به نام خداوند جان افرین

حکیم سخن درزبان افرین

سعدی – بوستان

The Role of Quantum Phenomena in Human Brain Function .

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در پس هر ذره درگاهی دگر

پس ز هر ذره به او راهی دگر

عطار

Topics that will be discussed

1. Quantum physics
2. The principles of quantum physics
3. Theories of quantum consciousness
4. The role of quantum in biological systems
5. The role of microtubules in the quantum brain
6. The role of spins in the brain

THE DIFFERENCE BETWEEN

Classical physics

Predictable rules.

Definite concepts

No effect of particle size

&

Quantum physics

Uncertainty 

Wave-particle phenomena

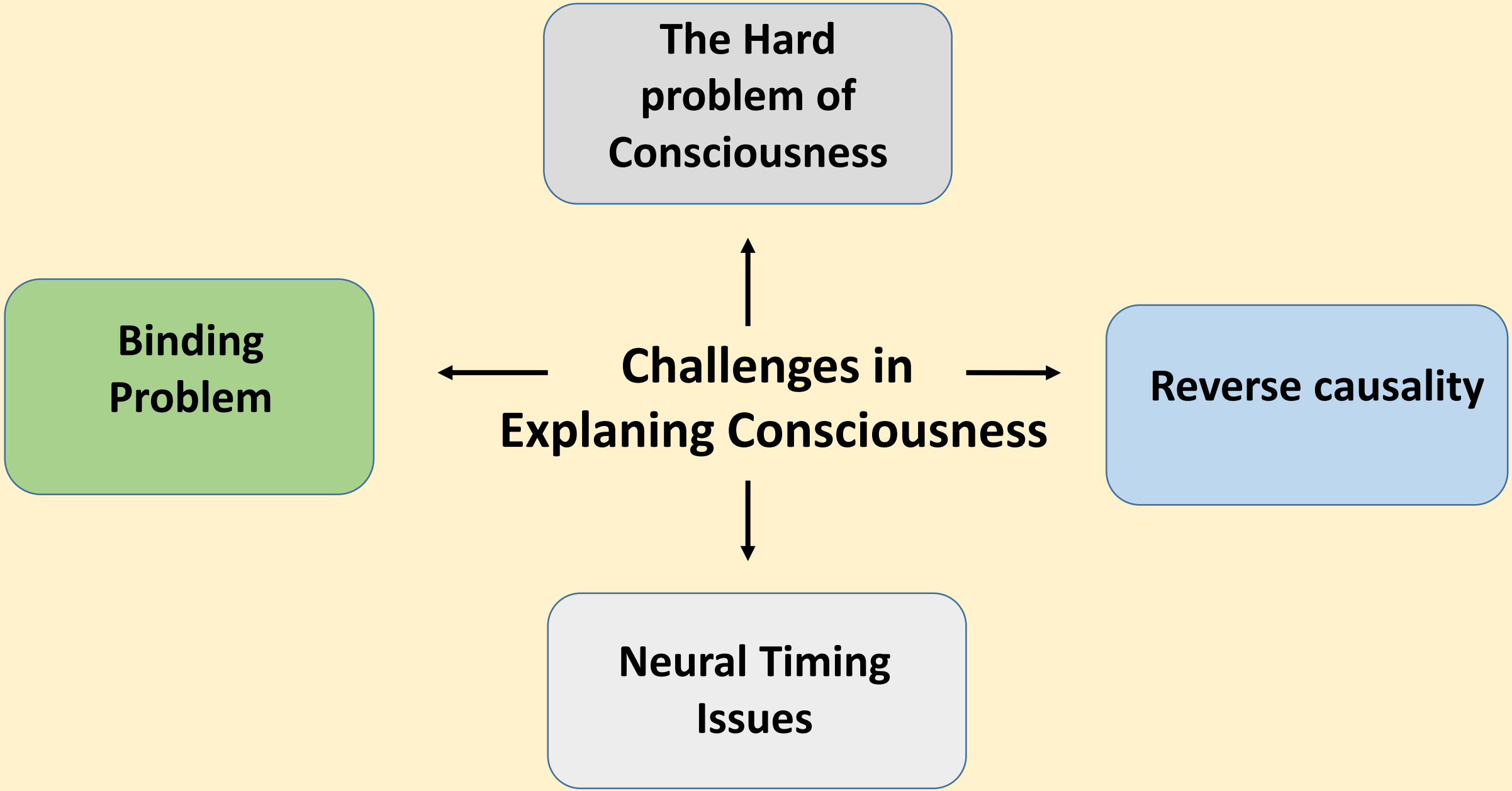
The principle of overlap and superposition

Why was the theory of quantum mind proposed?

