ABSTRACTS

The Stützfunktion and the cut-function

K.P.Tod

A convex body B in R^3 is defined by its *Stützfunktion* or support function; the boundary of the future of B meets future-null-infinity in a cut determined by a cut-function; these turn out to be proportional. I review parts of the theory of convex bodies and show how they can be generalised to cover future- and past-convex space-like 2-surfaces in Minkowski space.

(in 'Recent Advances in General Relativity' eds A.I.Janis and J.R.Porter, Birkhauser:Boston 1992)

The Hoop conjecture and the Gibbons-Penrose construction of trapped surfaces

K.P.Tod

The Hoop conjecture in the form that a marginally-trapped surface has its maximum 'circumference' less than about 4π times the mass it contains is studied for marginally-trapped surfaces produced by the construction of Gibbons and Penrose from shells of matter falling in at the speed of light in flat space. Some forms of the hoop conjecture are proved as new geometric inequalities on convex bodies; other forms of the conjecture are shown to be false. It is also shown how, despite a widespread belief to the contrary, marginally-trapped surfaces can be formed in the collapse of cylindrical or extremely prolate bodies.

(Class.Quant.Grav. 9 (1992) 1581-1591)

An algebraic treatment of certain classes of spinor equations with an application to General Relativity

JÖRG FRAUENDIENER
AND
GEORGE A. J. SPARLING

ABSTRACT. A new formulation for treating spinor equations on a spacetime is introduced and applied to the spin-2 equation for the Weyl spinor in vacuum General Relativity. The power of the formalism rests on the fact that it is index free, describing structures in terms of algebraic relations which makes it well adapted for use in algebraic manipulation programs. The starting point is the fact that connections in bundles can be viewed as derivations on the algebra of sections of the bundle. In the case of the spin bundle there is a canonical operator basis that allows one to take components in a canonical way so that one can express everything in terms of scalar operators. Thus, essentially, this is a non-commutative Newman-Penrose formalism. In an application to General Relativity we present an algorithm that recursively produces the terms of a Taylor series expansion of the Weyl spinor around the apex of a light cone from characteristic data given on that cone.

JÖRG FRAUENDIENER, MAX PLANCK INSTITUT FÜR ASTROPHYSIK, KARL-SCHWARZSCHILD-STRASSE 1, 8046 GARCHING BEI MÜNCHEN, GERMANY
Current address: Mathematical Institute, University of Oxford, 24–29 St. Giles, Oxford, OX1 3LB, U. K.

G. A. J. SPARLING, DEPARTMENT OF MATHEMATICS AND STATISTICS, UNIVERSITY OF PITTSBURGH, PITTSBURGH, PA 15260, U. S. A.

COMPLEX STRUCTURES ON QUATERNIONIC MANIFOLDS

MASSIMILIANO PONTECORVO

Dipartimento di Matematica
Universita' di Bologna
and
S.I.S.S.A.
Via Beirut 2-4
34014 Trieste, Italy

September 7, 1992

ABSTRACT. In the first part of this work we consider compact riemannian manifolds M with holonomy in $Sp(n)Sp(1)$. We show that M admits a compatible complex structure if and only if the holonomy is in $Sp(n)$, up to finite coverings. We also show that the sign of the Ricci curvature completely determines the algebraic dimension of the twistor space.

In the second part, by way of contrast, we give two geometric constructions of simply-connected quaternionic manifolds with a compatible complex structure which is not hypercomplex. The first examples are non-compact and symmetric. The second one is compact and follows from general reults of Joyce [J].