

Rosquist Kjell

Position: Professor of Theoretical Physics at Stockholm University

Period covered: 2007-2008



I Scientific Work

Einstein's general theory of relativity is the basis for understanding many, if not most, of the astrophysical phenomena which are observed today. Black holes, in particular, are described by the Kerr-Newman family of solutions to the Einstein-Maxwell field equations. This family has a very special multipole structure with an infinite sequence of moments. Due to the black hole uniqueness theorems, the Kerr-Newman structure can be regarded as the end point of gravitationally collapsing astrophysical systems. Part of Rosquist's interest in this area is an attempt to characterize the Kerr-Newman solutions within a wider class of asymptotically flat systems.

There is an important general relativistic relation between the three quantities a , Q and M known as the Christodoulou-Ruffini mass formula. For black holes, the formula gives the available amount of energy which can be extracted. This is of relevance for macroscopic systems such as those responsible for gamma ray bursts. The mass formula is also expected to be important in the non-black hole case (i.e. not dominated by M), in particular in the microscopic domain as well. The situation in the non-black hole case is however less well-known. Rosquist is now working to fill in this gap. In particular, it is important to understand the relation between the two terms in the mass formula. This is an issue which can be investigated using the framework of the Kerr-Newman family of solutions.

II Conferences and educational activities

Conferences and Other External Scientific Work

Lectures and talks at the University of Rome and at conferences:

Bego Scientific Recontres, Nice, February 2006

Eleventh Marcel Grossmann Meeting on General Relativity (MG11), Berlin, July 2006

Italy-Korea meeting, Pescara, June 2007

18th International Conference on General Relativity and Gravitation (GR18), Sydney, July 2007

Work With Students

Mikael von Strauss, new graduate student
– Project on interacting fields using the theory of general relativity

Diploma thesis supervision

Tomas Bylund
– Carter's constant

Other Teaching Duties

Courses taught in the academic year 2008-2009:

Relativistic quantum mechanics (advanced undergraduate level)

Waves and Quantum Mechanics (undergraduate level)

Work With Postdocs

Lars Samuelsson at the Nordita Institute, Stockholm.
– Work on Carter's constant and other aspects of relativistic astrophysics

III Service activities

Within ICRA Net

Adviser at various scientific committees

Outside ICRA Net

Member of undergraduate teaching committee at the Dept of Physics, Stockholm University.

External examiner of licentiate thesis 2006 of Thomas Bäckdahl, Linköping University, Sweden.

IV Other

Collaboration with R. Ruffini, V. Belinski and others on aspects of general relativity, in particular field energy and interactions including both gravity and electromagnetic fields.

V 2007-2008 List of Publications

- K. Rosquist, Some physical consequences of the multipole structure of the Kerr and Kerr-Newman solutions, in Proceedings of the 11th Marcel Grossmann Conference on General Relativity (2008), in press.
- K. Rosquist, A dielectric analogue model of the Kerr equatorial plane, in Proceedings of the 11th Marcel Grossmann Conference on General Relativity (2008), in press.
- K. Rosquist, A link between general relativity and quantum mechanics, in Proceedings of the 11th Marcel Grossmann Conference on General Relativity (2008), in press.
- G. Pucacco and K. Rosquist, 1+1-dimensional separation of variables, J. Math. Phys. 48 (2007) 112903.
- K. Rosquist, T. Bylund and L. Samuelsson, Carter's constant revealed, E-print, arXiv:0710.4260 Int. J. Mod. Phys. (2008) (in press).
- K. Rosquist, Some Consequences of Gravitationally Induced Electromagnetic Effects in Microphysics, J. Kor. Phys. Soc. (2008) (in press).

Kjell Rosquist was born in Stockholm in 1948. He received his Ph. D. Degree in theoretical physics at the University of Stockholm in 1981. The thesis discussed the possibility that the universe could be rotating. In 1982-1983 he was a postdoc with Dr M. MacCallum at Queen Mary College in London. In 1984, Rosquist was given the title Docent in Theoretical Physics at Stockholm University. He was appointed as lecturer at Stockholm University in 1987. In 1993-1995 he was performing research at Université Libre de Bruxelles supported by a grant from the European Union. Rosquist was appointed as Professor at the University of Stockholm in 2000. He is now Professor at the Department of Physics at the University of Stockholm.

Starting with an invited visit in 1992, Rosquist has had a long time affiliation with the University of Rome. He has been an active participant in many conferences and other activities organized by ICRA and ICRANet in Rome, Pescara and Nice. Since 2005 he has been a regular visitor to the ICRANet center in Pescara.

The main focus in Rosquist's research activity has been on aspects of general relativity with applications in several separate directions. It began with the research in theoretical cosmology in his thesis which was followed by a long collaboration on Bianchi cosmology with R. Jantzen (Villanova University, Philadelphia), and with his first student C. Uggla (now Professor at Karlstad University, Sweden). He has also been collaborating extensively with G. Pucacco (the University of Rome, "Tor Vergata") on geometric formulations of dynamical systems. Other applications pursued by Rosquist include relativistic stellar models and gravitational waves.

Rosquist has been teaching a number of courses at both the graduate and undergraduate levels. Since the mid 1980s he has supervised a number of Ph D students. Rosquist was the founder and first chairman of the Section on Gravitation of the Swedish Physical Society. He is a member of the International Society on General Relativity and Gravitation and of the International Astronomical Union.

Rosquist has authored several popular science articles in a number of Swedish magazines including *Forskning och Framsteg* and the Yearbook of the national Swedish research council as well as the Swedish Astronomical Yearbook. He has also participated in a number of science programs on television and radio.