The complex and inexplicable nature of consciousness

The inability of classical physics to model the brain

Similarities between quantum mechanics and mental performance


The Hard problem of Consciousness
Binding Problem
Challenges in Explaning Consciousness
Reverse causality
Neural Timing Issues

Subatomic particles the invisible world of matter

Structure of subatomic particles

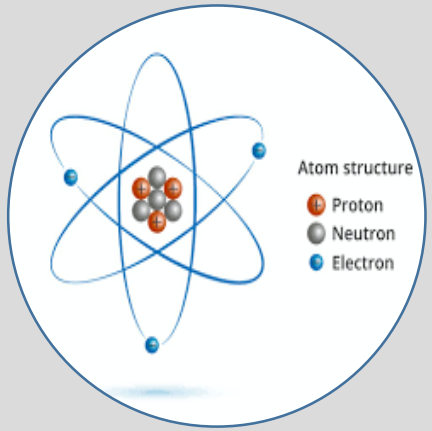
Matter is made of **atoms** ,
atoms consist of **subatomic particles**:

Fermions :
(buiding blocks matter)
Quarks (6 type) :
protons and neutrons
leptons :
includes the electron ,muon ,tau

2 .bosons :(force carrier)
Photon :(electromagnetism)
gluon,:(strong nuclear force)
W&Z bosons: (weak nuclear force)
graviton(gravity)
Higgs (mass- giving)

Elecrton
the bridge between matter and energy

- A lepton with a negative charge
- Moves around the nucleus according to quantum models
- Wave-particle duality : exhibits both particle and wave properties
- Leads to quantum machanism and the possible role of consciousness in particle behavior



Quantum physics
Key principles

1

Superposition - (wavefunction collapse)

→

Particles exist in multiple states until observed

Interconnected particles that instantly affect each other , regardless of distance

←

Entanglement

2

3

Heisenbergs Uncertainly Principle

→

Exact position & momentum cant be measured simultaneously

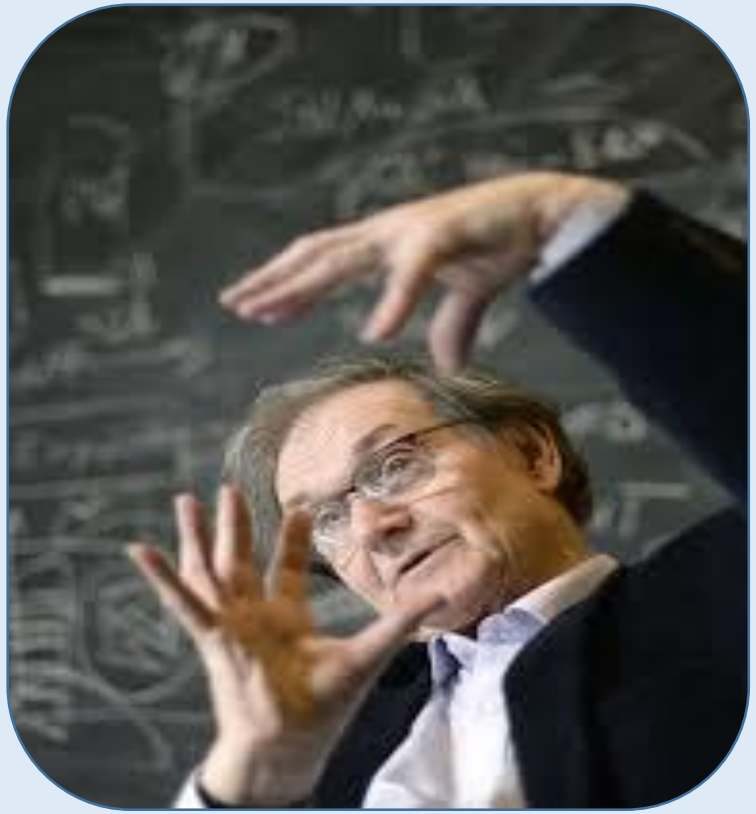
Particles act as both waves and particles

