Mathematical and Physical Foundations of Extended Gravity

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Conceptual Aspects

- Foundation: gravity and space-time

- Shortcomings in General Relativity

- Alternatives, way out and extensions

- The key role of conformal transformations

- Metric or connections?

- The role of Equivalence Principle

- Testing EP at classical and quantum level

Gravitational waves and ETGs

- GWs really exist!!

- GWs in GR and Alternative Gravity

- Upper bound on the graviton mass?

- Further polarizations?

- Selecting affine or metric theories by GWs?

- Testing EP by GWs?

- Testing extreme gravitational fields

- Cosmology by GWs

Dark Energy and Dark Matter as Curvature Effects

- Dark Energy and Dark matter problems
- Extending General Relativity
- The weak field limit
- Stellar structures and Jeans instability
- Quadrupolar gravitational radiation
- Application to the binary systems
- Testing spiral galaxies
- Testing elliptical galaxies
- Modeling clusters of galaxies
- Cosmography

Hamiltonian formulation and Quantum Cosmology of ETGs

- The Hamiltonian formulation of General Relativity and the problem of canonical quantization

- The Minisuperspace Approach to Quantum Cosmology

- The Noether Symmetry Approach

- Extending General Relativity

- Extended Minisuperspace Models

- Discussion and conclusions