



FAKULTA MATEMATIKY,
FYZIKY A INFORMATIKY
Univerzita Komenského
v Bratislave

What do microwave and X-ray have in common?

And what does quantum gravity have to do with it?

Juraj Tekel
Comenius University, Bratislava



30. 5. 2024, CaLISTA annual meeting Public event, Sofia, Bulgaria



Funded by
the European Union



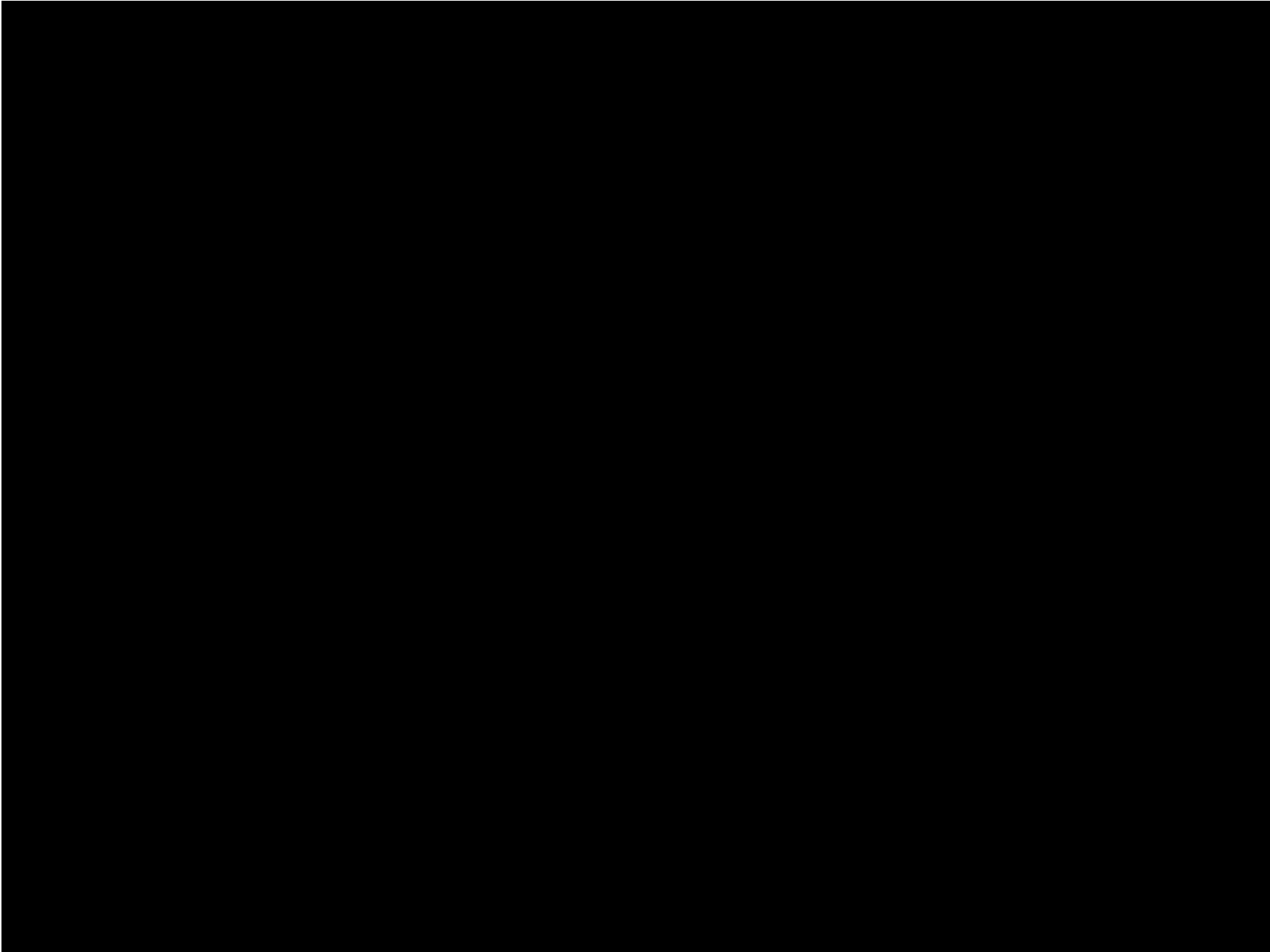


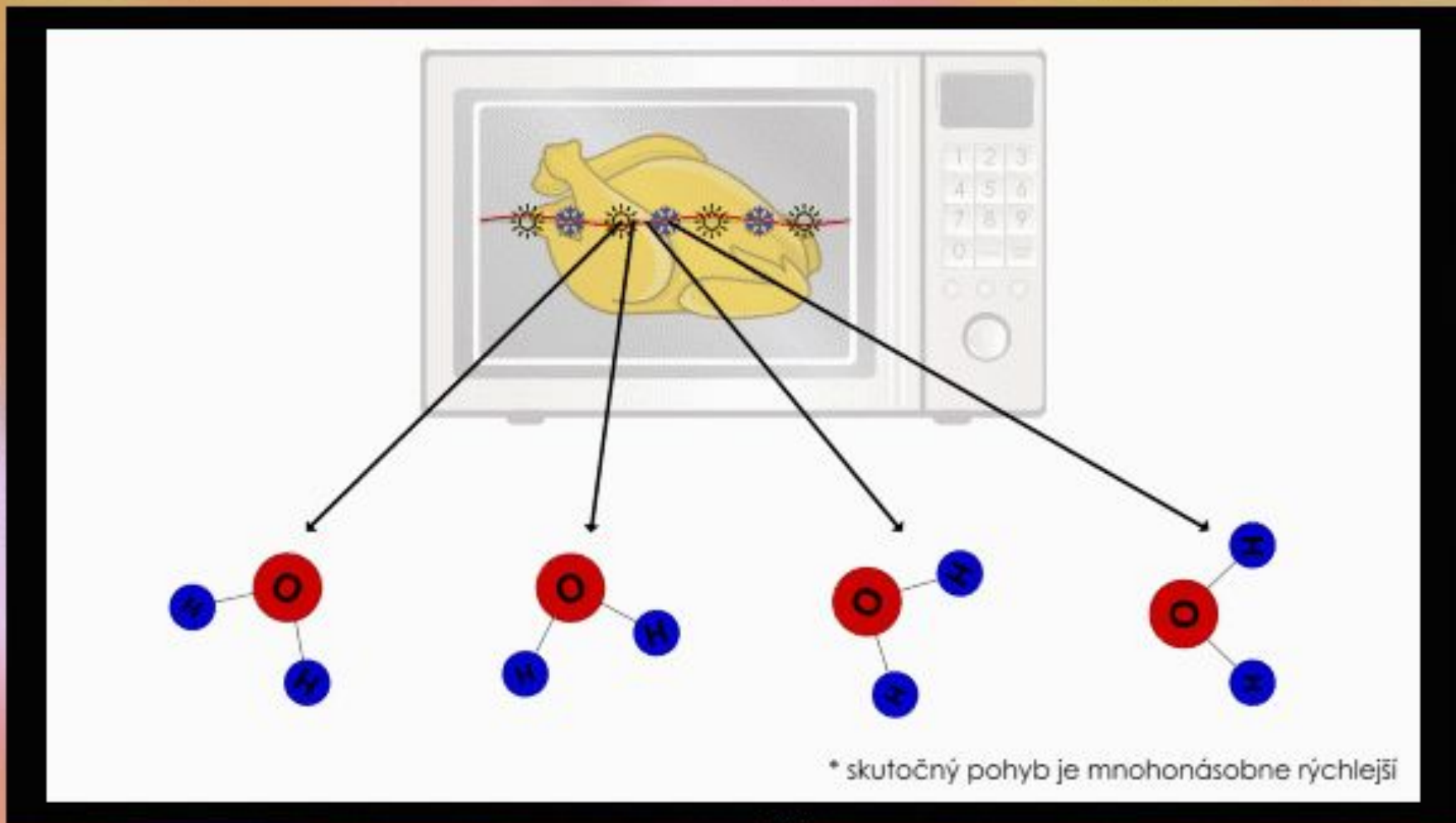
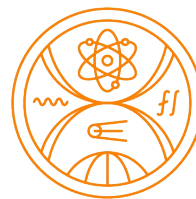
What do microwave
and X-ray have in common?