←

Wave –Particle Duality

4

Roger Penrose
Quantum consciousness Theory

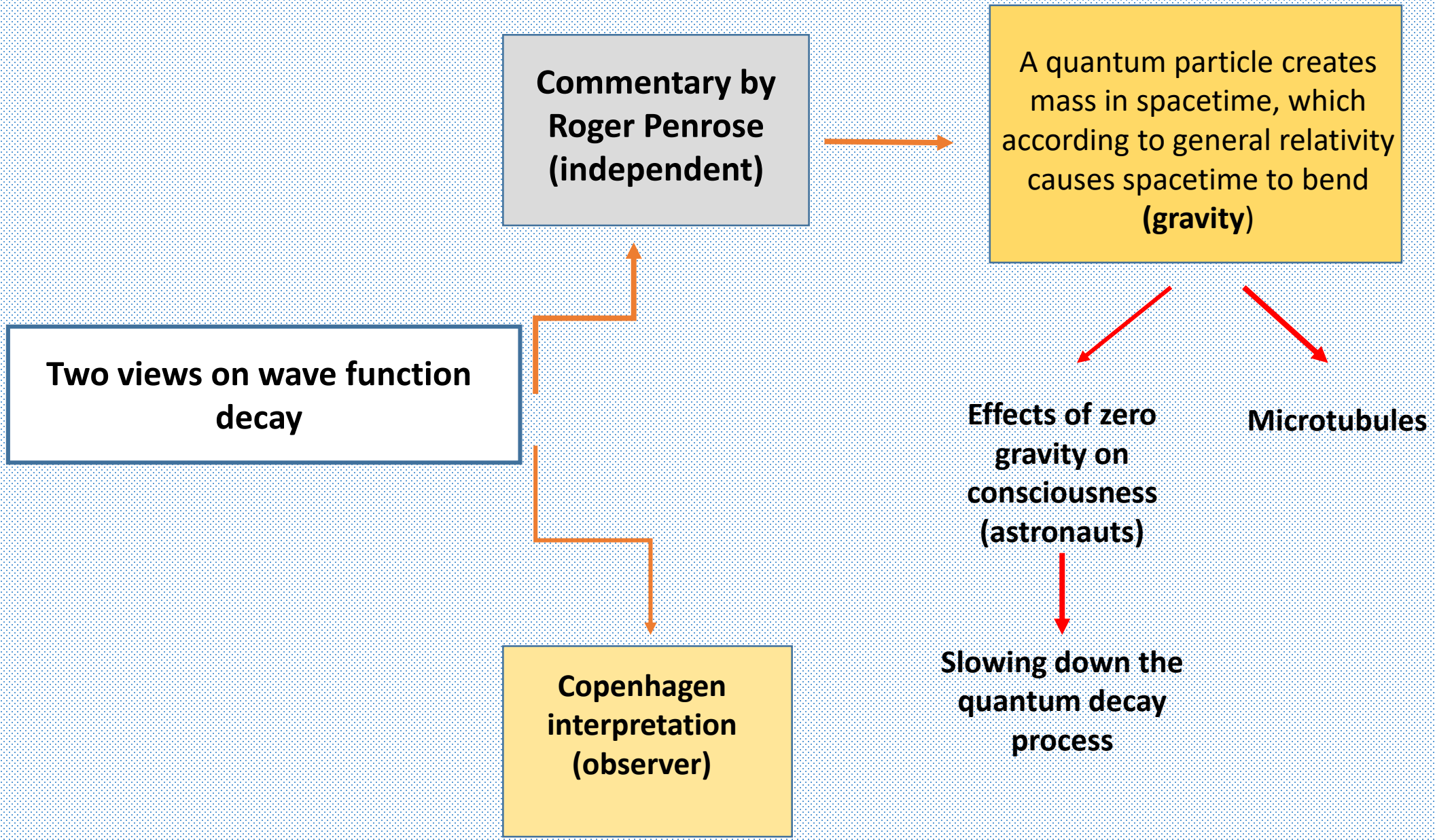


Orchestrated Objective Reduction (Orch OR) – Penrose & Hameroff

Consciousness & Quantum :
Consciousnee results from Quantum processes in Microtubules

Microtubules :
Quantum structures in neurons

Objective Reduction (OR):
Quantum superposition leading to Consciousness


Commentary by Roger Penrose (independent)
A quantum particle creates mass in spacetime, which according to general relativity causes spacetime to bend (gravity)
Two views on wave function decay
Effects of zero gravity on consciousness (astronauts)
Microtubules
Slowing down the quantum decay process
Copenhagen interpretation (observer)

