

On principles of repulsive gravity: the Elementary Process Theory

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overview

acronyms:

- EPT: Elementary Process Theory
- GR: General Relativity
- WEP: Weak Equivalence Principle
- QM: Quantum Mechanics
- SM: Standard Model
- SR: Special Relativity

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CONTAINS PHILOSOPHICAL ARGUMENTS!

overview



*"experiment is **the sole judge** of scientific truth" ---Richard Feynman*

current state of affairs:

matter-antimatter repulsive gravity **cannot** be ruled out

purpose of this talk:

comprehensible introduction to the principles of the EPT
no other theory gives deeper explanation of repulsive gravity

overview

In this talk:

1. why principles of repulsive gravity are outside GR and QM
2. EPT: elementary principles underlying repulsive gravity
3. how the EPT corresponds with SR
4. future research

1: why outside GR and QM

repulsive gravity is a fact of nature



Morrison & Gold (1957): $\bar{m}_i > 0 \wedge \bar{m}_g < 0$

for rest-mass-having antimatter



- WEP: $m_i = m_g$ for all particles **VIOLATED!**
- C-inversion: $\bar{m}_g = C(m_g) = m_g$ **VIOLATED!**

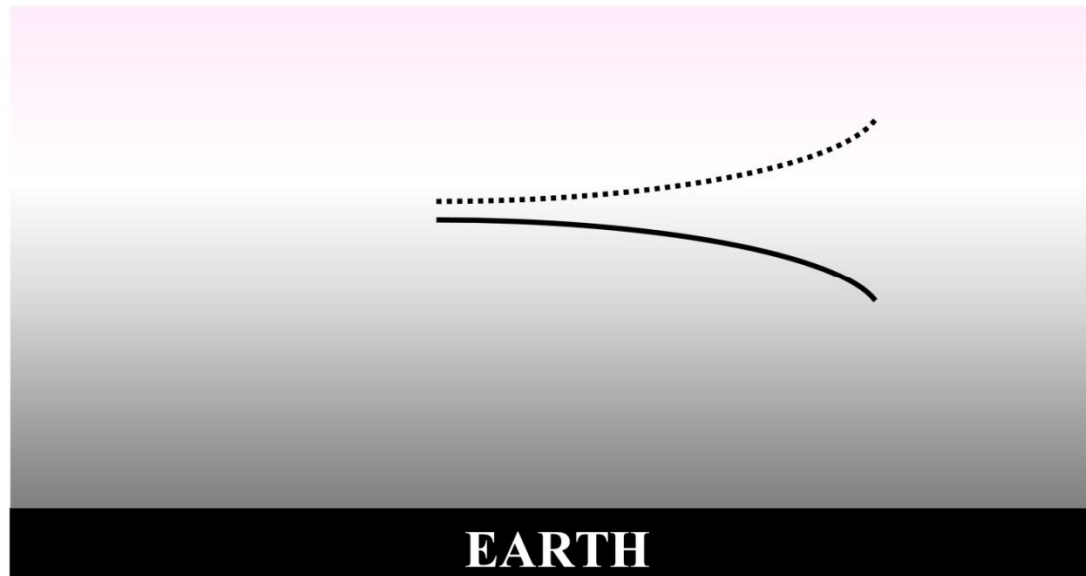


GR and the SM are not correct!

1: why outside GR and QM

R.M. Santilli (1999), M. Villata (2011):

- principle of gravity as in GR
- antimatter “sees” an ‘inverted’ space-time

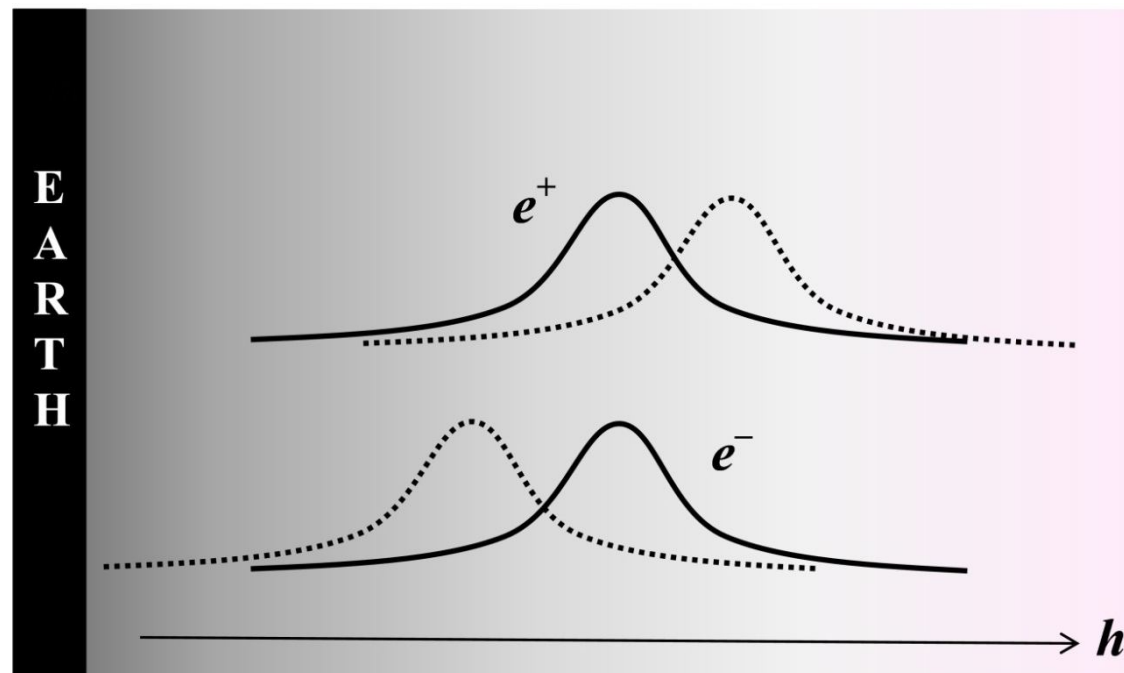


- extensions of GR are **consistent** with antimatter antigravity!
- but: **empirically inadequate**

1: why outside GR and QM

Kowitt (1996), extension of Dirac theory:

- positron is hole in sea of electrons with $E < 0$ and $m_g > 0$
- gravitation described by potential Φ_g in wave equation

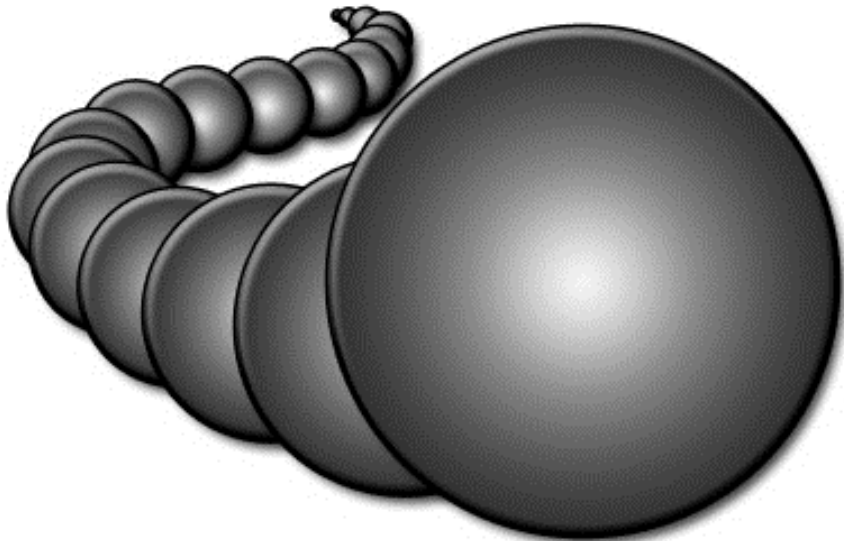


- this adjusts the C-inversion!
- but: **inconsistent with Eötvös-like experiments**