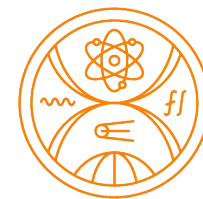
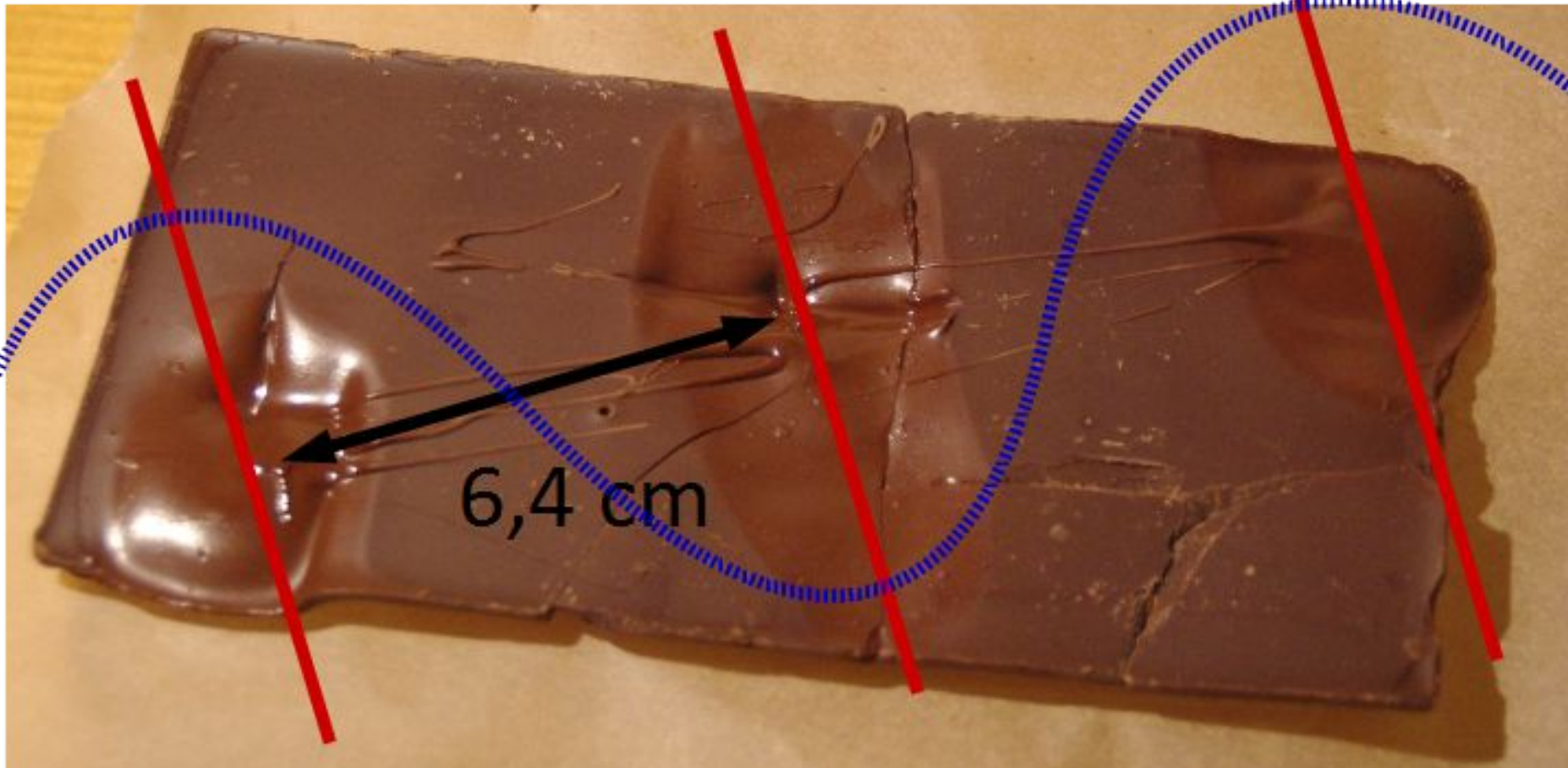


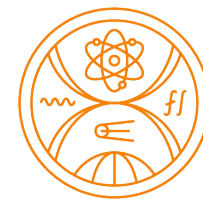
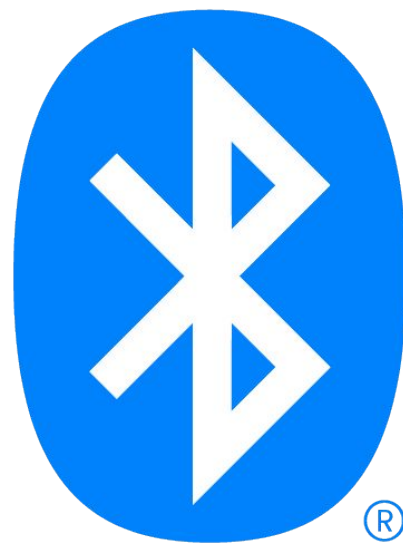
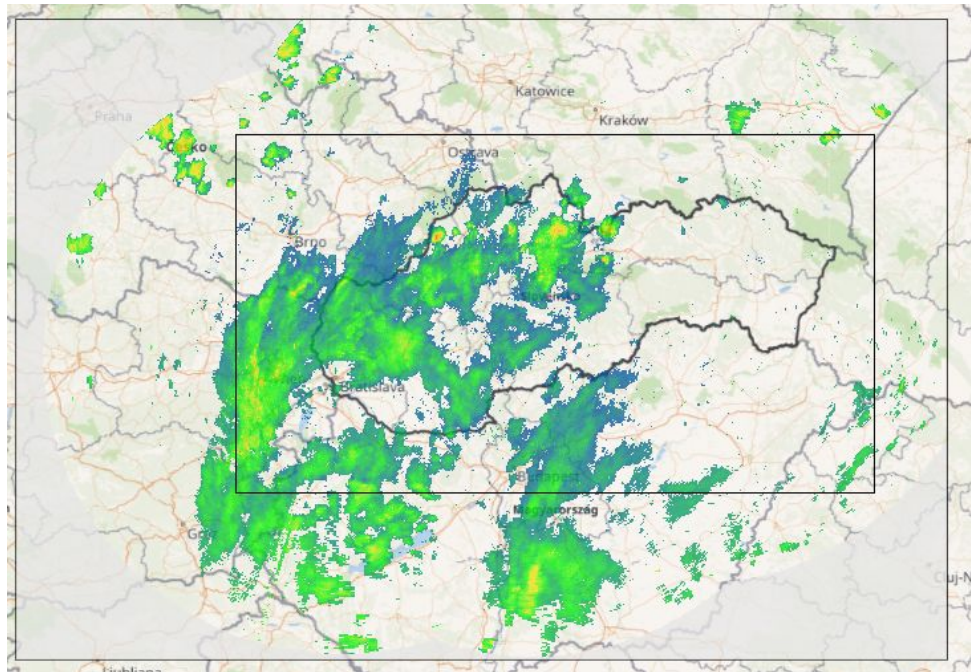
img.: Mrbeastmodeallday, wiki commons