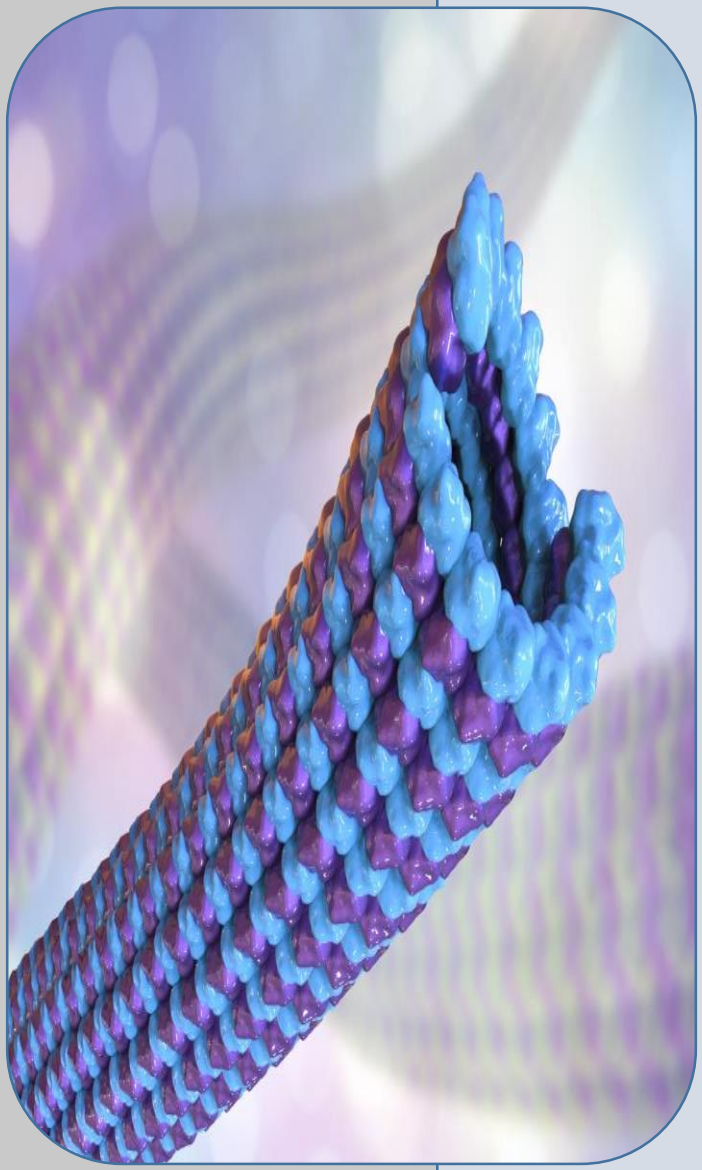
Microtubules
Physical properties

Size : 25 nm in diameter
(Isolated environment, superposition deja vu ,

Structure:
can grow and shrink quickly
(dynamic instability)

Hydrophobic properties

effect in anesthesia



Microtubules geometric feature

Shape :

Cylinder with a helical arrangement of tubulin dimers

Semi-hexagonal ☆

Symmetry:

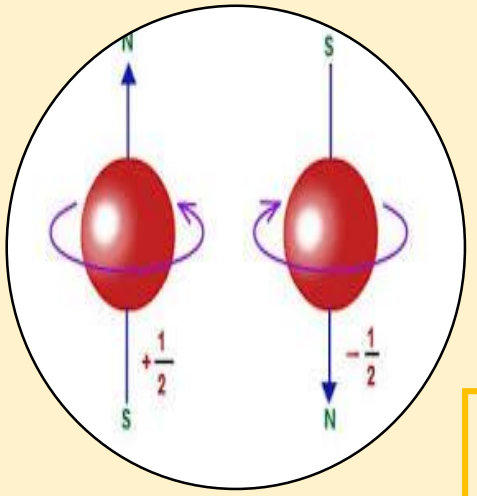
Radial symmetry (13 protofilaments)

Flexibility:

Ability to bend and adapt

Connection:

Creating a network



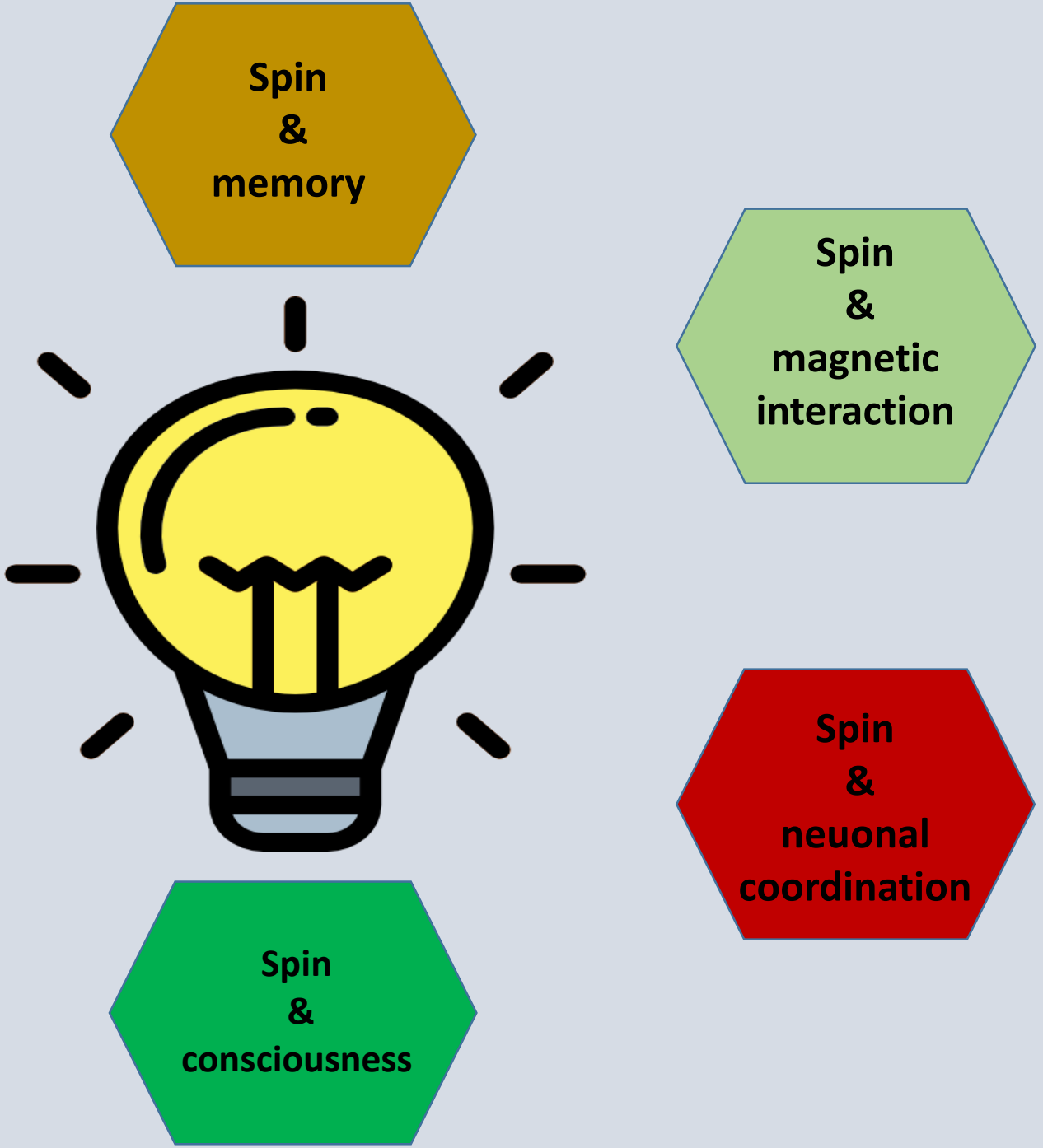
Spin and Quantum Effects in the Brain

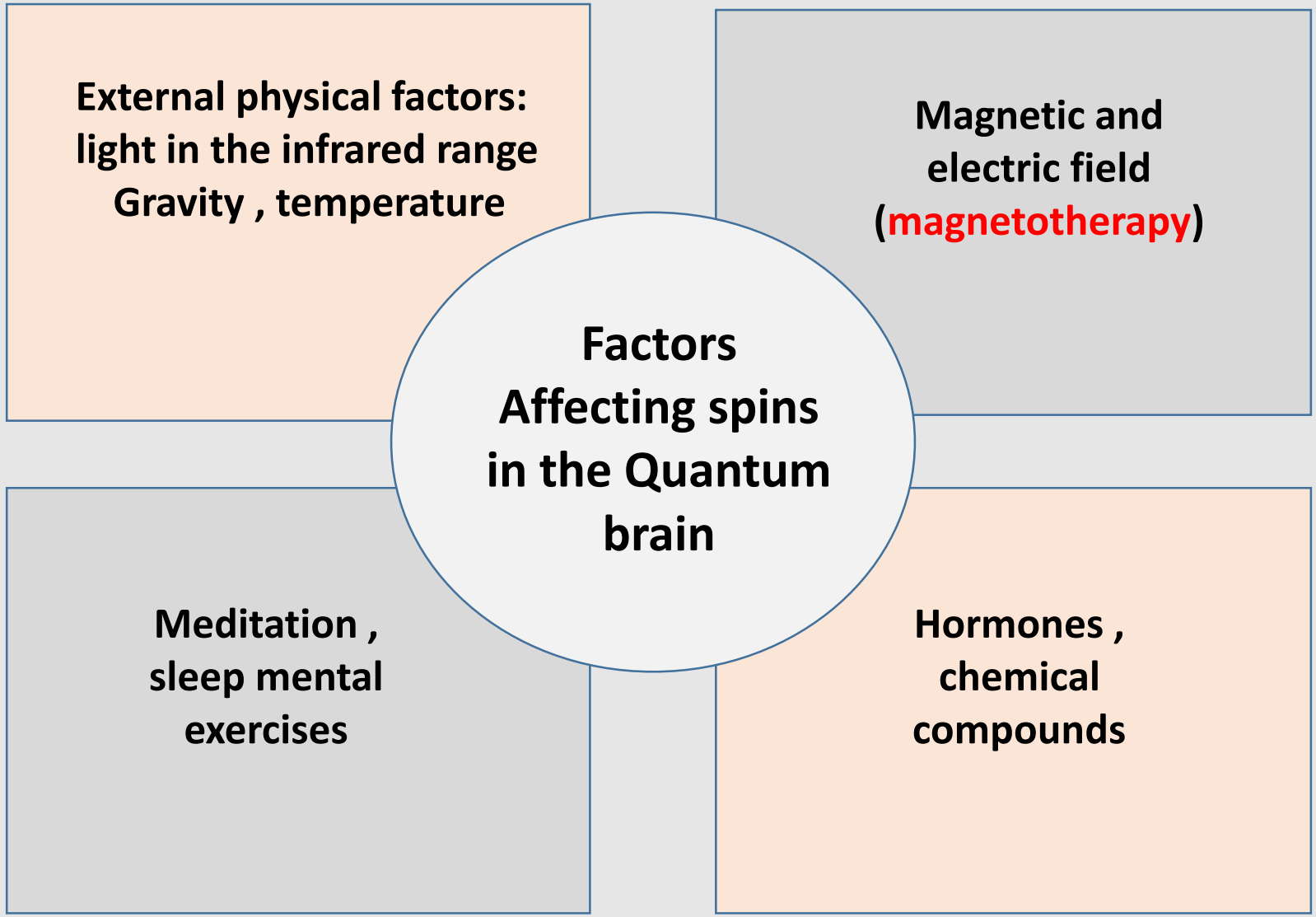
Spin
quantum property of electrons , behavior different from classical particles

Spin creates
magnetic momentum , enables quantum superposition

The effect of spin on the interaction of atoms:
magnetic interaction
(effect on the physical and chemical properties of matter)
Entropy and quantum equivalence

The Role of spins in the brain




External physical factors:
light in the infrared range
Gravity , temperature
Magnetic and
electric field
(magnetotherapy)
Factors
Affecting spins
in the Quantum
brain
Meditation ,
sleep mental
exercises
Hormones ,
chemical
compounds