2: principles of repulsive gravity of the EPT

EPT:

- finitely many integer-valued **degrees of evolution**
- at every degree of evolution:
finitely many **processes** to the next degree of evolution

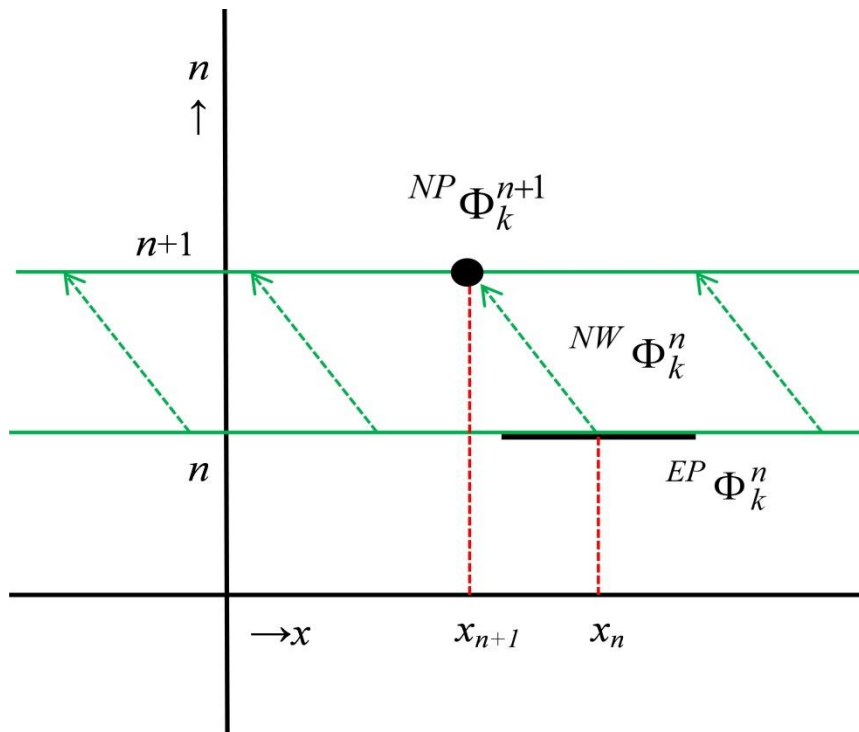


**stepwise motion:
every step is a 'leap'
from one
'degree of evolution'
to the next**

2: principles of repulsive gravity of the EPT

k^{th} process from n^{th} to $(n+1)^{th}$ degree of evolution:

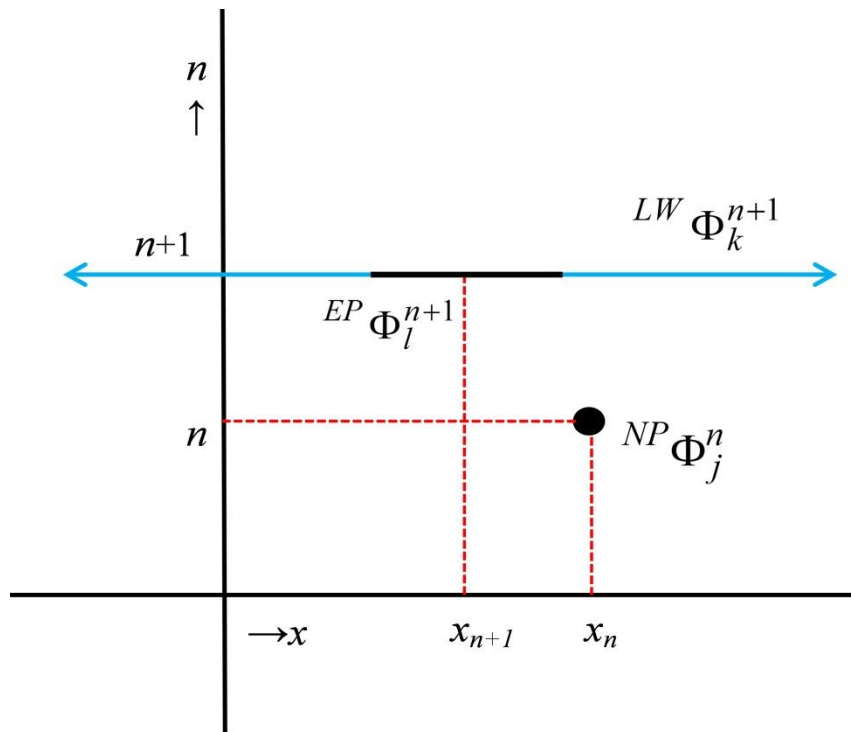
- extended particle $EP \Phi_k^n$
- nonlocal matter wave $NW \Phi_k^n$
- point-particle $NP \Phi_k^{n+1}$



2: principles of repulsive gravity of the EPT

k^{th} process from n^{th} to $(n+1)^{th}$ degree of evolution:

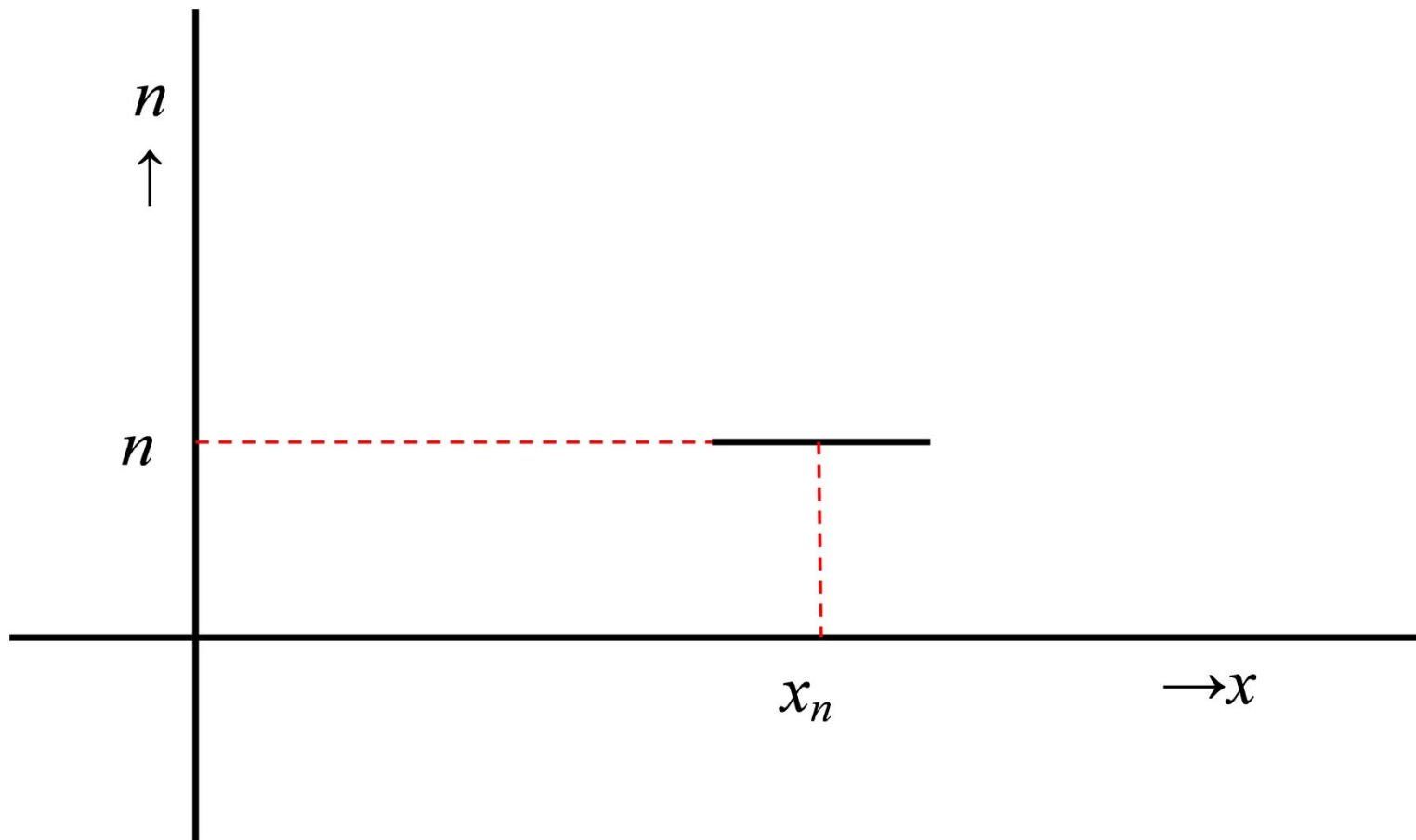
- point-particle $NP \Phi_k^{n+1}$
- local matter wave $LW \Phi_k^{n+1}$
- extended particle $EP \Phi_l^{n+1}$