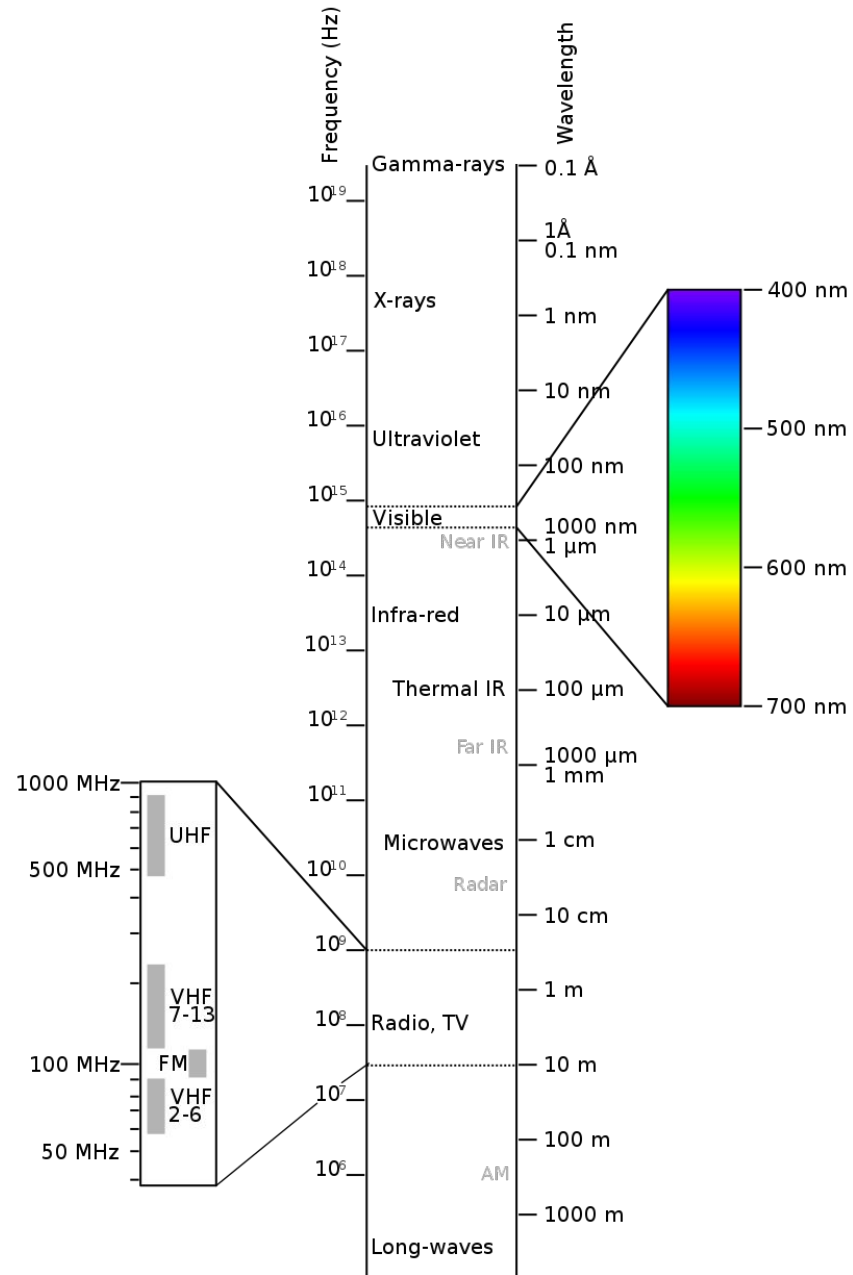






Electromagnetic spectrum





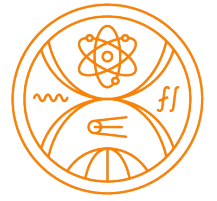


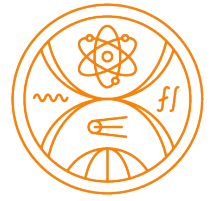
What do microwave
and *X-ray* have in common?