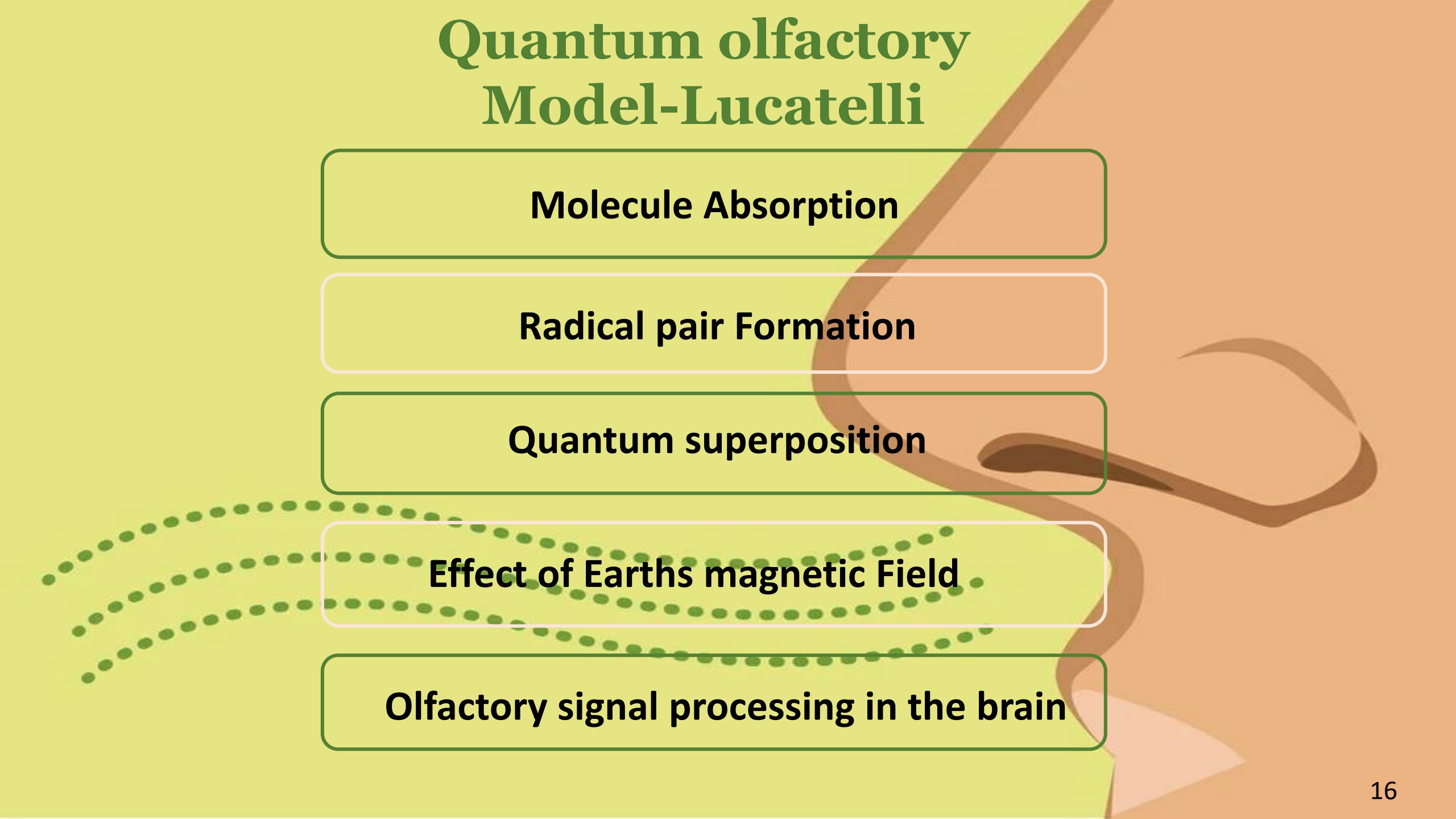
بیرون ز تونیست هر چه در عالم هست

در خود بطلب هر انچه خواهی که توئی

مولانا

Biological models in quantum

Quantum olfactory Model-Lucatelli



- Molecule Absorption
- Radical pair Formation
- Quantum superposition
- Effect of Earths magnetic Field
- Olfactory signal processing in the brain

Quantum mechanics in photosynthesis

Photon absorption
by chlorophyll molecule, An exciton is created

superposition (Quantum coherence)
Exciton moves through multiple pathways simultaneously

Optimal path selection
Coherence helps find the fastest rout

Quantum tunneling
Electrons move through the electron transport chain

Energy conversion :
ATP& NADPH are produced for calvin cycle

Quantum Model of Bird Navigation

Light activation:
(stimulation of cryptochrome protein)

↓

Radical Pair Formation:
(excited elecrton pairs in a superposition)

