LMS Invited Lecture Series:
Black holes in a vacuum: examples and uniqueness properties

31 March - 4 April, 2009

	Tuesday 31 March	Wednesday 1 April	Thursday 2 April	Friday 3 April	Saturday 4 April
10-11am	Ionescu 1	Ionescu 3	Ionescu 5	Ionescu 7	Ionescu 9
11am-noon	COFFEE	COFFEE	COFFEE	COFFEE	COFFEE
noon-1pm	Ionescu 2	Ionescu 4	Ionescu 6	Ionescu 8	Ionescu 10
1-3pm	LUNCH	LUNCH	LUNCH	LUNCH	LUNCH
3-4pm		Andersson	Rendall	Valiente Kroon	

Location: JCMB 5215
All lectures will be in room 5215 of JCMB (the James Clerk Maxwell building), which is on the northwest corner of the fifth floor. Coffee and lunches will be served in room 5212.

http://www.maths.ed.ac.uk/~wright/Ionescu/

Accommodation (Pollocks Hall)

For nonlocal participants, accommodation has been arranged in single rooms with ensuite at Pollock Halls . In addition to accommodation, breakfast and dinner will be provided at Pollock Halls. Lunch will also be provided for course participants. Please arrive at the Reception Centre of Pollock Halls (click on "Location map" at the web address below) after 2pm on Monday, 30 March, 2009. There will be a registration and wine reception from 4 to 6pm in the Red Room at the Salisbury Green Hotel. The lectures will finish by 2pm on Saturday, 04 April so arrange your travel back home sometime after this time.

18 Holyrood Park Road, Edinburgh

http://www.edinburghfirst.com/

Directions

From Pollock's Halls, leave via Holyrood Park Road. Turn left (southwest) onto Holyrood Park Road and go 200m. Turn left (southeast) onto Dalkeith Road, and go 100m. Turn right (east) on to Salisbury Road, and go 500m. Turn left (south) on to Ratcliffe Terrace. After 500m, this will change name to Mayfield Road. Continue for another kilometre. Pass gate 3, and continue along Mayfield Road until gate 4. Turn right to enter the University of Edinburgh campus via gate 4. Continue along this road until it forks. The building directly in front of you will be the one you want to enter, JCMB. To find the entrance, go slightly to the right, then follow the foot path along the side of the building. At the end of this path will be a set of steps leading to the main entrance of the building.

From the JCMB entrance, follow the signs and take the stairs or elevator to the fifth floor.

www.ed.ac.uk/maps

Information

The 2009 LMS Invited Lectures will be given at Edinburgh University and is co-sponsored by the Maxwell Institute Centre for Analysis and Nonlinear PDEs. The series is held annually: a single speaker gives a course of 10 expository lectures, examining an important topic in depth over a five day period. In the 2009 programme there will be two lectures each morning given by Professor Ionescu from the University of Wisconsin, who will cover the following topics

- Lorentzian geometry: basic definitions
- The Einstein vacuum equations
- Special solutions: Minkowski, Schwarzschild, Kerr
- Stationary regular black holes
- Unique continuation: examples
- The uniqueness of the Kerr solution (3-4 lectures on this topic)

In addition to the lectures given by Professor Ionescu there will be more specialised one hour lectures given by

- Lars Andersson (Albert Einstein Institute) on 01 April at 3pm "Hidden symmetries and the wave equation on Kerr"
- Alan Rendall (Albert Einstein Institute) on 02 April at 3pm "Cosmic censorship: an introduction and status report"
- Juan Antonio Valiente Kroon (Queen Mary, London) on 03 April at 3pm "A characterisation of initial data sets for Kerr spacetime"

Abstracts are on the lecture series website.

Course Overview Uniqueness properties of the Kerr space-times

A fundamental conjecture in General Relativity asserts that the domain of outer communication of a regular, stationary, four dimensional, vacuum black hole is isometrically diffeomorphic to the domain of outer communication of a Kerr black hole. One expects, due to gravitational radiation, that general, asymptotically flat solutions of the Einstein-vacuum equations1 settle down, asymptotically, into a stationary regime. Thus the conjecture, if true, would characterize all possible asymptotic states of the general evolution. So far the conjecture has been resolved, by combining results of Hawking [2] Carter [1] and Robinson [3], under the additional hypothesis of non-degenerate horizons and real analyticity of the space-time. The assumption of real analyticity is both hard to justify on physical grounds and difficult to dispense of. I will discuss some recent work, joint with S. Klainerman, aimed at understanding this conjecture in the class of smooth manifolds. We develop a new strategy to bypass analyticity based on a tensorial characterization of the Kerr space-times, and new geometric Carleman estimates.

References

[1] B. Carter, An axy-symmetric black hole has only two degrees of freedom, Phys. Rev. Lett., 26, (1971) 331-333.

[2] S.W. Hawking and G.F.R. Ellis, The large scale structure of space-time, Cambridge Univ. Press, 1973

[3] D.C. Robinson, Uniqueness of the Kerr black hole, Phys. Rev. Lett. 34 (1975), 905-906.

A longer course overview is available here.