2: principles of repulsive gravity of the EPT

k^{th} process from n^{th} to $(n+1)^{\text{th}}$ degree of evolution:

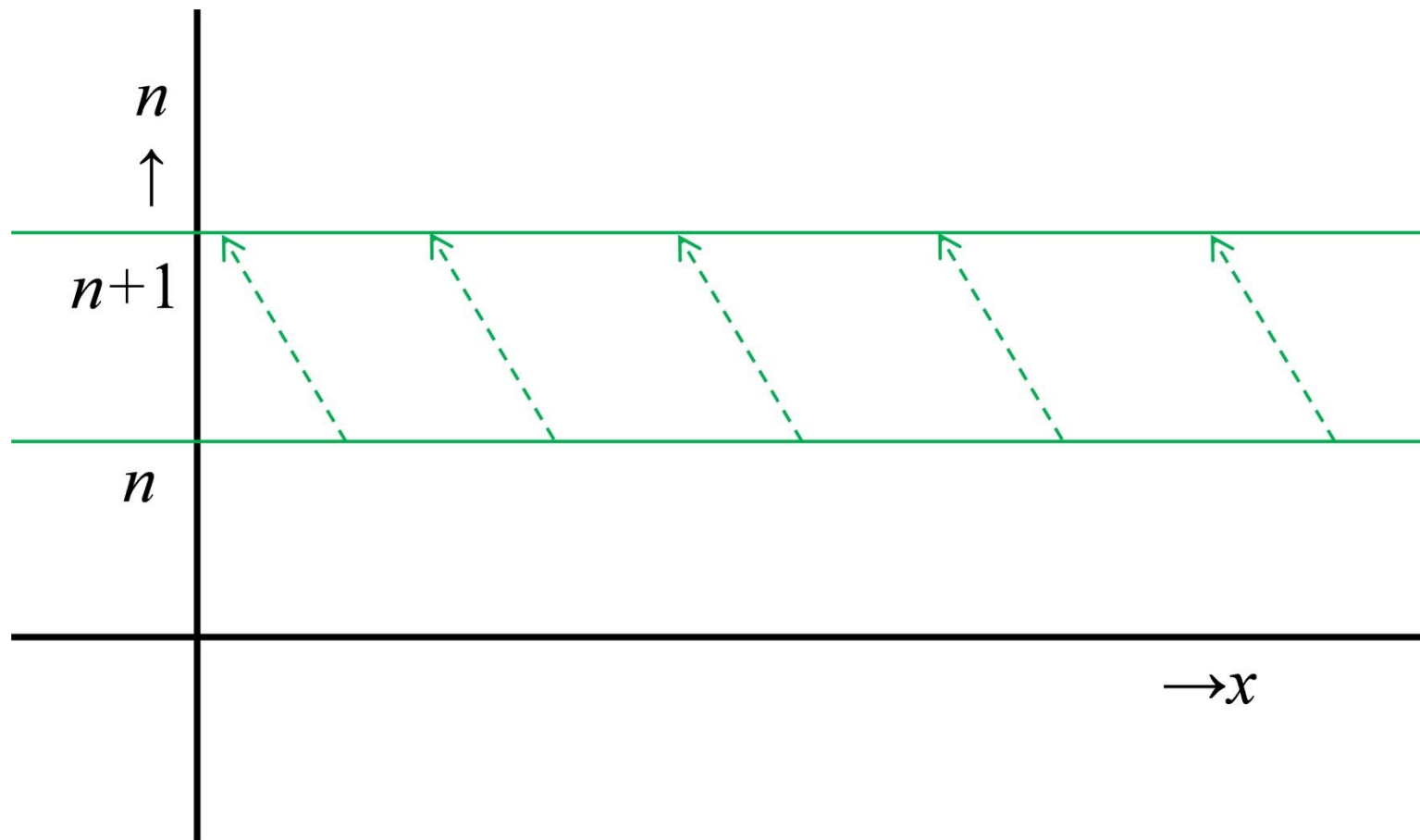
- extended particle ${}^{EP}\Phi_k^n$



