

The background features a central, glowing blue ring that resembles a gravitational well or a lensing effect. Surrounding this ring are numerous thin, curved lines in various colors, including red, green, and purple, which create a sense of dynamic movement and depth, similar to a visualization of spacetime curvature or gravitational waves.

TESTS DE LA RELATIVITÉ GÉNÉRALE ET THÉORIES ALTERNATIVES

Neuvième Assemblée Générale du GdR Ondes Gravitationnelles
Oct 13 – 14, 2025, LPENS

Why modify gravity?

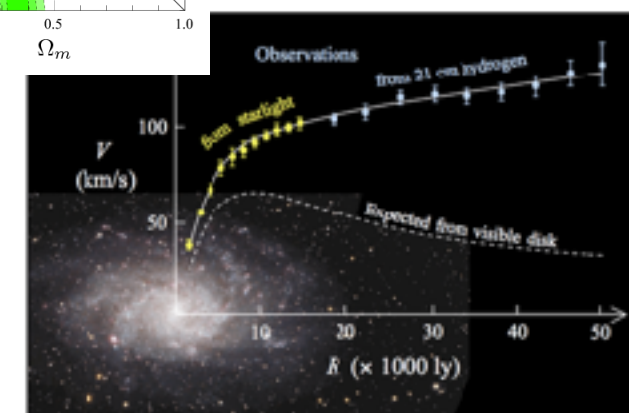
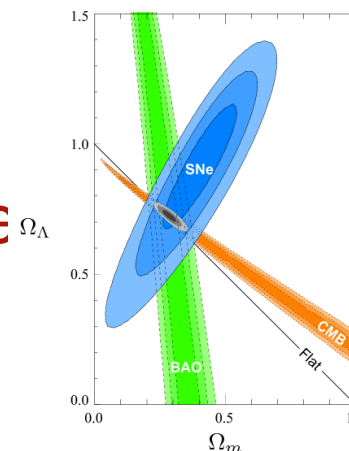
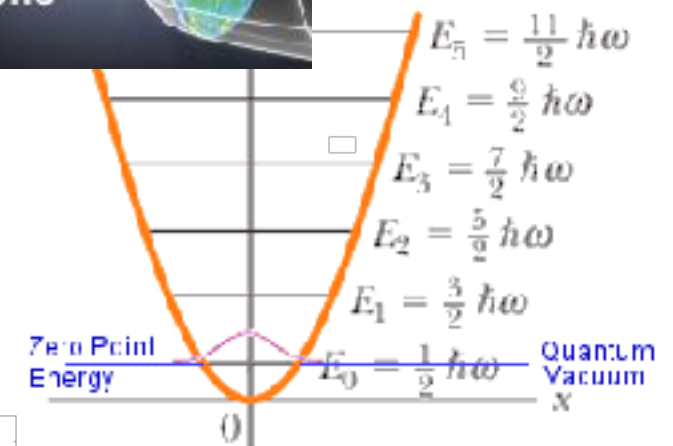
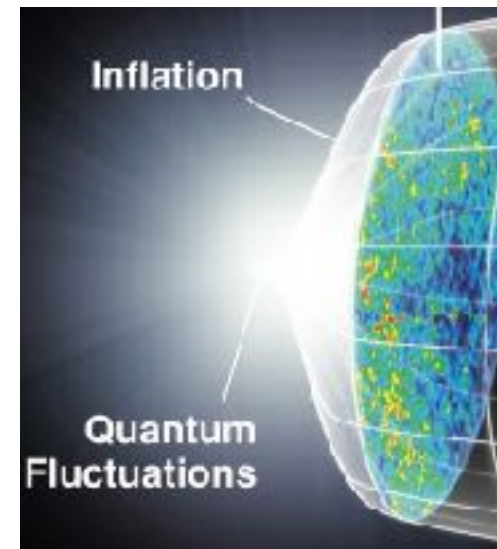
$$R + \frac{R^2}{6M^2} \quad (\text{Starobinsky inflation})$$

◆ Inflation

◆ Cosmological constant problem: vacuum energy is huge. How to cancel it?

