Theory of General Relativity

Summary

- review of special relativity
- review on differential geometry
- 4-dimensional space-time description
- Einstein's equations
- Isometries: Killing vectors and maximal symmetric spaces
- quasi-local conserved quantities
- Schwarzschild's solution: interior and exterior solutions
- Solar system tests of GR: advance of mercury's perihelion, light's trajectory deviation from the Sun
- Reference and coordinate systems: congruence deviation, Fermi-Walker transport, Tetrad fields
- Observer description: irreducible decomposition and kinematics parameters
- Gravitational waves: linear approximation, polarisation, generation of gravitational radiation
- Gravitational waves: non-linear regime (shock waves) and Hadamard's methods
- Black Holes: singularity and manifold's conformal analysis, maximal extension of manifodls
- Black Holes: Schwarzschild, Reissner-Nordstöm, Kerr and BH thermodynamics
- Exact solutions: de Sitter, FLRW, LTB, Kasner and Gödel