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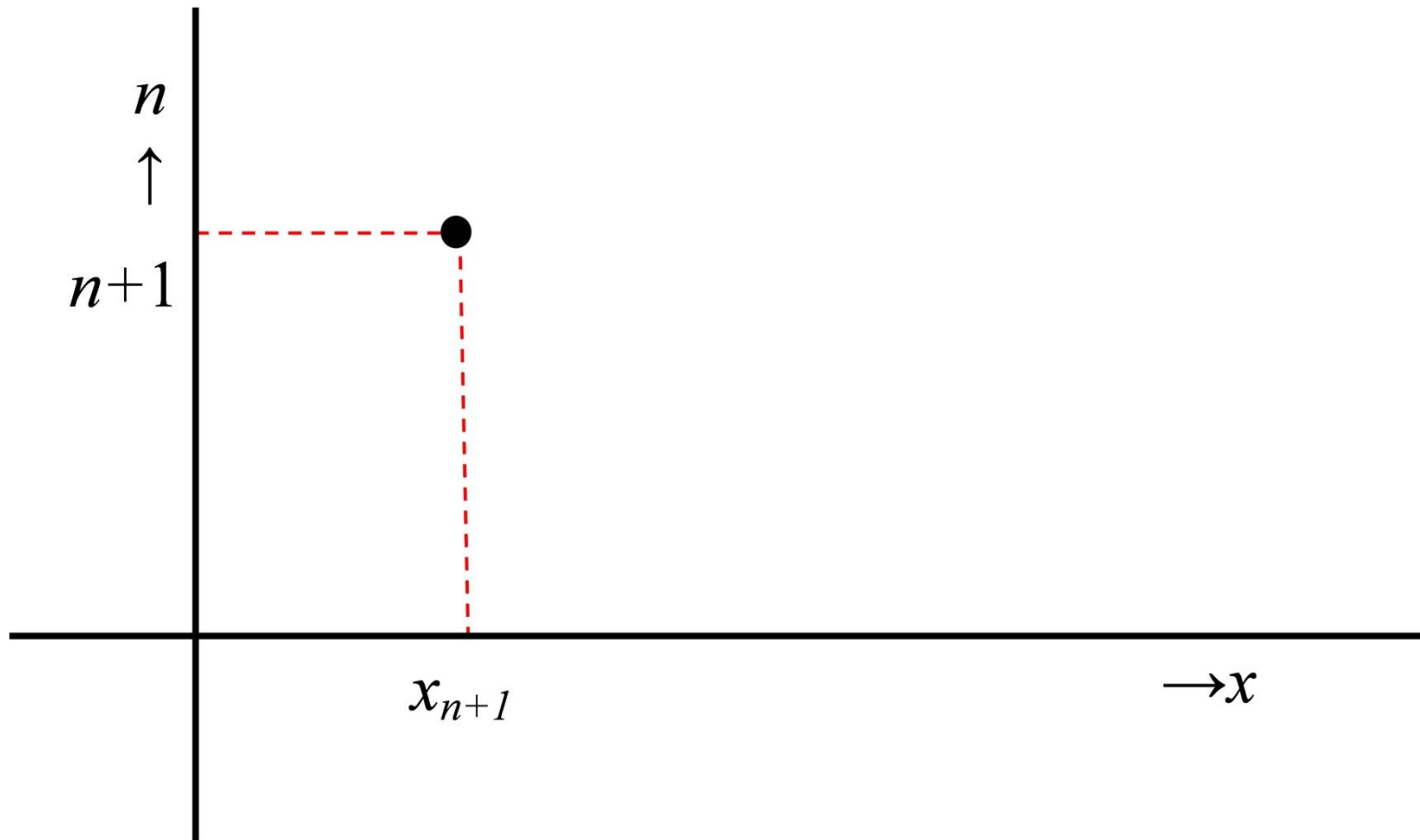
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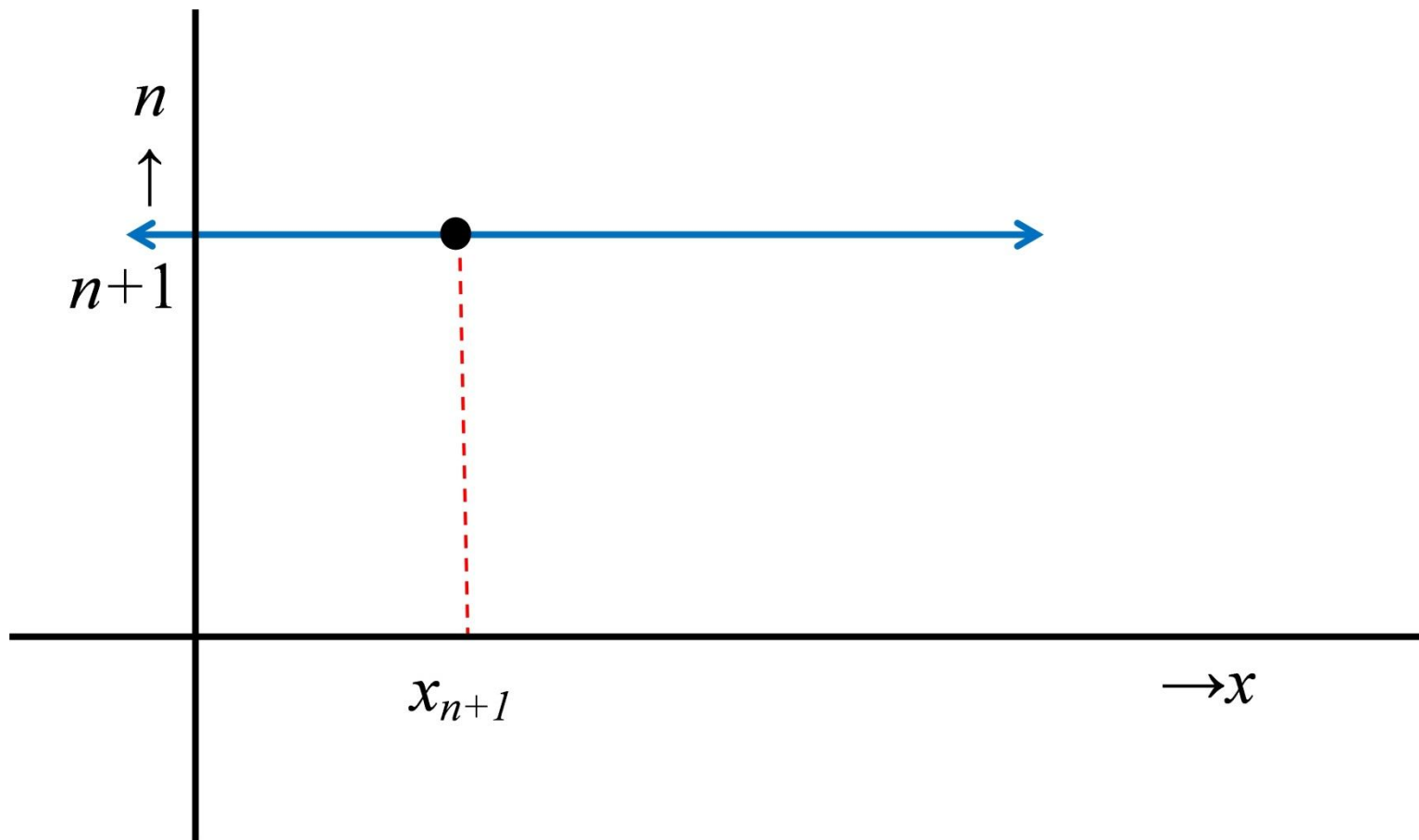
- point-particle ${}^{NP}\Phi_k^{n+1}$