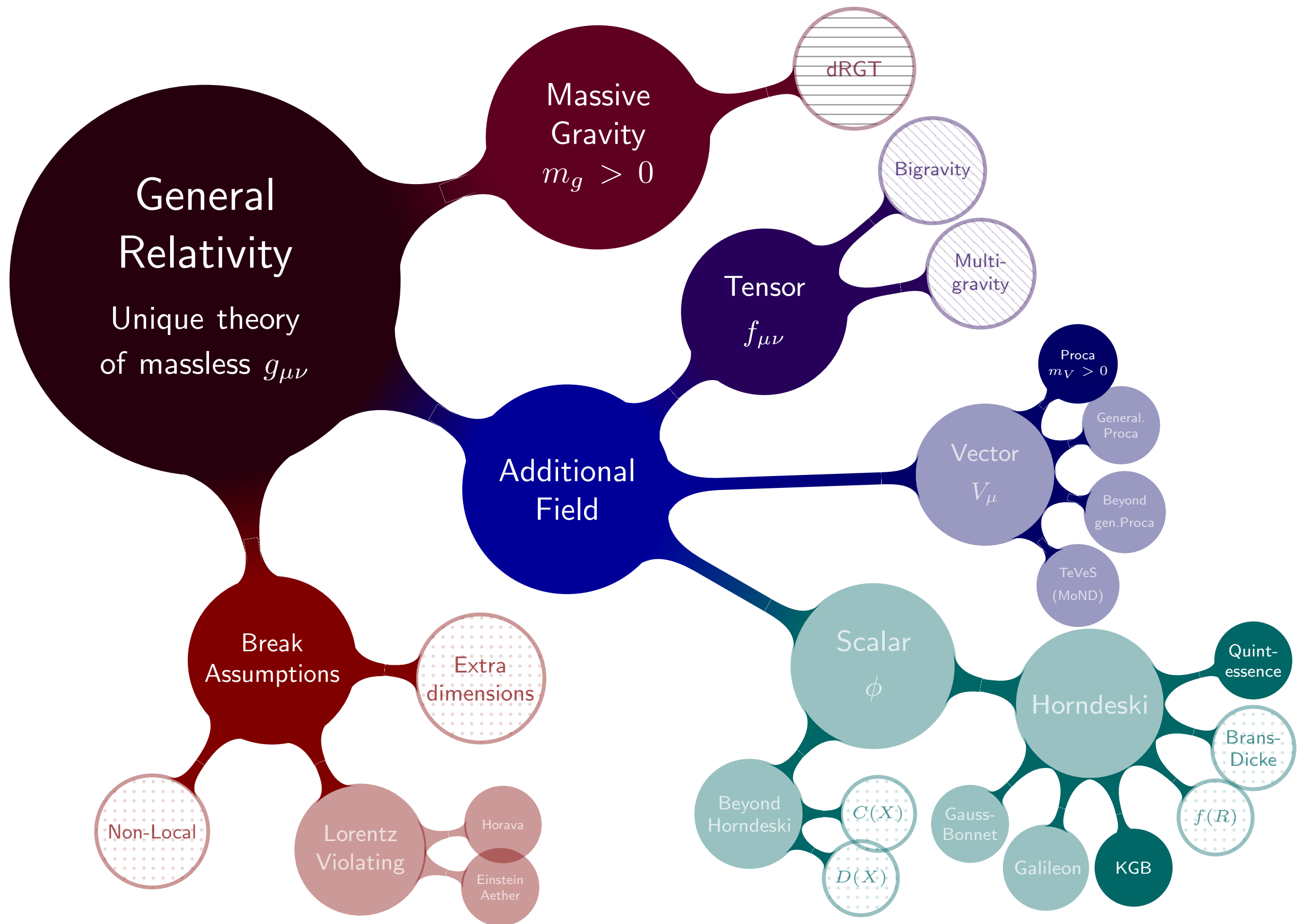
◆ Dark energy problem: the present-day acceleration of the Universe. What is the cause? Also coincidence problem.

◆ Dark matter problem.