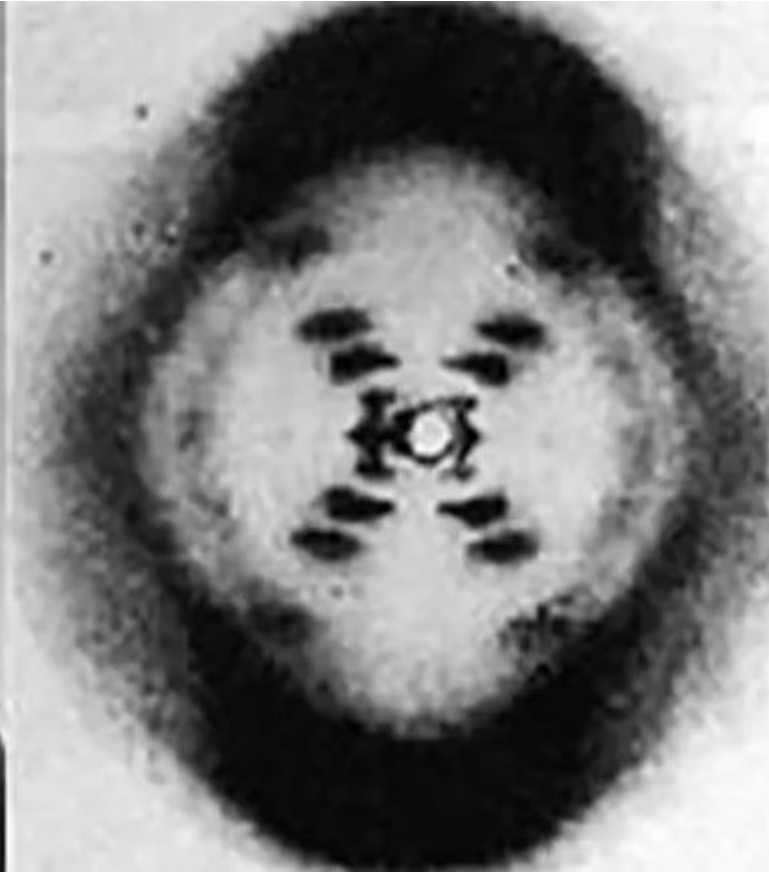


Wilhelm Conrad Röntgen
1845 – 1923



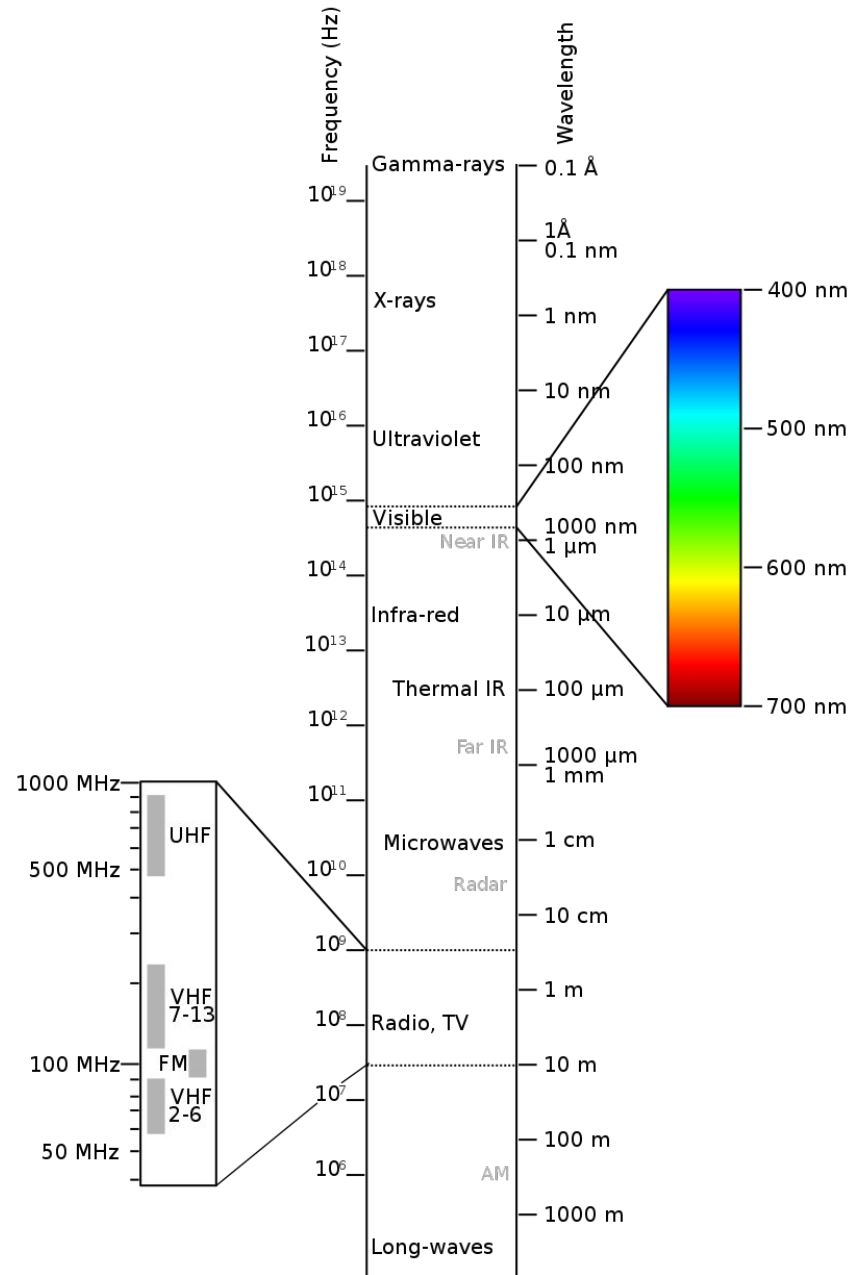






Rosalind Elsie Franklin
1920 – 1958







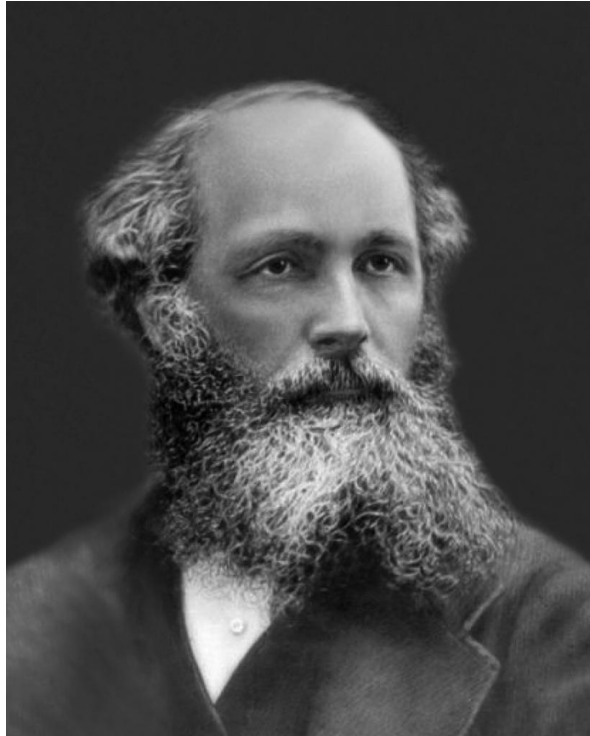
img.: Mrbeastmodeallday, wiki commons





Maxwell and theory of electromagnetic field





James Clerk Maxwell
1831 – 1879





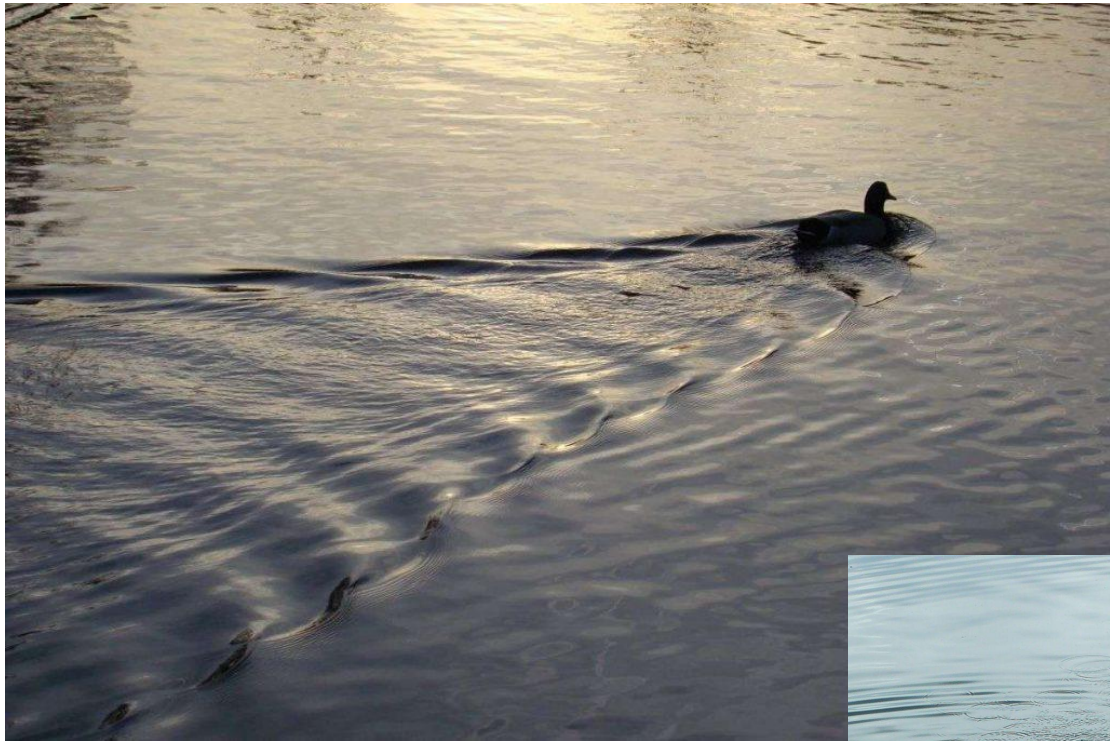
$$\nabla \cdot \mathbf{D} = \rho$$

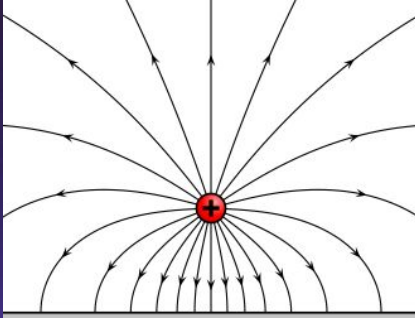
$$\nabla \cdot \mathbf{B} = 0$$

$$\nabla \times \mathbf{E} = -\frac{\partial \mathbf{B}}{\partial t}$$

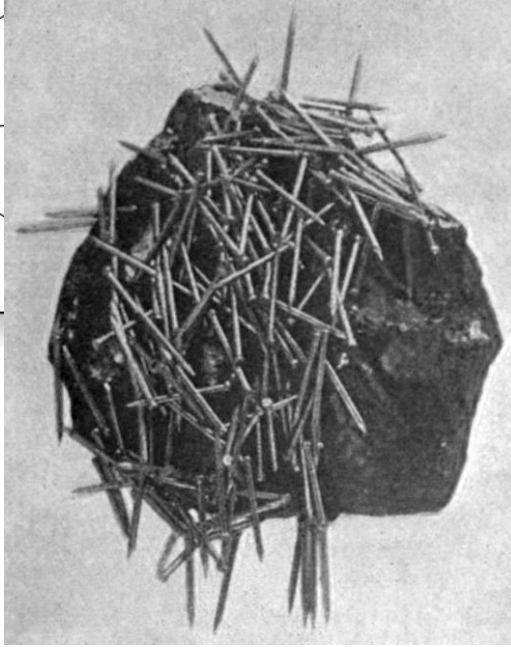