2: principles of repulsive gravity of the EPT

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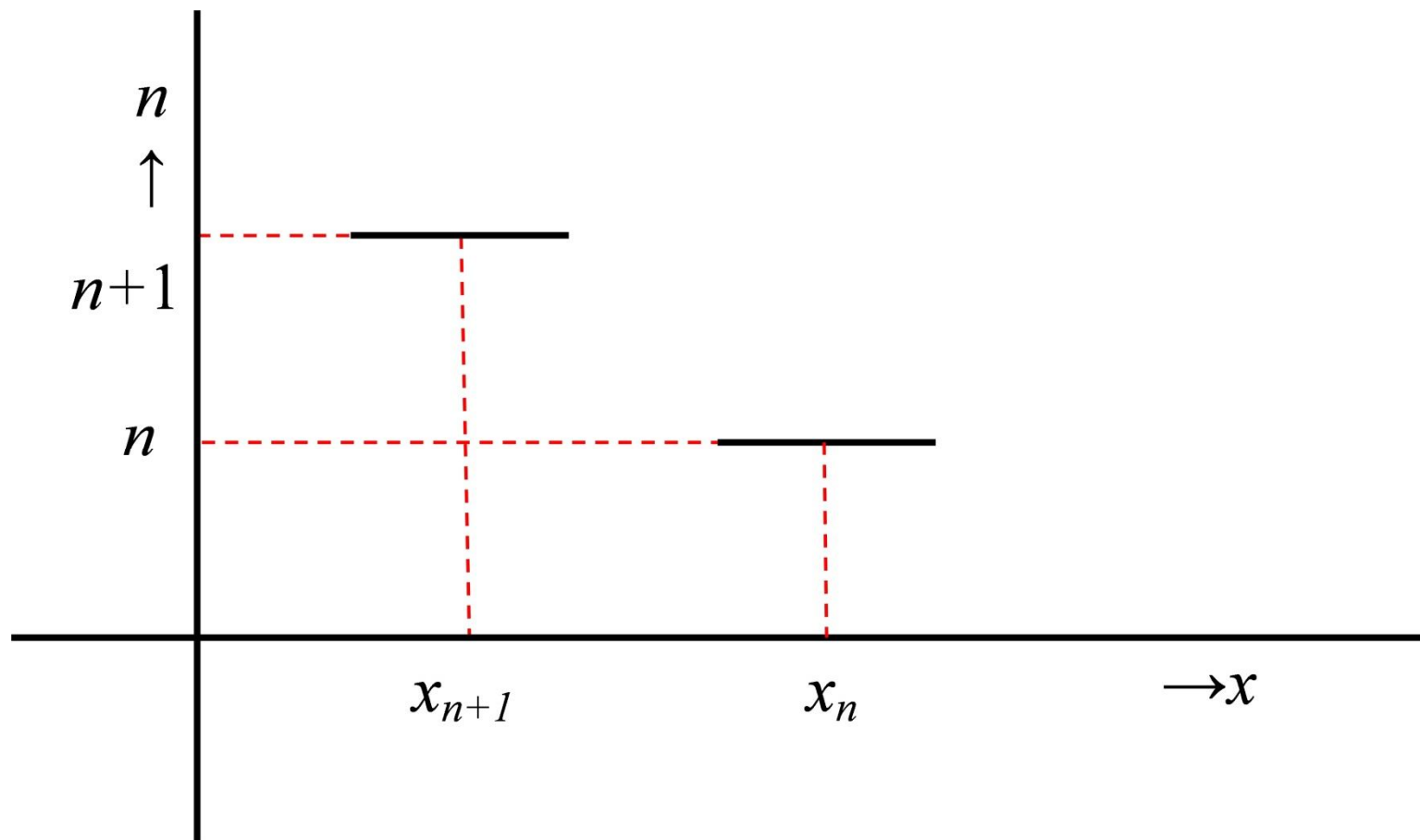
- local matter wave $LW \Phi_k^{n+1}$



2: principles of repulsive gravity of the EPT

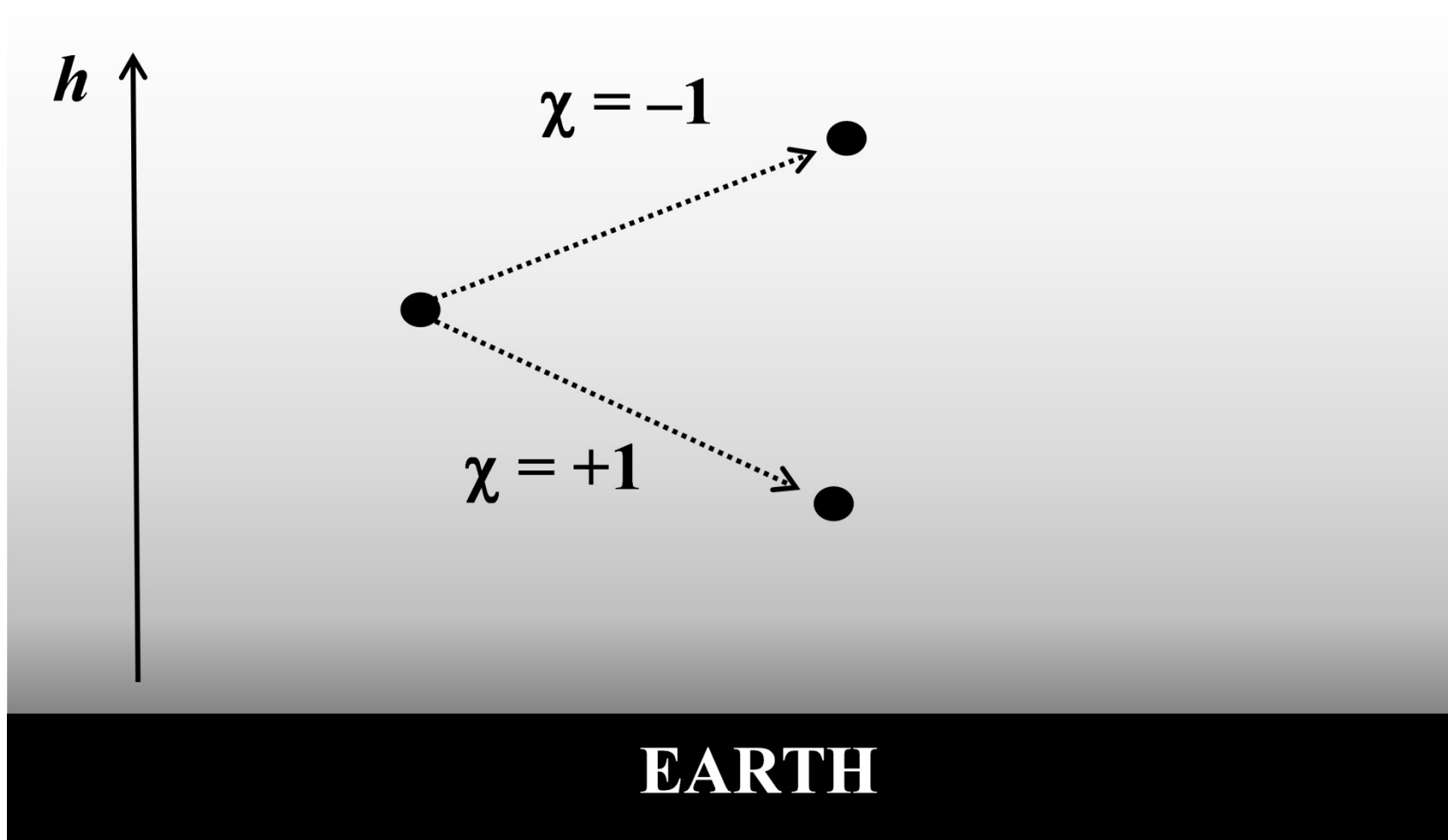
k^{th} process from n^{th} to $(n+1)^{th}$ degree of evolution:

- extended particle $EP \Phi_l^{n+1}$



2: principles of repulsive gravity of the EPT

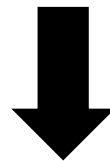
EPT: principle of (anti)gravitation



3: correspondence of the EPT to SR

EPT:

- **new formal language**
- **new physical concepts**
- **new physical principles**
- **higher degree of abstractness than GR and QM**



**no proof that the EPT satisfies
the correspondence principle**

3: correspondence of the EPT to SR

1. we live in a 5D space-time:

- three regular spatial dimensions
- 'degrees of evolution': curled-up dimension
- time is the duration of a particle leap:

