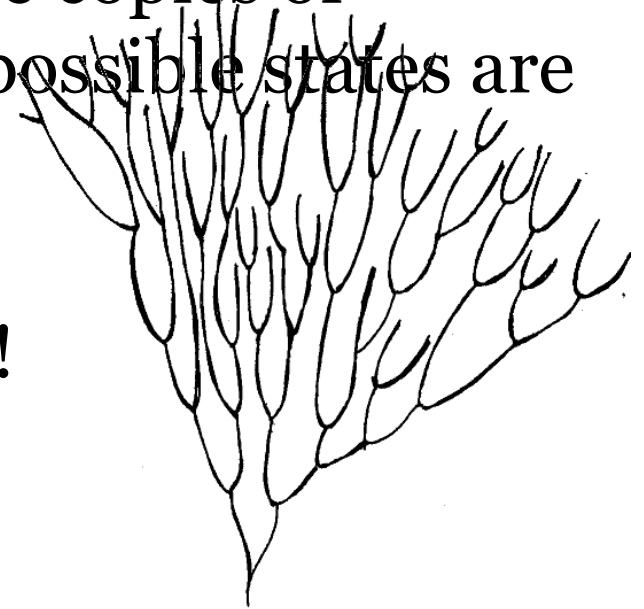


# Two Creations

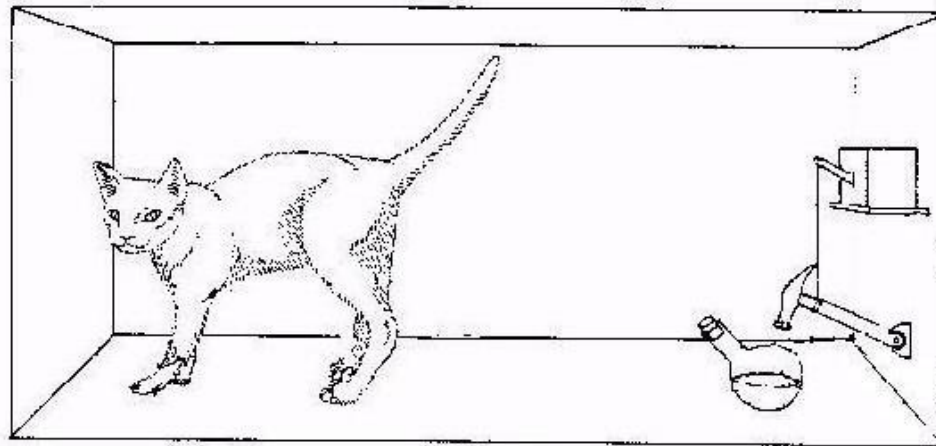
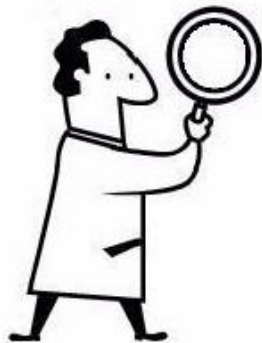
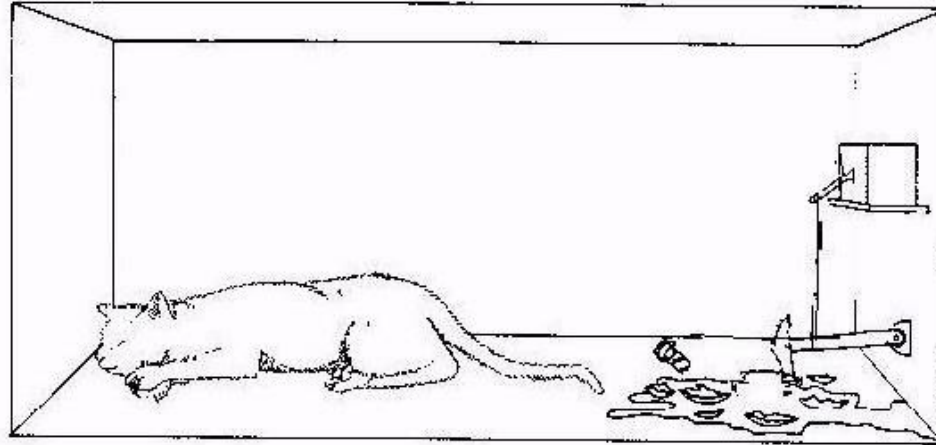
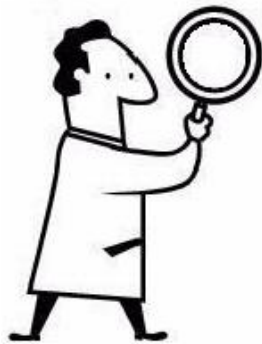
- Two creations
- The date of universe's conception
- The date of universe's birth
- The real age of the universe may, by definition, be no greater than the age of the first human observer who collapsed the world wavefunction

# Many-Worlds Interpretation of Quantum Mechanics

- According to Everett's Many-World interpretation of QM, every transition between quantum states splits the universe into multiple copies or "branches" in which all of the possible states are realized.
- The observer is also split.
- Schizophrenia with vengeance!



# Many-Worlds Interpretation of Quantum Mechanics



# Quantum Cosmology

- Quantum cosmology propose that the Universe has evolved for billions of years as a “multiverse,” i.e. collection of many parallel universes quantum-entangled until one of this universes is chosen, according to the Antropic principle, as the only universe suitable for human habitation.