Theoretical motivation for gravity modifications

- ❖ **Theoretical curiosity**
- ❖ **Establishing benchmarks to compare with GR**
- ❖ **Make gravity renormalisable**



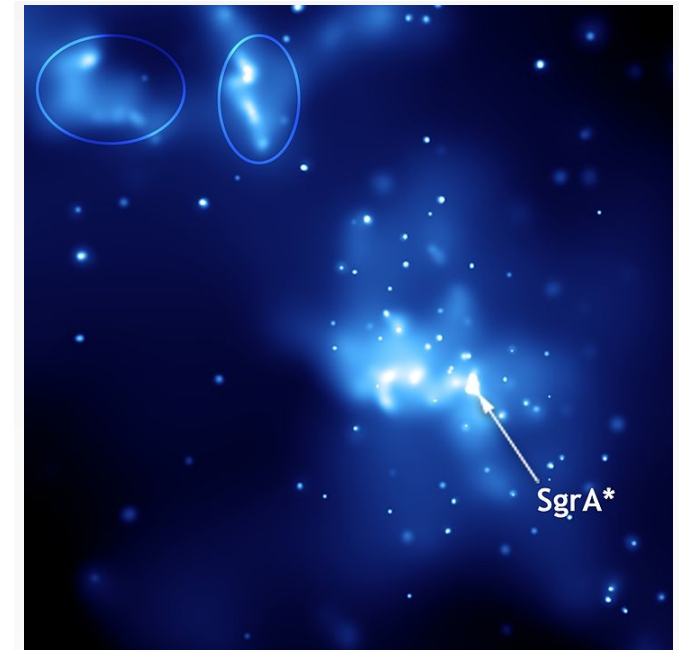
Golden era for observational gravity and cosmology



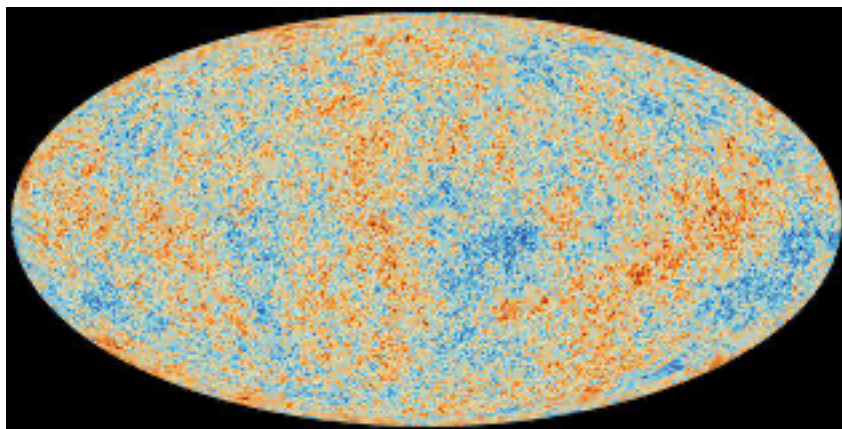
GW signals from binaries at their ringdown phase (LIGO/Virgo)



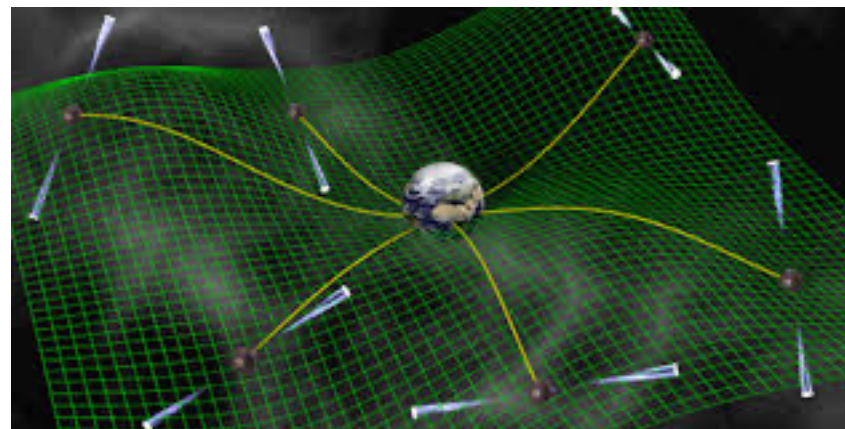
Image of M87 black hole with its light ring (from array of radio telescopes, EHT)



Observation of star trajectories orbiting SgrA central black hole (GRAVITY)



Anisotropies of the CMB with unmatched sensitivity and resolution



nHz stochastic gravitational wave background with Pulsar Timing Arrays

Look for deviations from GR in observations?

- ❖ Forecasting general relativity constraints with 3G detectors
- ❖ Beyond GR Tests with the Einstein Telescope
- ❖ Multi-messenger lensing time delay as a probe of the graviton mass
- ❖ Numerical relativity waveforms in effective field theories of gravity
- ❖ Positive spin-induced quadrupole moment