$$\nabla \times \mathbf{H} = \mathbf{J} + \frac{\partial \mathbf{D}}{\partial t}$$





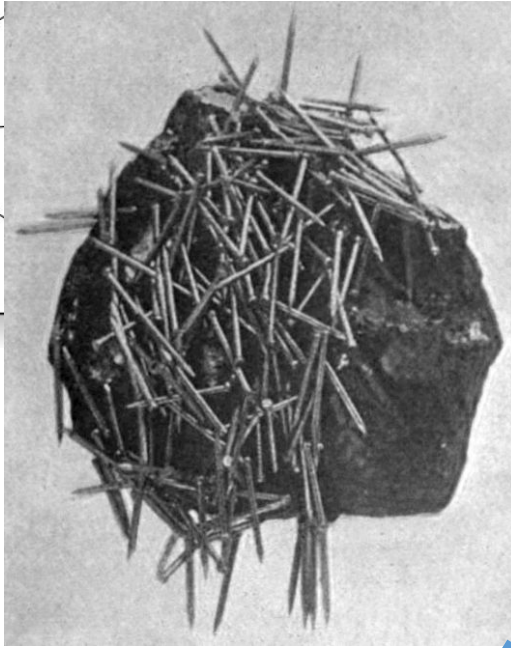
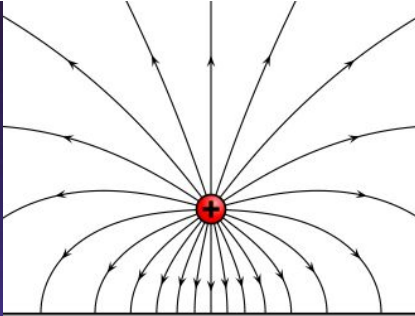


EL



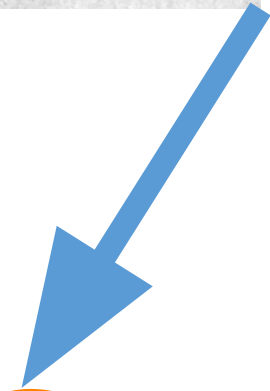
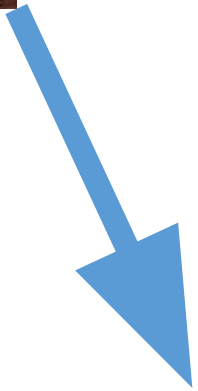
MAG





EL

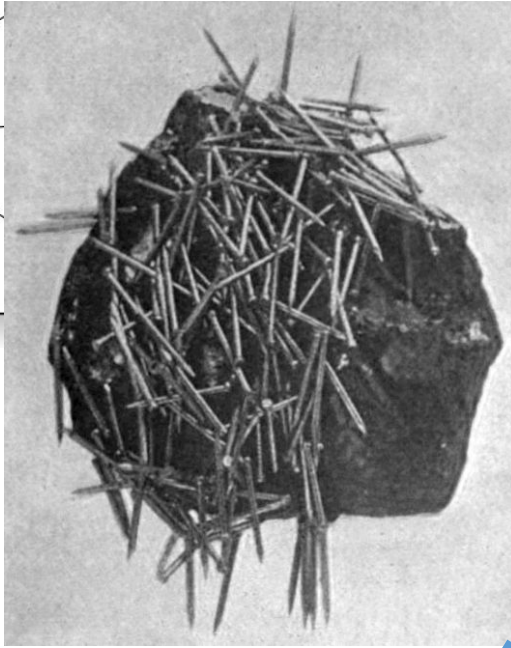
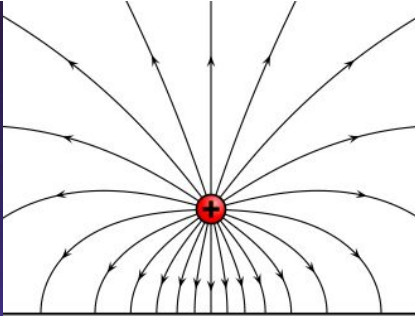
MAG



$$\begin{aligned} \nabla \cdot \mathbf{D} &= \rho \\ \nabla \cdot \mathbf{B} &= 0 \\ \nabla \times \mathbf{E} &= -\frac{\partial \mathbf{B}}{\partial t} \\ \nabla \times \mathbf{H} &= \mathbf{J} + \frac{\partial \mathbf{D}}{\partial t} \end{aligned}$$