↓

magnetic field Interaction :
change of spin state

↓

Neural signal generation

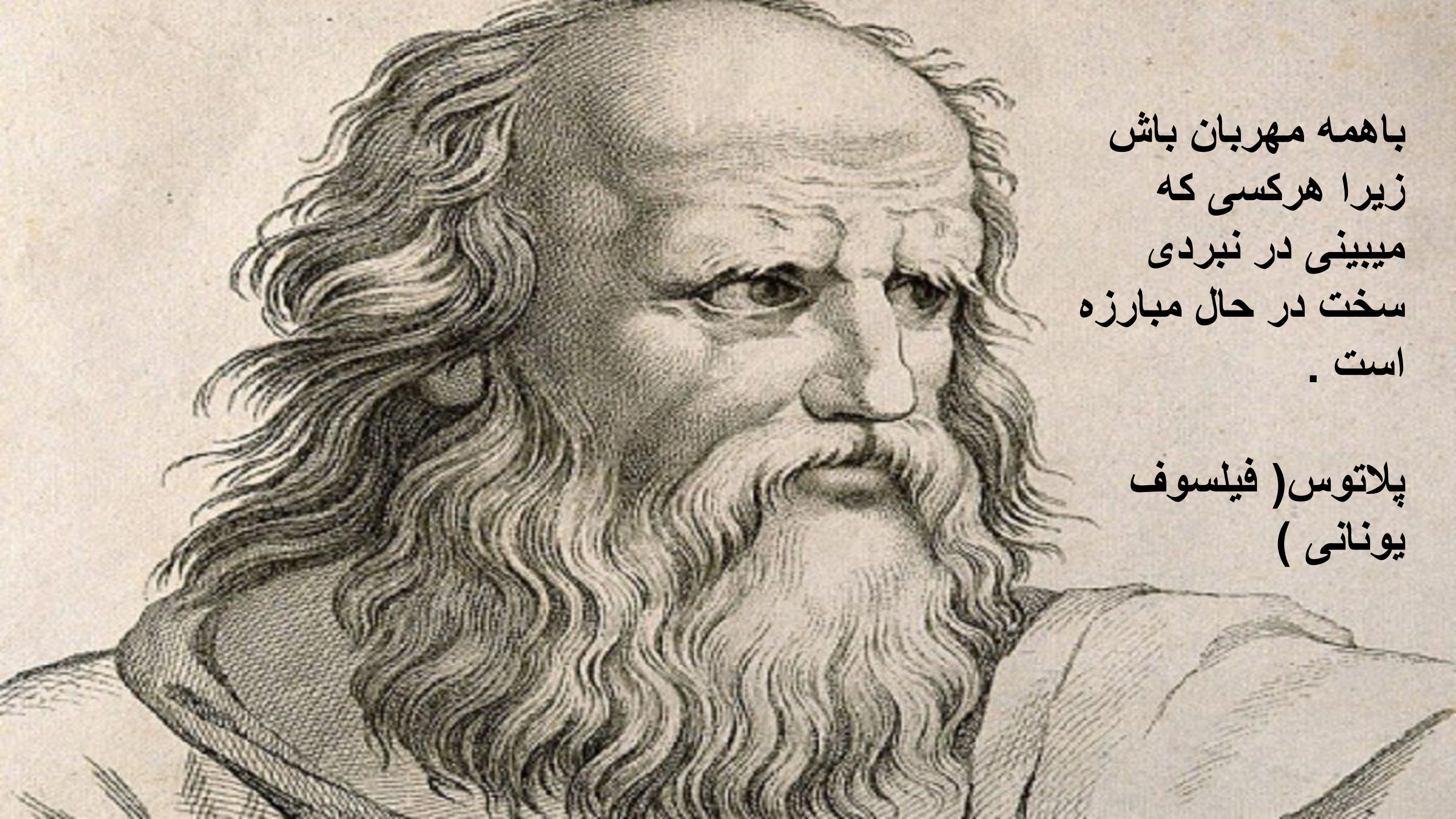
↓

Navigation : Birds perceive a **magnetic map**

Challenges and criticisms to the theory of quantum superposition in biological systems (including the theories of Teg-mark)

criticisms to the theory of quantum superposition

- Lack of empirical evidence
- Effect of hot and humid environment on quantum effects
- Decoherence problem
- ✓ Teg-mark confirmation in photosynthesis



باهمه مهربان باش
زیرا هرکسی که
میبینی در نبردی
سخت در حال مبارزه
است .

پلاتوس(فیلسوف
یونانی)


دیر گاهیست که افتاده ام از خویش به دور
شاید این عید به دیدار خودم هم بروم...
قیصر امین پور