I.S. GSS-MI - INFN, 05 July 2023

Gauge theories, Supergravity and String theory

Mi-Bicocca, Mi-Statale, Genova,
Padova, Lecce, Pisa, Torino

Coord. naz.: Anna Teresa Ceresole (TO) ⟶ Davide Cassani (PD)

String theory, M-theory, Supergravity
Perturbative and non perturbative gauge theories
Supersymmetric Black Holes, holography, micro state counting
Models of SUSY breaking in cosmology and particle physics




Silke Klemm
Alberto Santambrogio
Antonio Amariti
Luca Guido Molinari


GSS - Mi

https://www0.mi.infn.it/~strings/index.php

Marco Astorino
Antoine Pasternak





Andrea Zanetti
Simone Rota
Alessia Segati
Davide Morgante
Carlo Alberto Mantica
+ in arrivo

associati: Sefano Bertini, Adriano Vigano`

A covariant description of space-times in Einstein and extended gravity

The field equations of gravitational theories are covariant, and equate a geometric tensor (e.g. Einstein, Cotton, Bach tensor) to a tensor describing matter. Solutions are usually found in coordinates that exploit the symmetries. However, there are advantages in keeping the coordinate-free tensor description as far as possible. Besides the formal elegance, it naturally addresses scalar identities.

A selection of publications by C.A.Mantica & L.G.Molinari (& S. Capozziello, NA):

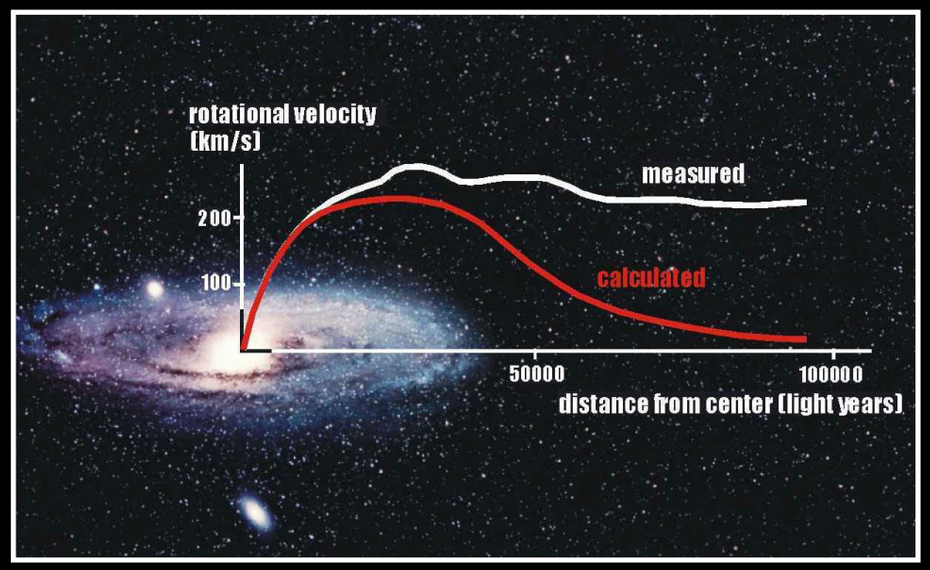
- The covariant approach to static space-times in Einstein and extended gravity theories.
- Codazzi tensors and their space-times, and Cotton gravity (GERG 2023)
- Spherical doubly warped spacetimes for radiating stars and cosmology (GERG 2022)
- Geometric perfect fluids from Extended Gravity (EPL perspectives 2022)
- Doubly torqued vectors and a classification of doubly twisted and Kundt spacetimes (GERG 2021)
- w = 1/3 to w = −1 evolution in a Robertson–Walker space-time with constant scalar curvature (IJGMMP 2019)
- Cosmological perfect-fluids in f(R) gravity (IJGMMP 2019)

…

- Extended Derdziński-Shen theorem for curvature tensors (Coll Math 2012)

Col gruppo abbiamo condiviso tesi di laurea

Fritz Zwicky (Mt. Wilson 1933): missing mass in the motion of galaxies in galactic clusters (virial) - Vera Rubin (’70): the rotation curve of galaxies (Newt)



THE QUEST FOR DARK MATTER

New geometry ? $G_{\mu\nu} = \kappa T_{\mu\nu}$ **New particles ?**

For cosmology we prove:
In many extended theories of gravity in RW background (ex: f(R), string-inspired corrections to Einstein-Hilbert action) the curvature corrections to Einstein equations have the perfect fluid form as required by the COSMOLOGICAL PRINCIPLE.

Cosmological perfect-fluids in f(R) gravity (IJGMMP 2019), …
Geometric perfect fluids from Extended Gravity (EPL 2022)

They modify the perfect-fluid parameters of the matter source and may correspond to observed effects of unobserved DM (S. Capozziello).

Doubly torqued vectors and a covariant classification of a (large) class of space-times

$$ds^2 = -e^{-\beta(x,t)}dt^2 + e^{\alpha(x,t)}g^{\star}_{\mu\nu}(x)dx^\mu dx^\nu$$

$$\nabla_i\tau_j = \kappa g_{ij} + \alpha_i\tau_j + \tau_i\beta_j$$

$$\alpha_j\tau^j = 0, \quad \beta_j\tau^j = 0$$

A covariant approach to static space-times in Einstein and extended gravity theories

$$ds^2 = -e^{-\beta(x)}dt^2 + g^{\star}_{\mu\nu}(x)dx^\mu dx^\nu$$

$$\nabla_i u_j = -u_i\dot{u}_j$$

$$\nabla_i\dot{u}_j = \nabla_j\dot{u}_i$$

Geometry dictates the covariant expressions for the Ricci, Weyl, Cotton, Bach tensors
A gravity theory (Einstein, Cotton, f(R), conformal - each one with its own variational principle) implies the form of energy-momentum tensor.
In spherical symmetry, we reobtain in simple manner several known solutions (Schwarzschild, Reissner-Nordstrom, Harada, Mannheim-Kazanas, some BH … and new ones), and properties of non-lin electrodynamics

$$F_{jk} = \frac{E}{\sqrt{\eta}}(u_j\dot{u}_k + u_k\dot{u}_j) + B(y_jz_k + y_kz_j) \qquad \text{(Faraday tensor)}$$

(The M-K and Harada solutions both have a log term in beta that mimics DM)