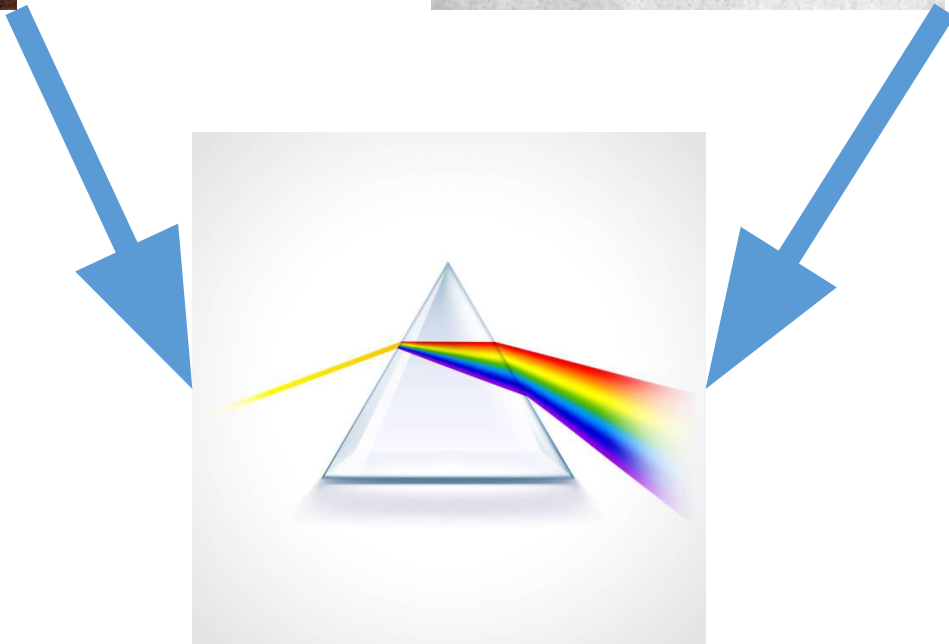
ELMAG

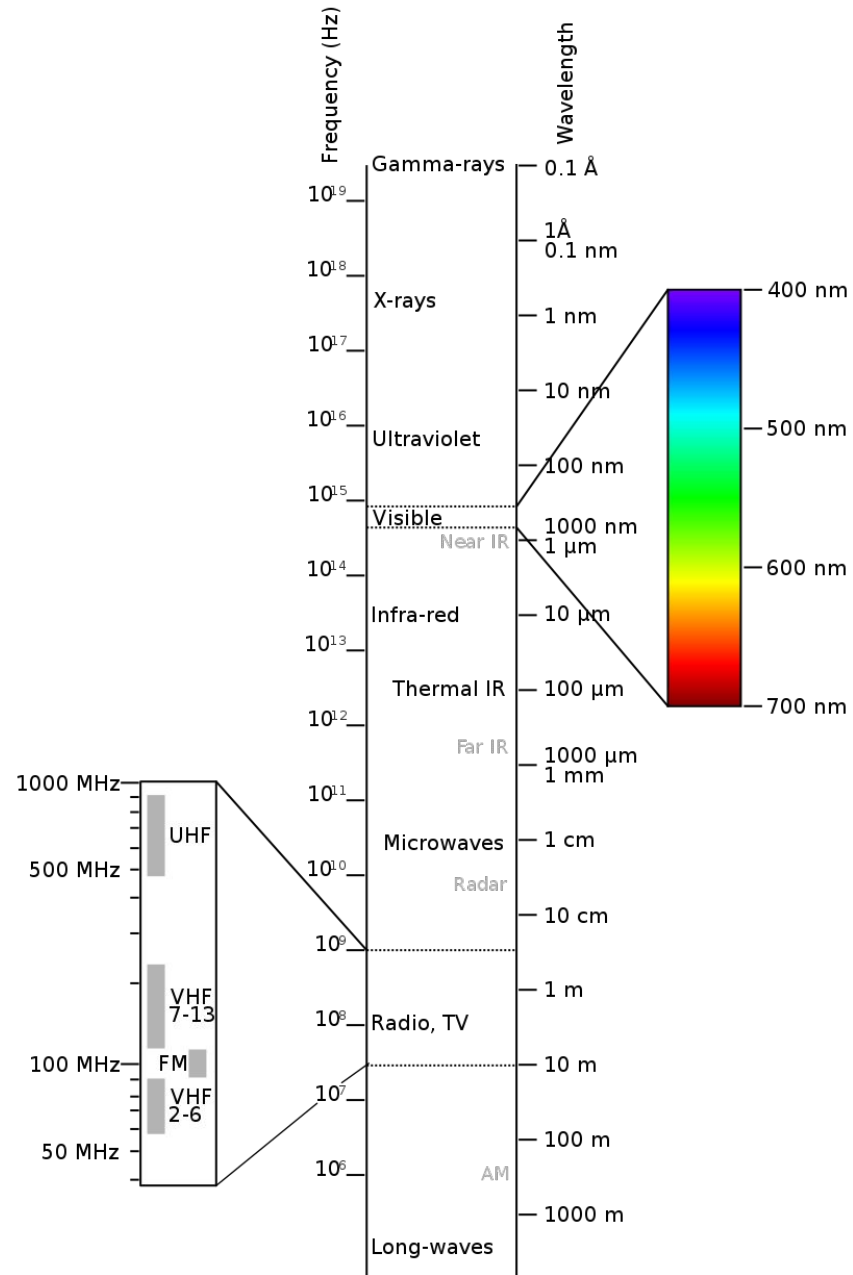




EL

MAG

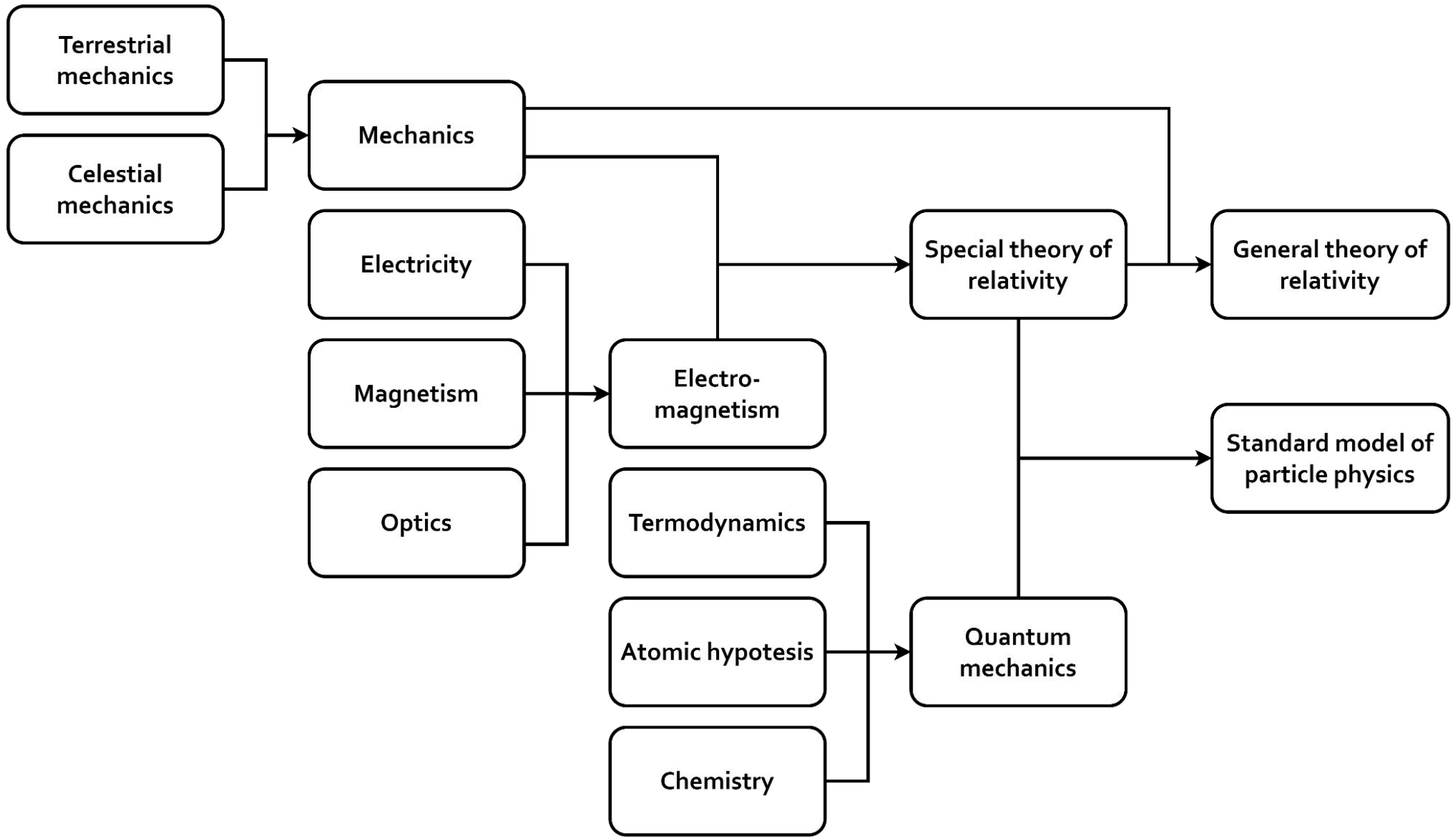


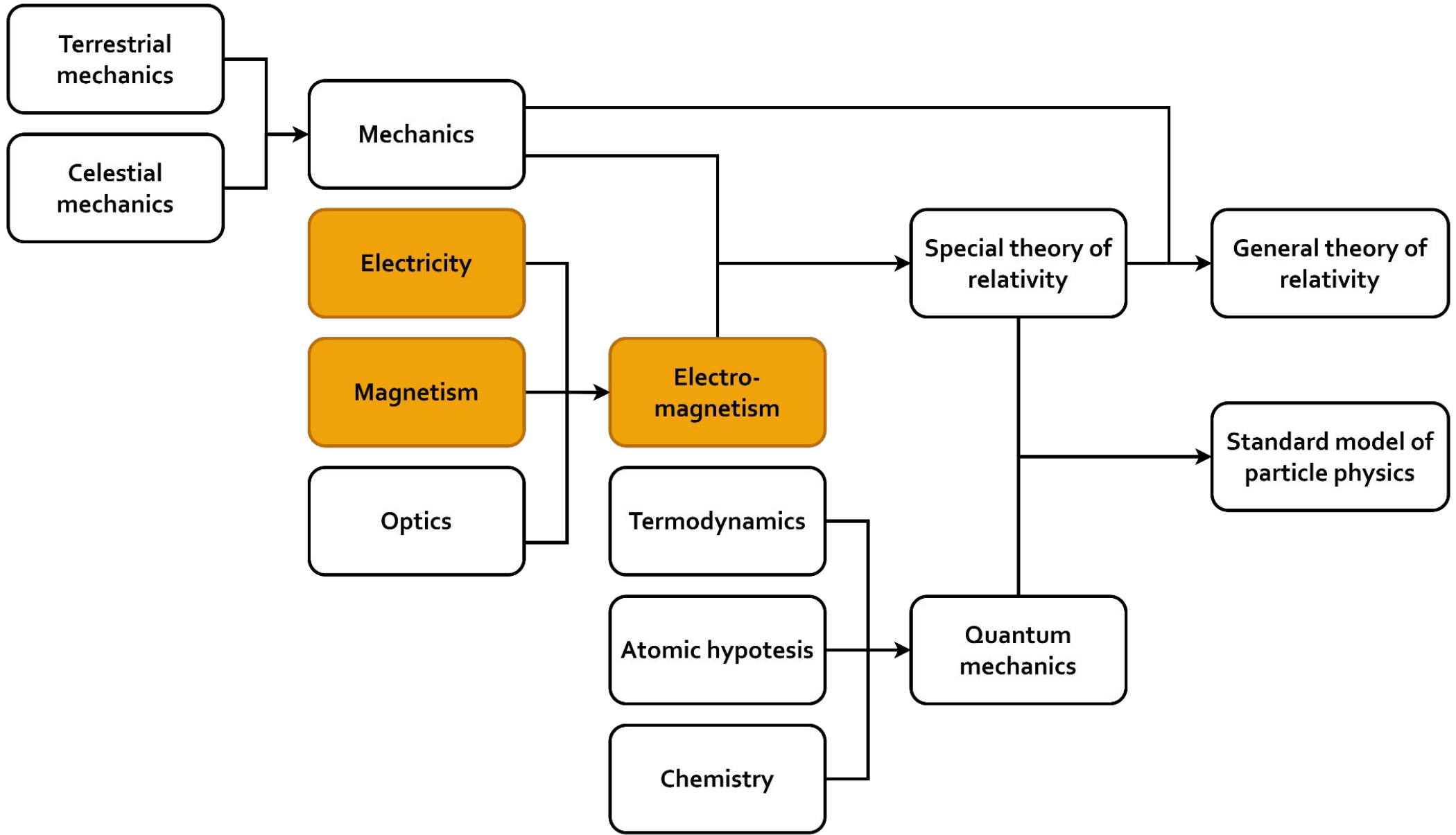