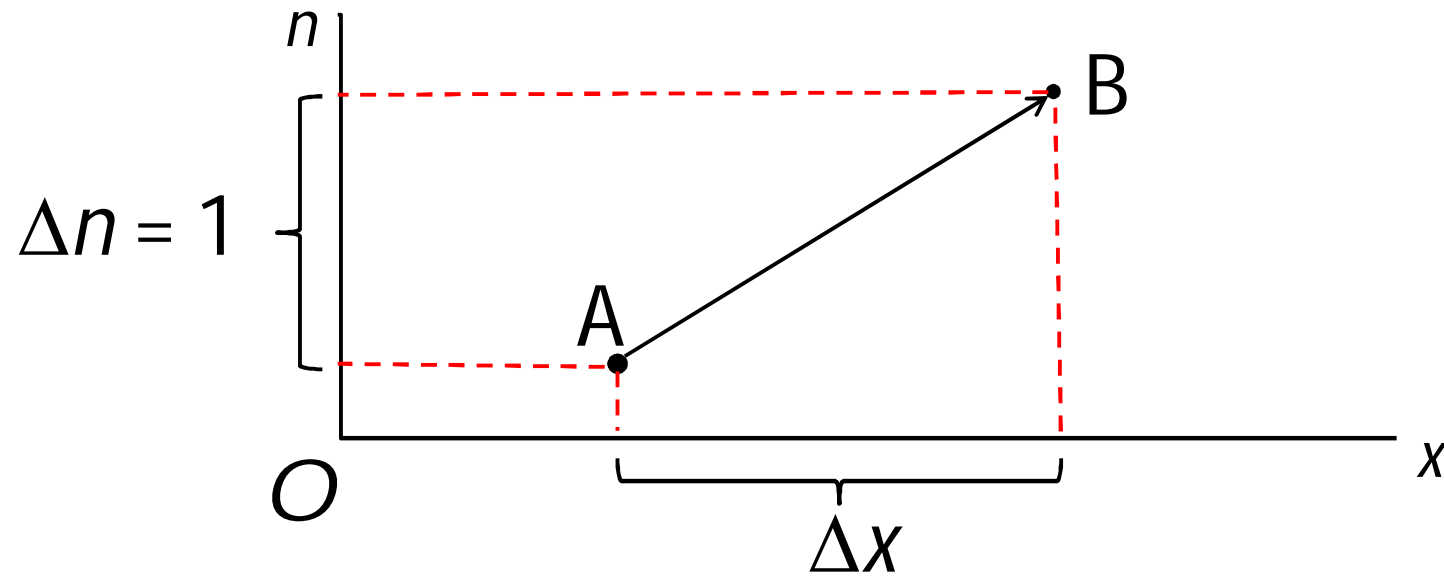
$$\Delta t^2 = \Delta x^2 + \Delta y^2 + \Delta z^2 + \Delta n^2$$

2. every leap of every nonzero rest mass particle is a unit displacement in degrees of evolution:

- $\Delta n := 1$

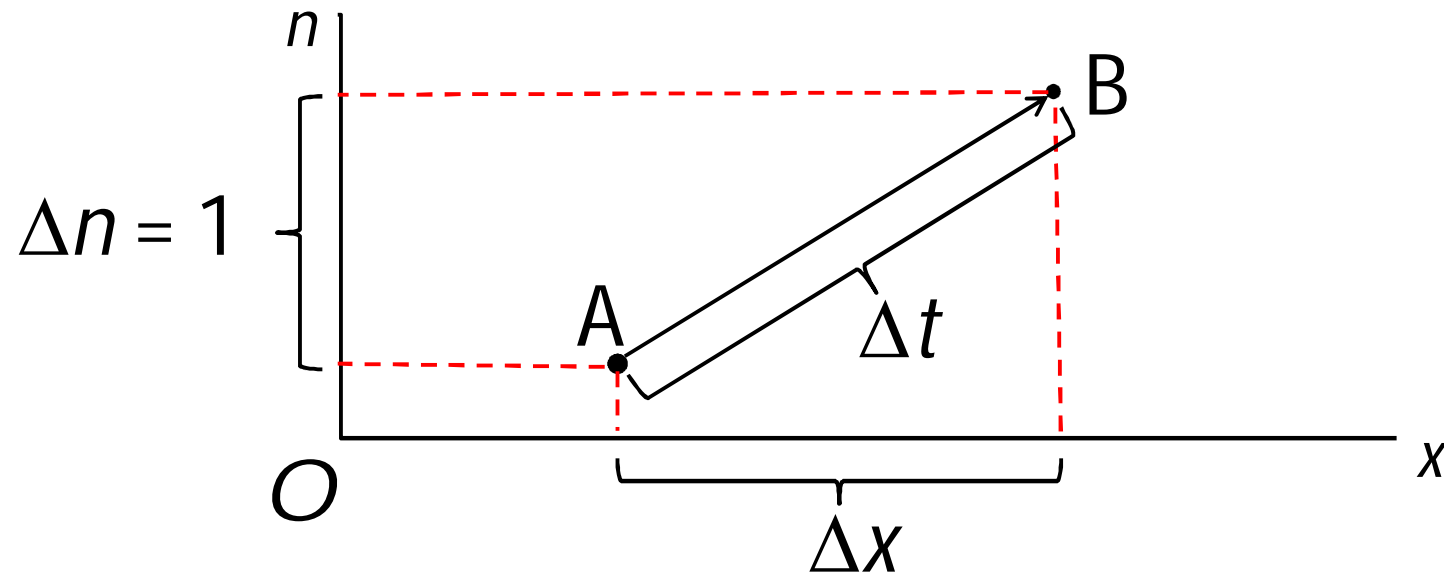
3: correspondence of the EPT to SR

particle: a single leap from A to B



3: correspondence of the EPT to SR

particle: a single leap from A to B



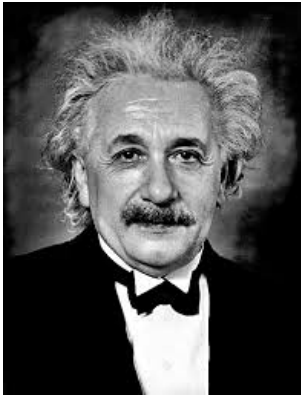
$$\Delta t^2 = \Delta x^2 + \Delta n^2$$

$$\Delta n^2 = \Delta t^2 - \Delta x^2$$

3: correspondence of the EPT to SR

EPT:

$$\Delta n^2 = \Delta t^2 - \Delta x^2$$



$$\Delta s^2 = \Delta t^2 - \Delta x^2$$

IN OTHER WORDS:

for every 'leap' in the universe of the EPT

$$\Delta s = \sqrt{\Delta s^2} = 1 = \Delta n$$

4: future research

general method:

- EPT describes what happens in the curled-up dimension
- add analytical postulates to derive events in 4D space-time

correspondence with classical mechanics:

- i. model *matter waves* after *classical fields*
- ii. define *gravity* and *electromagnetism*
- iii. derive *Newton's laws* and *Maxwell equations*

4: future research

correspondence with GR:

- i. describe *metric tensor* in terms of *matter waves*

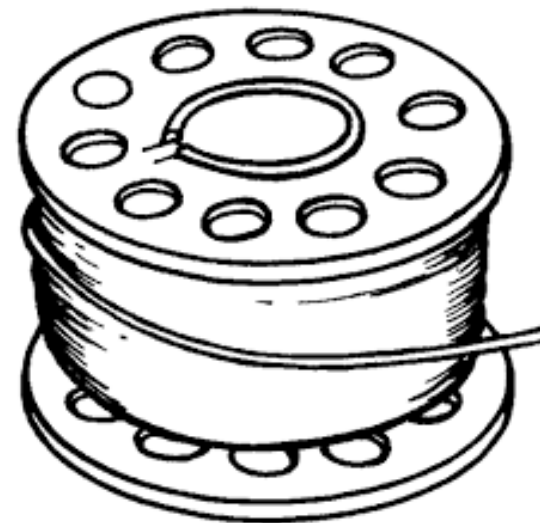
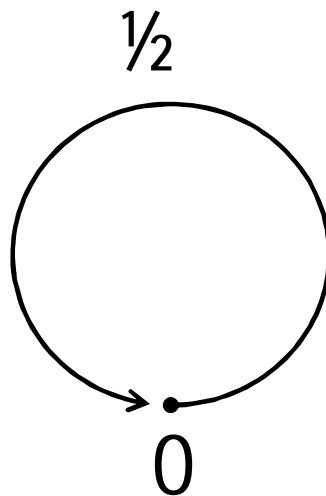
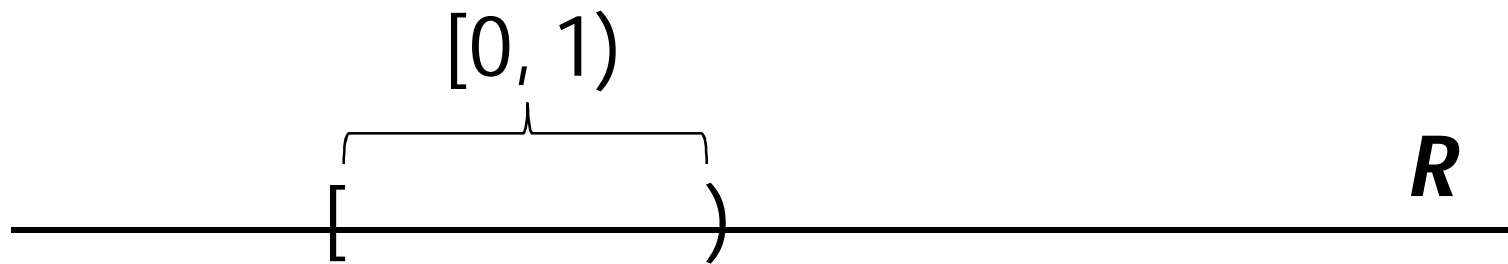
$$g(x) = [{}^S\Phi_k^n(x) + i \cdot {}^{NW}\Phi_k^n(x)]^2$$

- ii. derive *Einstein field equations*
- iii. new approach to *dark energy?*

correspondence with QM:

- distant future

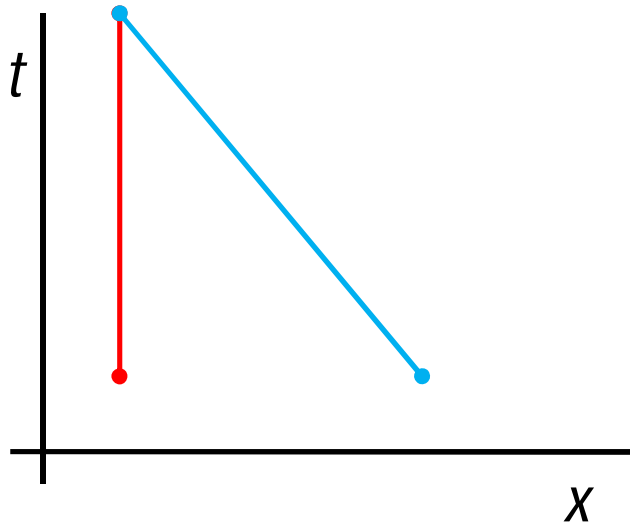
extra: a curled up dimension



$$x \equiv y \Leftrightarrow |x - y| \in \mathbb{N}$$

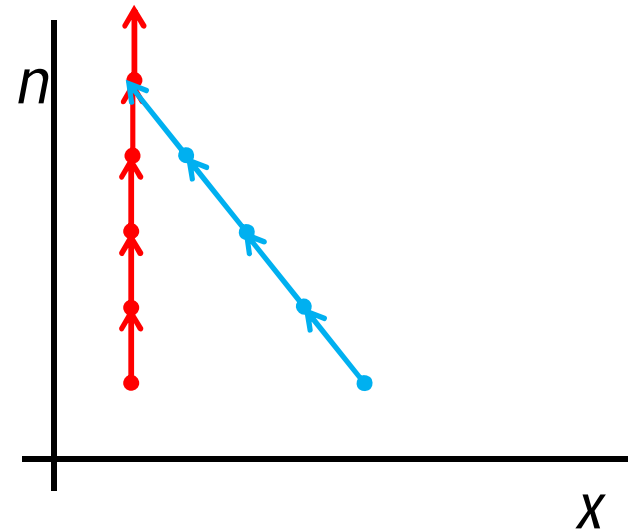
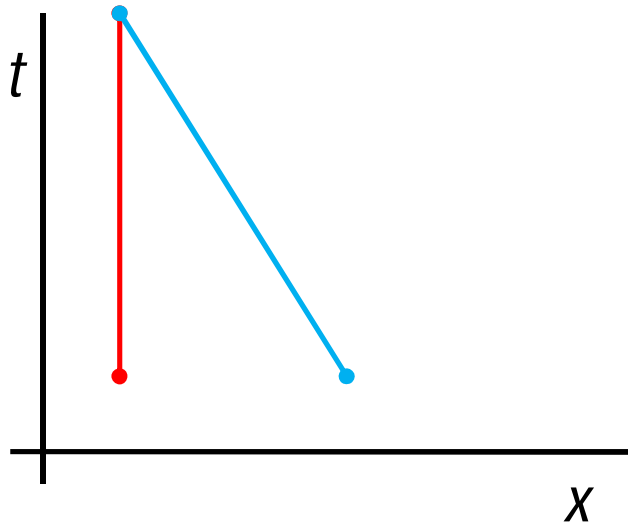
extra: a curled up dimension

- at $t = 1$, **particle #1** is at $x = 1$
- at $t > 1$, **particle #1** remains at $x = 1$
- at $t = 1$, **particle #2** is at $x = 4$
- at $t > 1$, **particle #2** moves with $v = -0.6$
- **we know that the particles will collide at $t = 6$**

