Roy@70 - the early years

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Cosmic Roy and the General Roylativitis
SAAO, Cape Town, 2024

The years at Wits

- First contact: middle 1983
- MSc supervisor, PhD supervisor, mentor for my fledgling research career
- Difficult period because of apartheid legislation;
  ministerial approval to travel and study; group areas act;
  environment at Wits was very supportive
- Provided template to follow in terms of being an academic and research scientist;
  strong impact on my development as an academic and researcher
- Staff at: Wits: David Mason, Nigel Bishop, Roy Maartens, Peter Leach, Michael Sears
- Students with some Wits connections: Sunil Maharaj, Manoj Maharaj, David Taylor,
  Charlemagne Pooe, Abie Kgathi, Athol Kemball, Fazal Mahomed;
  William Lesame, Aroon Beesham
- Visit of George Ellis
- Some notes:
  Cigarettes
  Cups of coffee
  Sowetan newspaper
  Planned parenthood

Ellis@85


LIFETIME ACHIEVEMENT
AWARD
PRESENTED TO
PROFESSOR
GEORGE F.R. ELLIS (F.R.S)

Mason@80

Maartens@70

Young guns

Online presence

Roy as an NRF bureaucrat

Roy as a socialist

J. Math. Phys, 26, 2870 (1985)

Collision-free gases in spatially homogeneous space-times

R. Maartens and S. D. Maharaj
Department of Applied Mathematics, University of the Witwatersrand, 1 Jan Smuts Avenue, Johannesburg 2001, South Africa

(Received 19 December 1984; accepted for publication 16 May 1985)

The kinematical and dynamical properties of one-component collision-free gases in spatially homogeneous, locally rotationally symmetric (LRS) space-times are analyzed. Following Ray and Zimmerman [Nuovo Cimento B **42**, 183 (1977)], it is assumed that the distribution function f of the gas inherits the symmetry of space-time, in order to construct solutions of Liouville's equation. The redundancy of their further assumption that f be based on Killing vector constants of the motion is shown. The Ray and Zimmerman results for Kantowski–Sachs space-time are extended to all spatially homogeneous LRS space-times. It is shown that in all these space-times the kinematic average four-velocity u^i can be tilted relative to the homogeneous hypersurfaces. This differs from the perfect fluid case, in which only one space-time admits tilted u^i, as shown by King and Ellis [Commun. Math. Phys. **31**, 209 (1973)]. As a consequence, it is shown that all space-times admit nonzero acceleration and heat flow, while a subclass admits nonzero vorticity. The stress π_{ij} is proportional to the shear σ_{ij} by virtue of the invariance of the distribution function. The evolution of tilt and the existence of perfect fluid solutions are also discussed.

Relativistic gravitating fluids, conformal symmetries, inheriting symmetries, material curves, gravastars ...

J. Math. Phys. 27, 2987 (1986)

Kinematic and dynamic properties of conformal Killing vectors in anisotropic fluids

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An example from a perfect fluid FRW space-time is presented to show that a conformal Killing vector (CKV) need not map fluid flow lines into fluid flow lines. Kinematic properties of the Lie derivative along a CKV of timelike and spacelike unit vectors are derived and applied to the fluid unit four-velocity vector. Dynamic properties of special conformal Killing vectors (SCKV) in a fluid with anisotropic pressure and vanishing energy flux are obtained using Einstein's field equations. It is shown that a SCKV maps both fluid flow lines and integral curves of n^a into themselves, where n^a is the unit spacelike vector of anisotropy. The relation between the anisotropic pressure components and the energy density is considered. By means of an example from a radiationlike viscous fluid FRW space-time it is shown that the dynamic results depend crucially on the vanishing of the energy flux vector. The extension of the dynamic results to a fluid with arbitrary stress tensor and zero energy flux vector is examined.

Gravitational collapse, gamma ray bursts...

GAMMA-RAY BURSTS AS THE BIRTH-CRIES OF BLACK HOLES*

Mod. Phys. Lett. A 15, 991
(2000)

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Received 18 May 2000

The origin of cosmic gamma-ray bursts remains one of the most intriguing puzzles in astronomy. We suggest that purely general relativistic effects in the collapse of massive stars could account for these bursts. The late formation of closed trapped surfaces can occur naturally, allowing the escape of huge energy from curvature-generated fireballs, before these are hidden within a black hole.

Higher order theories, EGB gravity, Lovelock gravity...

Gen. Relativ. Gravit. 26, 599 (1994)

Fluid Dynamics in Higher Order Gravity

R. Maartens[1] and D. R. Taylor[1]

Received August 5, 1993

We examine the kinematic and dynamic properties of fluid spacetimes in higher order gravity. In particular we extend the general equations of Ehlers and Ellis governing relativistic fluid dynamics from general relativity to the higher order theory. We find exact results for the evolution of shear in Bianchi spacetimes with isotropic surfaces, thus generalising the general relativity results. Furthermore we show that the vanishing of vorticity, shear and acceleration does not imply FRW geometry in $R + \alpha R^2$ gravity without the further assumption of a barotropic equation of state, $p = p(\rho)$, $p'(\rho) \neq 0$. In particular, this result means that the Ehlers–Geren–Sachs theorem on cosmic background radiation also holds in the higher order theory.

Roy retirement theorem

Proposition

The mention of retirement generates possibilities such as

- *The trouble with retirement is that you never get a day off (Abe Lemons),*
- *When a person retires and time is no longer a matter of urgent importance, his colleagues generally present him with a watch (R.C. Sherriff),*
- *When a person retires, his partner gets twice the person but only half the income. (Chi Chi Rodriguez).*
- .....

These are possibilities that Roy will not entertain. Hence Roy will NOT retire.