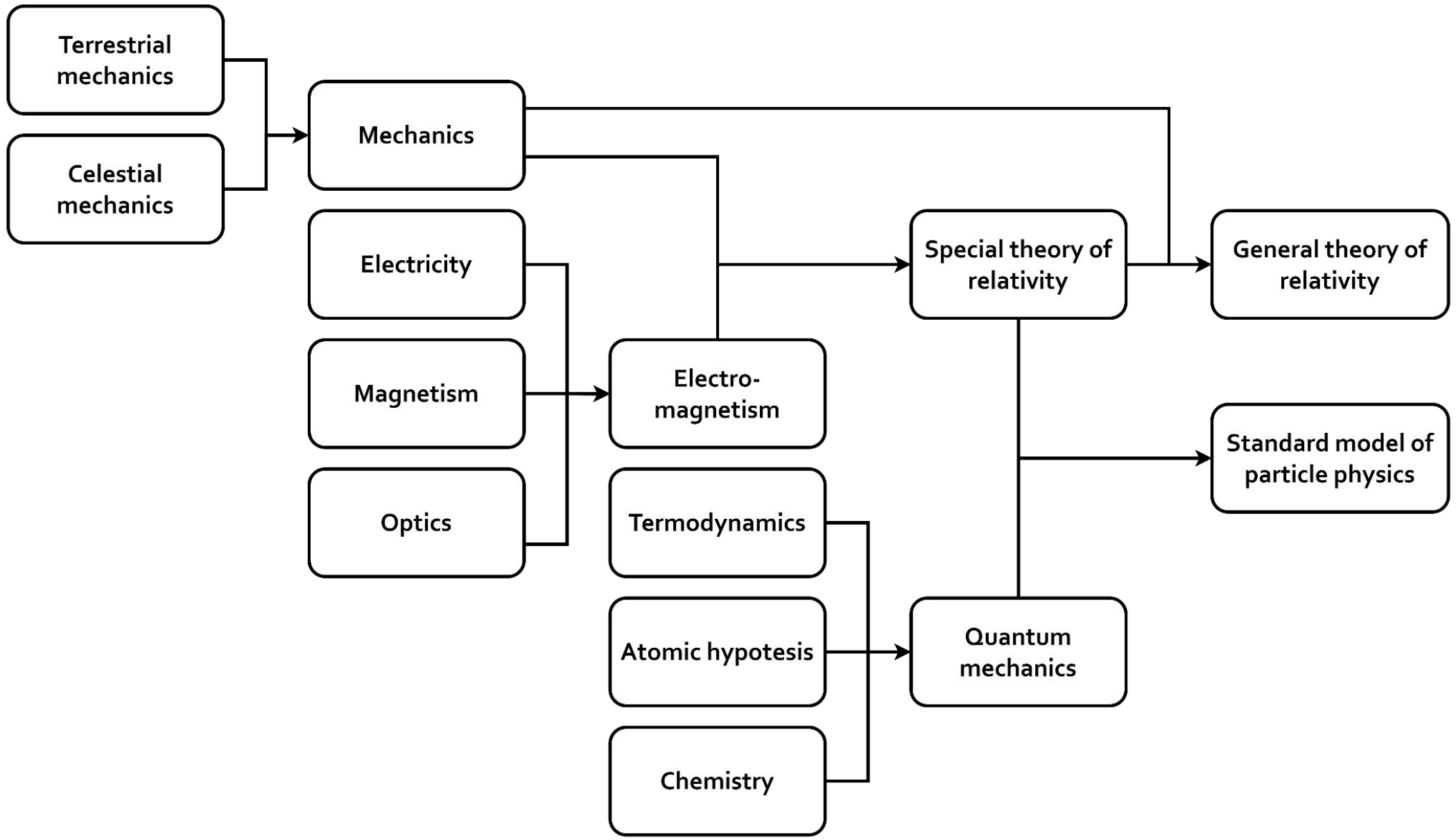


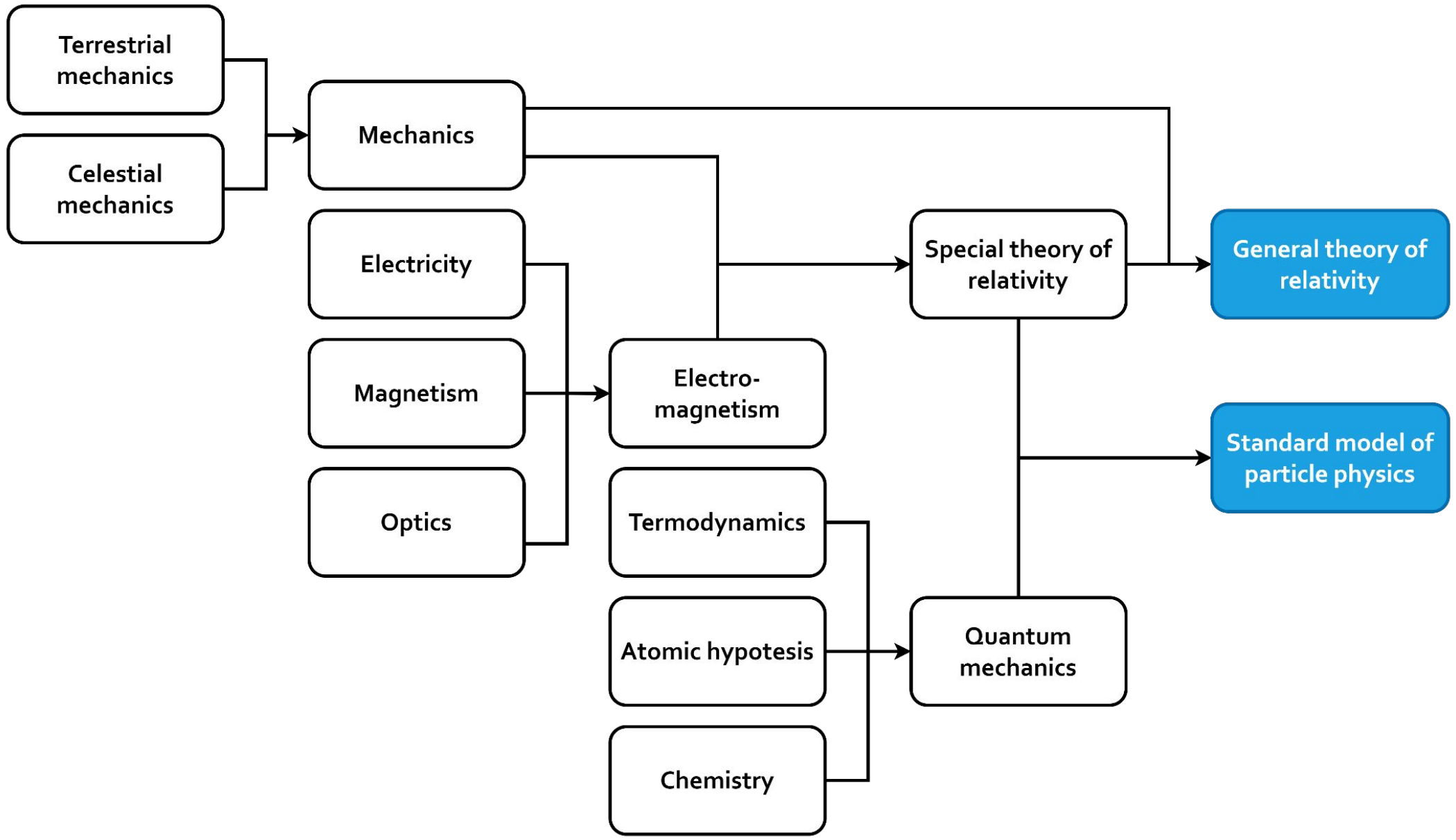
Unifications in physics













... and what does
quantum gravity have
to do with it?