# Futuristic Interpretation of Quantum Mechanics

- In 2002, A. Poltorak proposed that the uncertainty of quantum system is due to the fact that, until synchronization of clocks, a quantum system is in the future of the observer.
- An act of experiment, which synchronizes clocks brings quantum system into the present of the observer.
- “Collapse of the wavefunction” is merely reducing many possibilities of the future into a single reality of the present.

# Schrödinger Cat in Different Interpretations of QM

	Before box is opened	After box is opened
<b>Classical physics</b>	The atom either decays and kills the cat or not. At all times, the cat is either dead or alive	Observer finds the cat either dead or alive.
<b>Copenhagen interpretation of QM</b>	The atom exists in an entangled state of decay/non-decay; the cat is in an entangled state of being dead/alive at the same time.	Observer collapses the wavefunction, retroactively “causing” the atom to decay and kill the cat or not.
<b>Many-Worlds interpretation of QM</b>	The radioactive atom causes the universe to branch out into two copies: in one, it decays and kills the cat; and in the other, it doesn't. The cat is alive in one branch of the universe and is dead in the other.	Observer is split into two carbon-copies. One observer finds the cat alive in one universe and the other copy of the observer finds the cat dead in the other universe.
<b>Futuristic interpretation of QM</b>	Until the measurement, observer's clock is not synchronized with a clock in the box, each being in separate frames of reference. From the observer's vantage point, a possible decay of the atom and resulting demise of the cat are indeterminate because they are in the observer's future. From this point of view, cat is neither dead nor alive simply because it hasn't had a chance to die yet, as far as the observer is concerned.	Opening of the box, resulting in the exchange of information, synchronizes the clocks in two reference frames, one associated with the observer, and another, associated with the quantum-mechanical system. This brings the quantum-mechanical system into the observer's present allowing the observer to decide whether the cat is dead or alive. The “collapse of the wavefunction” is nothing more than a transition from future into the present.



# Adam as the First Observer

- Adam and Eve were the first fully conscious beings – the first observers.
- “And God blessed the seventh day, and sanctified it; because on it He had rested from all his work which God created to make”  
(Genesis 2:3)

# Both Ages are Real

- Both time periods representing respectively pre-human (“proto-physical”) and human (physical) stages of the universe history are real.
- Cosmologist who claims that the universe is 13.8 billion years old is right.
- A believer who refers to a biblical age of the world in terms of a few thousand years is also right.
- This approach allows us to rationally resolve the apparent contradiction between the scientific and the biblical ages of the universe.

# Resolution of the Dispute regarding Sabbatical Cycles

- According to the school of R. Nehunya ben HaKannah, as explained by R. Isaac of Akko, the universe existed for over fifteen billion years before creation of Adam.
- The Lurianic School of kabbalah maintained that this took place in the spiritual rather than physical realm.
- Quantum mechanics confirms that prior to the first human, the world indeed existed on a different (“proto-physical” or spiritual, in some sense) plain described by purely mathematical constructs such as the wavefunction.

# Biological Evolution

- Wavefunction evolves in time.
- Collapse of the wavefunction brings its past history into a reality.
- Biological evolution may have begun millions of years ago but remained in the abstract world the protophysical world.
- Collapse of the wavefunction by the first humans brought into reality plants and animals that had been evolving for over millions of year on planet Earth.
- When carbon-dating fossils, we measure dates of the events as they occurred in protophysical world before the collapse of the wavefunction by the first humans.

# Witnesses

- Two types of witnesses:
  - Clarifying witnesses – *eidei birur*; and
  - Establishing witnesses – *eidei kiyum*.
- Two interpretation in the Zohar III, 86
  - “You are my witnesses, says God.” (Isaiah 43:10)
  - “I call heaven and earth as witnesses.” (Deut. 30:19)
- Scientists are clarifying witnesses
- Jews are establishing witnesses

# Conclusions

- The history of the universe is comprised of two main periods: pre and post human.
- In the first period, before a first conscious observer peered into the universe, which lasted 13.8 billion years, the universe was in an amorphous proto-physical state, in an fuzzy state of linear superposition of all possible states.
- When the first humans opened their eyes, they collapsed the world wavefunction and brought the universe into actual physical existence.
- From that point on the Bible and the humanity began counting the new age of the universe.

# Further Reading

1. Alexander Poltorak, “*On the Age of the Universe,*” *B’Ohr Hatorah* (2002) vol. 13, pp.19-37  
([www.quantumtorah.com/towards-reconciliation-of-biblical-and-cosmological-ages-of-the-universe](http://www.quantumtorah.com/towards-reconciliation-of-biblical-and-cosmological-ages-of-the-universe))
2. Alexander Poltorak, “*The Age of the Universe: Using the Many-Worlds Interpretation of Quantum Mechanics,*” *B’Ohr Hatorah* (2008) vol. 18, pp. 149-168.  
([www.quantumtorah.com/on-the-age-of-the-universe-in-the-many-worlds-interpretation-of-quantum-mechanics](http://www.quantumtorah.com/on-the-age-of-the-universe-in-the-many-worlds-interpretation-of-quantum-mechanics))
3. Alexander Poltorak “*On the Nature of Time and the Age of the Universe.*” (Presented at the International Torah and Science Conference, Miami, 2005)  
([www.quantumtorah.com/on-the-nature-of-time-and-the-age-of-the-universe](http://www.quantumtorah.com/on-the-nature-of-time-and-the-age-of-the-universe))

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