CONTRIBUTED TALKS FOR XIX IFWGP

1 - Rui Albuquerque, Universidade de Évora, Portugal

Gwistor spaces

We survey on the latest results in gwistor theory, the geometry of the natural G2 structure on the unit tangent sphere bundle founded in "The G2 sphere of a 4-manifold", R. Albuquerque and I. Salavessa, Monat. fur Math. Vol 158, Number 4 December 2009, pp. 335-348. The implications to string theory of these results on calibrated or special Riemannian geometries are yet to be explored.

2- Manlio Bordoni, Universitá "La Sapienza" Roma, Italy

Construction of Isospectral Manifolds

Given two isospectral not isometric manifolds, we construct a new couple of such manifolds as the total spaces of two Riemannian submersions with totally geodesic fibres isometric to the given ones and of basis any other given manifold. By iteraation, we obtain families of isospectral not isometric manifolds.

Main reference:

M. Bordoni, V. Marino: Towers of isospectral manifolds,Complex Variables and Elliptic Equations Vol. 54 n.1 (2009), 1-7

Other references: see this paper

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3 - David Burton, Lancaster University and the Cockcroft Institute, Department of Physics, Lancaster University, UK

Exploring Born-Infeld electrodynamics using plasmas

Some of the most extreme conditions ever encountered in a terrestrial laboratory are created when high-power laser pulses interact with matter. The laser pulse immediately vaporizes the matter to form an intense laser-plasma providing novel avenues for generating intense bursts of coherent electromagnetic radiation for a wide range of applications in medicine, material science and security. Furthermore, the next generation of ultra-intense lasers, such as ELI [1] and HiPER [2], are expected to permit experimental investigation of long-standing questions in electrodynamics. Although it has already been anticipated that the QED vacuum will yield experimental signatures in such laser-plasmas [3], it has also been recently suggested that non-linear electrodynamics may feature at the classical level and may offer insight into the problems of classical radiation reaction [4]. Recent years have seen a re-ignition of interest [4,5,6] in Born-Infeld theory [7] and have led us to initiate a programme of study of Born-Infeld plasma electrodynamics.

To motivate our latest work we will briefly review our recent study of wave-breaking in relativistic warm Maxwell plasmas [8] and emphasize the central role played by geometrical methods in our approach to solving the covariant Vlasov-Maxwell system [9]. We will then turn to the non-linear field equations of a Born-Infeld plasma and present our latest calculations of the behaviour of large-amplitude Born-Infeld laser-plasma waves.

This work is being undertaken in collaboration with R.M.G.M. Trines (Rutherford Appleton Laboratory and U. Lancaster, UK), T.J. Walton (U. Lancaster and the Cockcroft Institute, UK) and H. Wen (U. Lancaster and the Cockcroft Institute, UK).

References :

[1] http://www.extreme-light-infrastructure.eu/

[2] http://www.hiper-laser.org/

[3] M. Marklund, J. Lundin, Eur. Phys. J. D 55 319 (2009)

[4] T. Dereli, R.W. Tucker, Euro. Phys. Lett. 89 20009 (2010)

[5] R. Ferraro, Phys. Rev. Lett. 99 230401 (2007)

[6] G.W. Gibbons, C.A.R. Herdeiro, Phys. Rev. D 63 064006 (2001)

[7] M. Born, L. Infeld, Proc. R. Soc. Lond. A 144 425 (1934)

[8] D.A. Burton, A. Noble, J. Phys. A: Math. Theor. 43 075502 (2010). arXiv:0908.4498

[9] D.A. Burton, A. Noble, H. Wen, Il Nuovo Cim. C 32 1 10 (2009). arXiv:0906.1096

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4 - Beniamino Cappelletti Montano, CRM, Bellaterra, Spain

Bi-paracontact structures and Legendre foliations

We illustrate the theoy of almost bi-paracontact structures on contact manifolds, closely linked to that of Legendre foliations. In particolar we point out the applications to the study of contact metric (κ,μ)-spaces, a recent important generalization of Sasakian manifolds.

References

B. Cappelleti Montano, Bi-paracontact structures and Legendre foliations, Kodai Math. J. (to appear).

B. Cappelletti Montano, The foliated structure of contact metric (κ,μ)-spaces, Illinois J. Math. (to appear).

B. Cappelletti Montano, L. Di Terlizzi, Geometric structures associated to contact metric (κ,μ)-structures, Pacific J. Math. 246 n. 2 (2010), 257-292.

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5 - Andrew Dancer, Mathematical Institute,Oxford University, United Kingdom

Ricci solitons

We discuss constructions for Ricci solitons, including non-Kahler examples

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6 - Rui Pacheco, Universidade da Beira Interior, Portugal

Singular Dressing Actions on Harmonic Maps

In this talk we show that any harmonic map f from a two-sphere S^2 into an arbitrary compact semisimple matrix Lie group G may be reduced to a constant by using the "singular dressing actions" introduced in [BeG].

[BeG] M.J. Bergvelt and M.A. Guest, "Action of loop groups on harmonic maps." Trans. Amer. Math. Soc. 326 (1991), 861--886.

[CP] N. Correia and R. Pacheco, Singular Dressing Actions on Harmonic maps, The Quarterly Journal of Mathematics 2009; doi: 10.1093/qmath/hap022.

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7 - Marcella Palese, Department of Mathematics, University of Torino, Italy

Geometric aspects of gauge-natural invariant field theories

We study geometric aspects concerned with symmetries and conserved quantities in gauge-natural invariant variational problems and investigate implications of the existence of a reductive split structure associated with canonical Lagrangian conserved quantities on gauge-natural bundles.

Joint work with E. Winterroth

References

MR2474411 Palese, M.; Winterroth, E.: Lagrangian reductive structures on gauge-natural bundles. Rep. Math. Phys. 62 (2008), no. 2, 229--239.

MR2453935 Ferraris, Marco; Francaviglia, Mauro; Palese, Marcella; Winterroth, Ekkehart: Canonical connections in gauge-natural field theories. Int. J. Geom. Methods Mod. Phys. 5 (2008), no. 6, 973--988.

MR2462830 Palese, M.; Winterroth, E.: Noether identities in Einstein-Dirac theory and the Lie derivative of spinor fields. Differential geometry and its applications, 643--653, World Sci. Publ., Hackensack, NJ, 2008.

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8 - Luigi Vezzoni, Universita di Torino, Italy

The Calabi-Yau equation in four-dimensional symplectic nilmanifolds.

In a joint work with A. Fino and S. Salamon we study the Calabi-Yau equation in four-dimensional nilmanifolds. We show that in these cases the Calabi-Yau equation reduces to a classical PDE equation and that it can be solved with standard technique.