Quantum theory

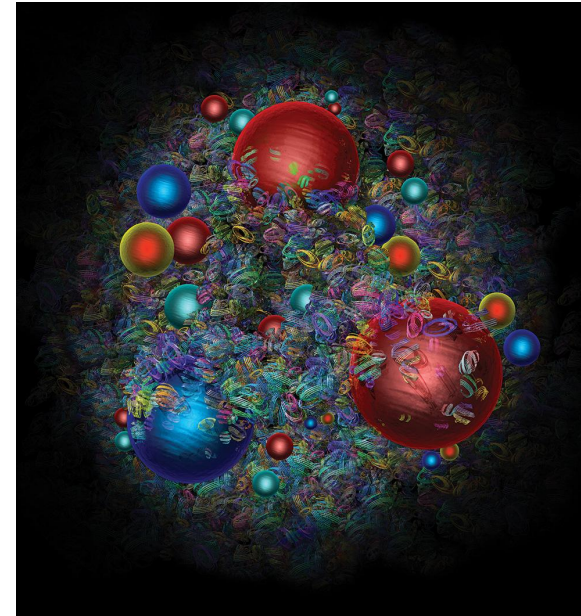


Standard Model of Elementary Particles

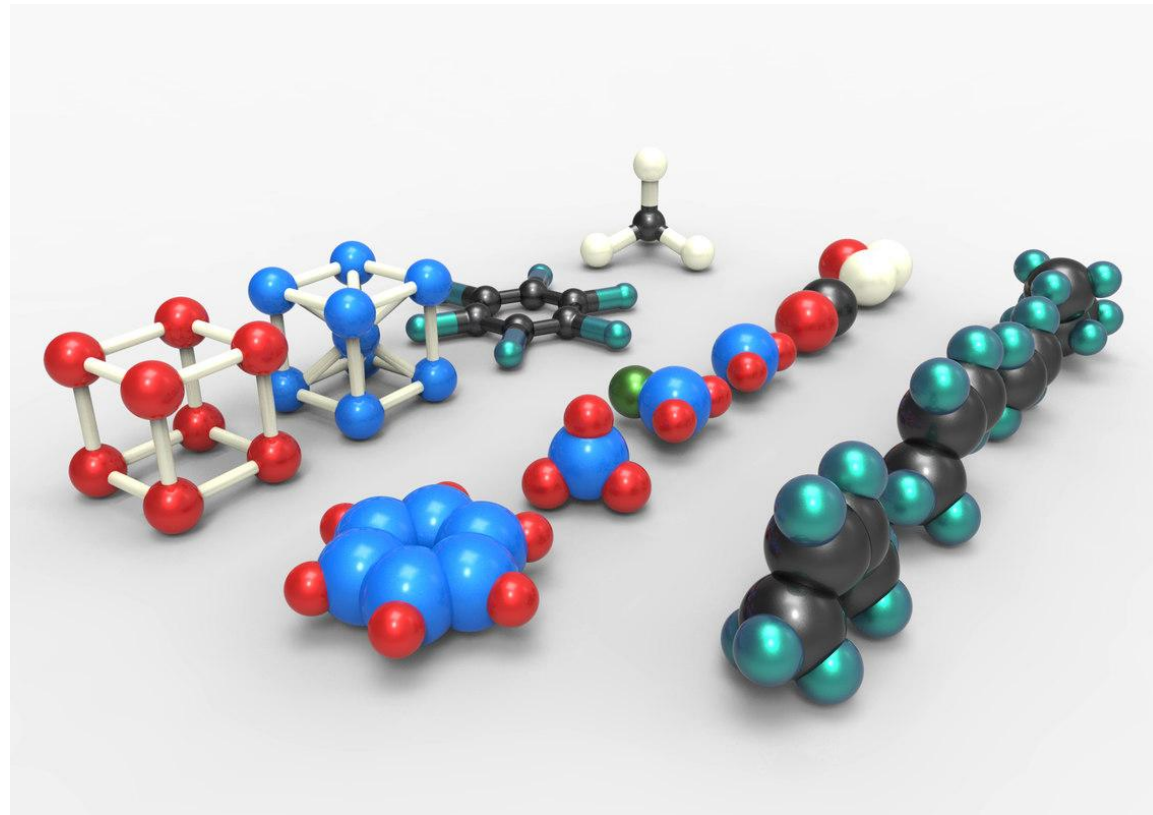
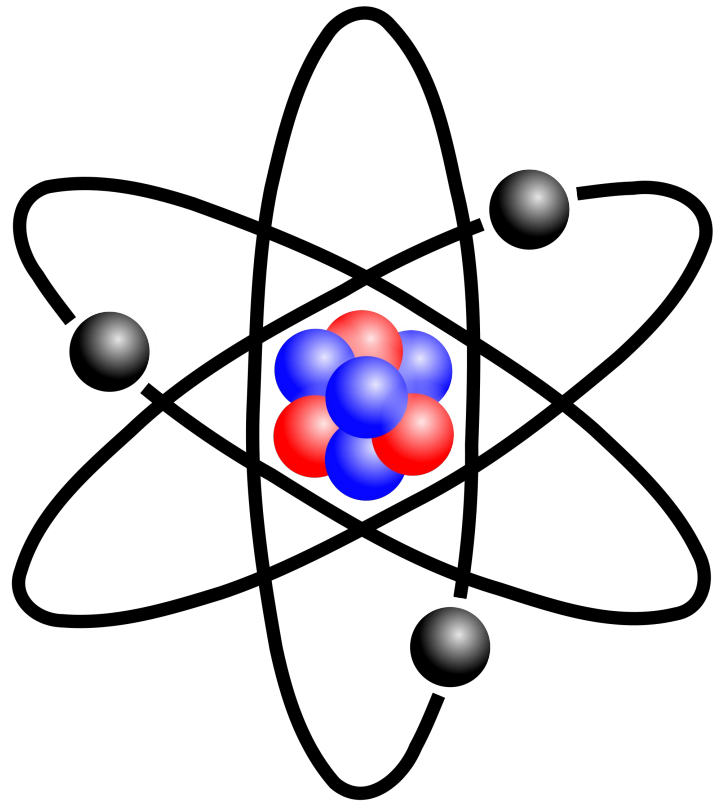
three generations of matter (fermions)			interactions / force carriers (bosons)		
	I	II	III		
mass	$\approx 2.2 \text{ MeV}/c^2$	$\approx 1.28 \text{ GeV}/c^2$	$\approx 173.1 \text{ GeV}/c^2$	0	$\approx 125.11 \text{ GeV}/c^2$
charge	$\frac{2}{3}$	$\frac{2}{3}$	$\frac{2}{3}$	0	0
spin	$\frac{1}{2}$	$\frac{1}{2}$	$\frac{1}{2}$	1	0
QUARKS	u up	c charm	t top	g gluon	H higgs
	d down	s strange	b bottom	γ photon	
	e electron	μ muon	τ tau	Z Z boson	
LEPTONS	ν_e electron neutrino	ν_μ muon neutrino	ν_τ tau neutrino	W W boson	

GAUGE BOSONS
VECTOR BOSONS

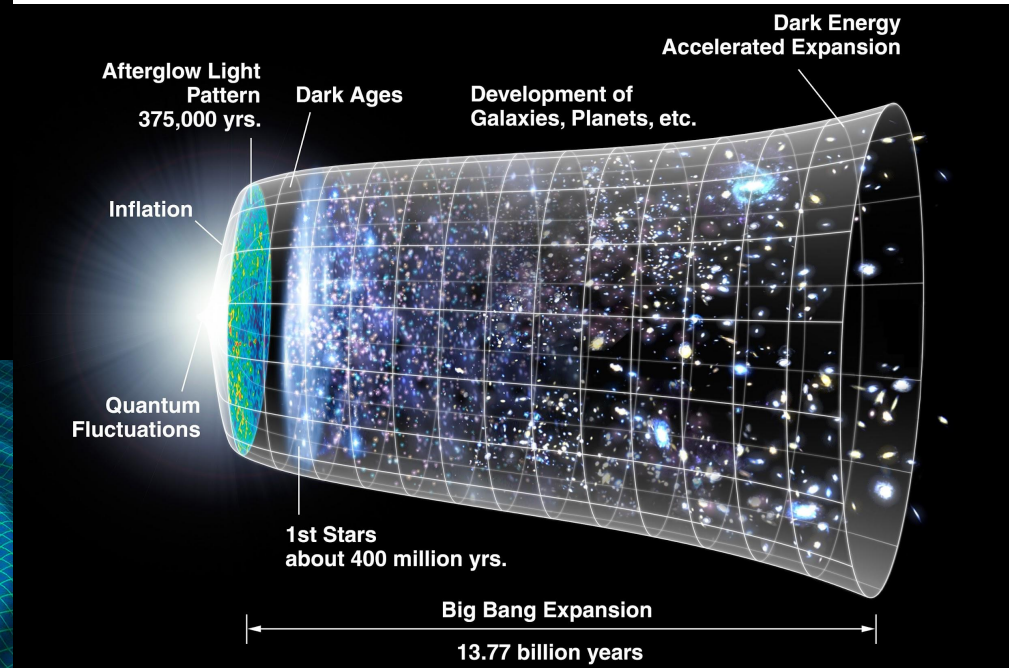
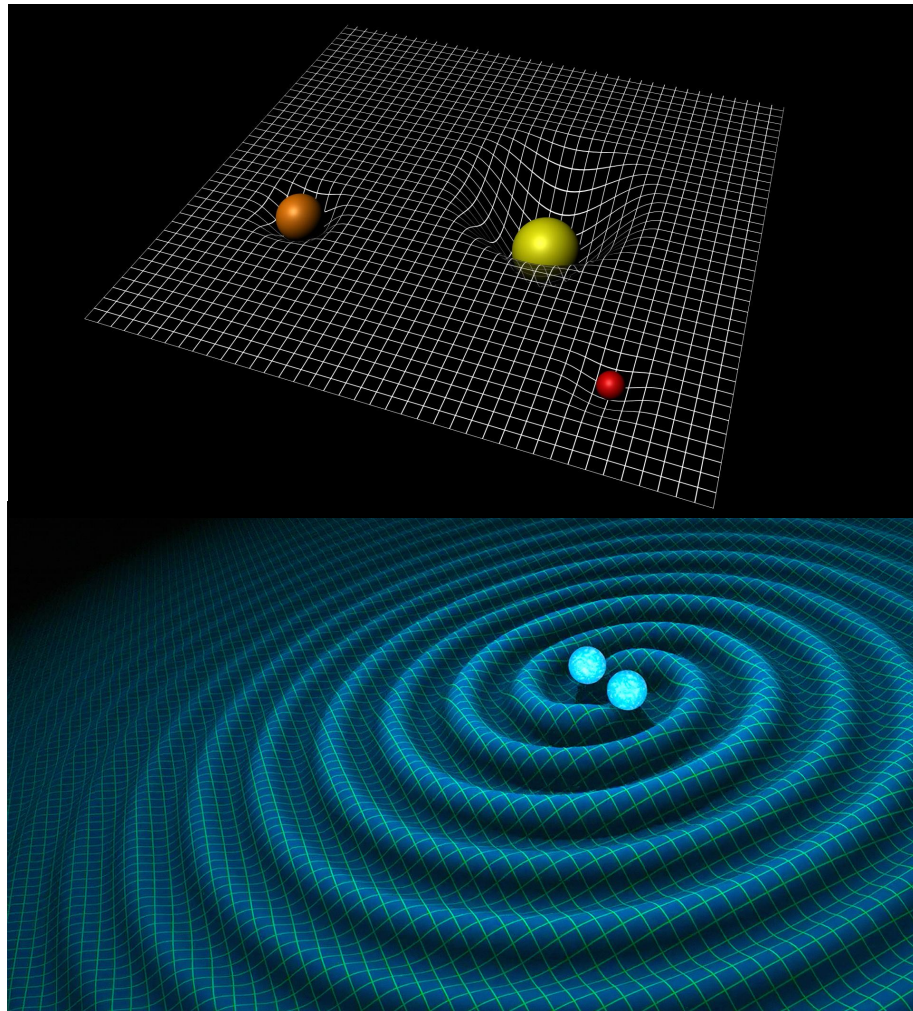
SCALAR BOSONS



Quantum theory



General relativity







???









COST ACTION CaLISTA



<https://site.unibo.it/calista/en>



Things can be discovered using pen and paper.



Things can be discovered using pen and paper.



Unification of two theories always gives more, than the original two theories.



Things can be discovered using pen and paper.



Unification of two theories always gives more, than the original two theories.

We will see what the unification of the quantum theory and gravity brings.



**Thanks for
attention!**