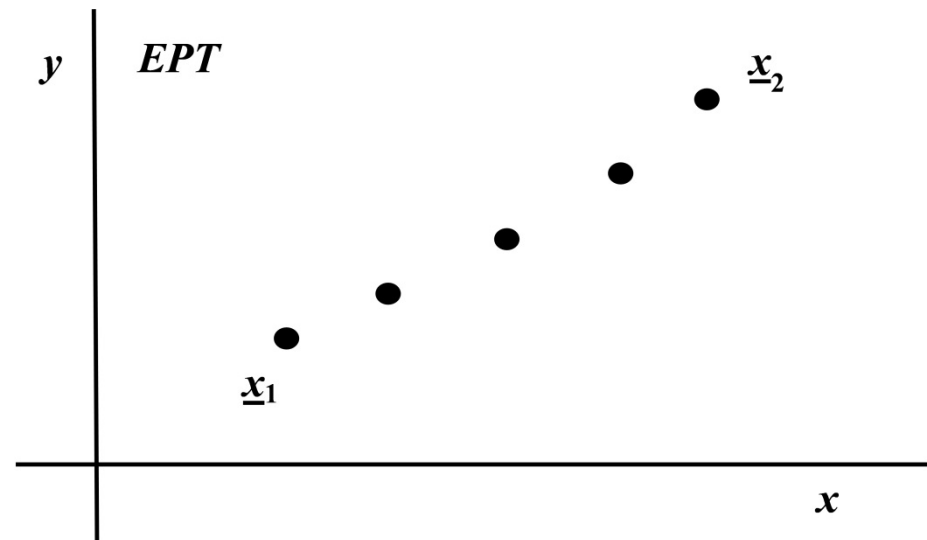
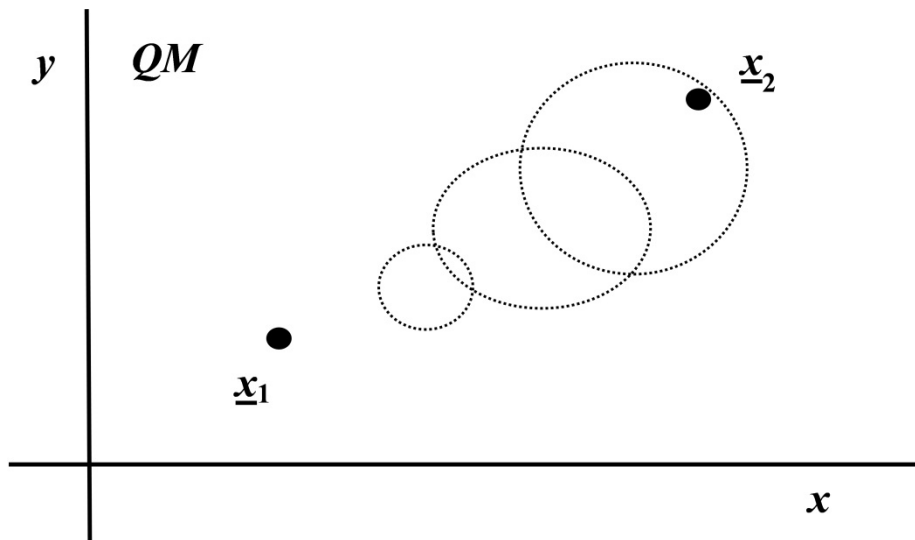
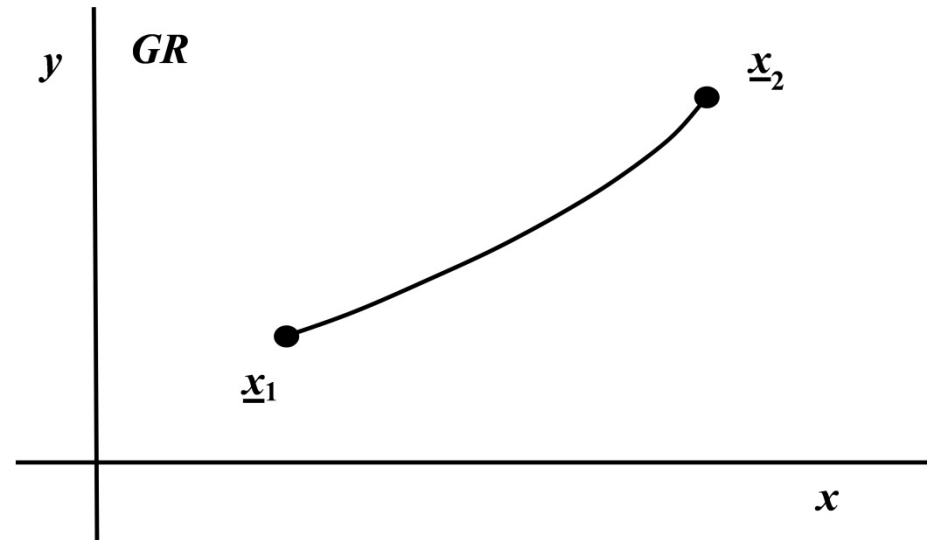
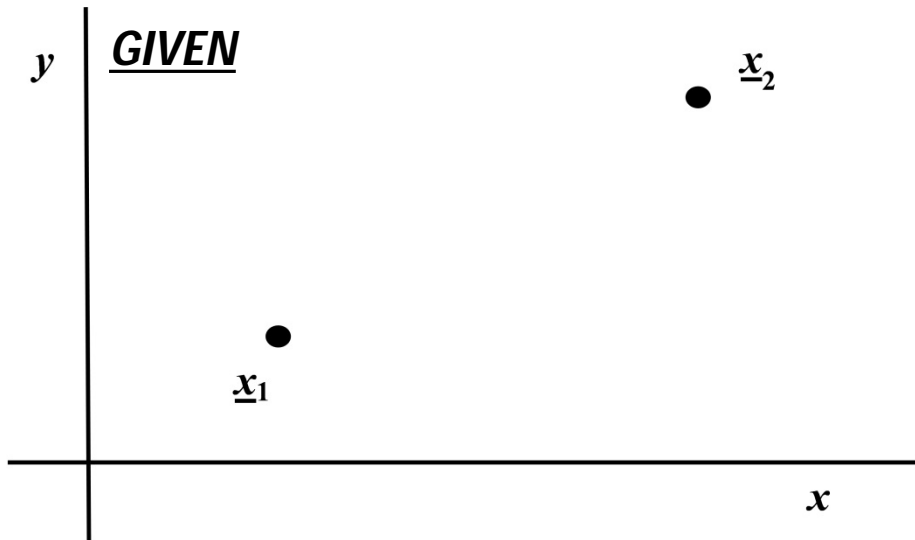


extra: a curled up dimension

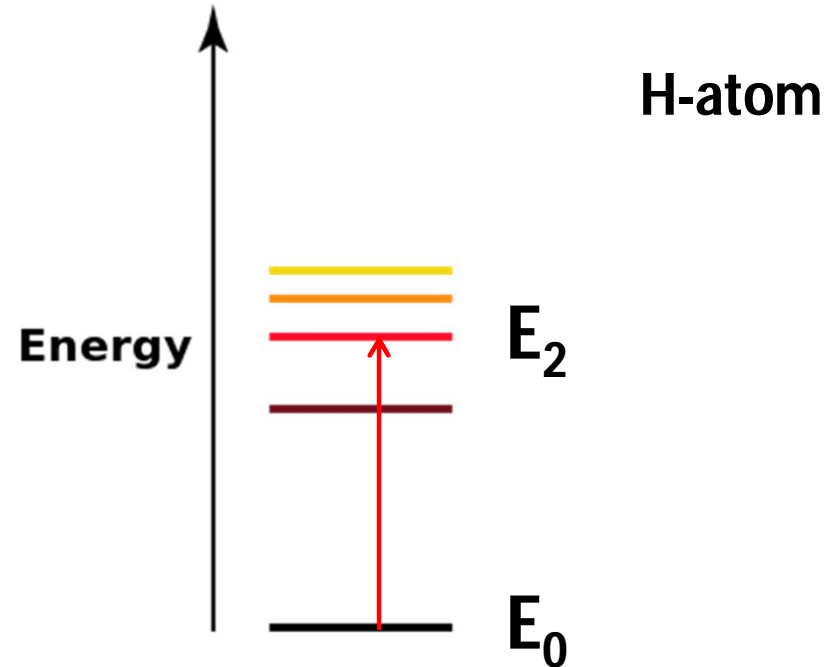
- we know that the particles will collide at $t = 6$
- particle #1: 5 leaps in the xn -plane ($\Delta x = 0$)
- particle #2: 4 leaps in the xn -plane (3-4-5 triangle)
- **thus: at collision point different n -coordinates**
- **but: $(x, n) \equiv (x, n+1)$!!!**



extra: difference between GR, QM and the EPT



extra: why outside GR



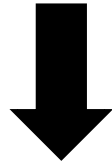
- intermediate $E_0 < E < E_2$ **not** attained
- **no such thing** as a continuous change of state



(extended) GR empirically inadequate

extra: why outside QM

$$\mathbf{P}: \bar{\mathbf{m}}_i = \mathbf{m}_i \wedge \bar{\mathbf{m}}_g = -\mathbf{m}_g$$



$$\Sigma_{\text{QM}}, \text{VP:P} \vdash \eta_{\text{Be-Ti}} \approx 10^{-6}$$

$$\text{experiment: } \eta_{\text{Be-Ti}} < 10^{-13}$$



any quantum theory T with $T \supset \{ \Sigma_{\text{QM}}, \text{VP:P} \}$ is
inconsistent with experiment

Mahoney (1977): over 50% of scientists doesn't recognize
modus tollens as a valid reasoning form