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**Objet:** COLLOQUE DES SCIENCES MATHÉMATIQUES DU QUÉBEC (25/09/2015, Dmitri Vassiliev)  
**Date:** 21 septembre 2015 10:22  
**À:** [activites@CRM.UMontreal.CA](mailto:activites@CRM.UMontreal.CA)

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 COLLOQUE DES SCIENCES MATHÉMATIQUES DU QUÉBEC - Montréal  
<http://www.crm.umontreal.ca/Colloques/index.html>  
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DATE :  
 Le vendredi 25 septembre 2015 / Friday, September 25, 2015

HEURE / TIME :  
 16 h / 4:00 p.m.

CONFERENCIER(S) / SPEAKER(S) :  
 Dmitri Vassiliev (University College London)

TITRE / TITLE :  
 Analysis of first order systems of PDEs on manifolds without boundary

LIEU / PLACE :  
 UQAM - Pavillon Sherbrooke, \*\* Salle SH-2420 \*\*

\*\* CHANGEMENT DE SALLE  
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RESUME / ABSTRACT :  
 In layman's terms a typical problem in this subject area is formulated as follows. Suppose that our universe has finite size but does not have a boundary. An example of such a situation would be a universe in the shape of a 3-dimensional sphere embedded in 4-dimensional Euclidean space. And imagine now that there is only one particle living in this universe, say, a massless neutrino. Then one can address a number of mathematical questions. How does the neutrino field (solution of the massless Dirac equation) propagate as a function of time? What are the eigenvalues (stationary energy levels) of the particle? Are there nontrivial (i.e. without obvious symmetries) special cases when the eigenvalues can be evaluated explicitly? What is the difference between the neutrino (positive energy) and the antineutrino (negative energy)? What is the nature of spin? Why do neutrinos propagate with the speed of light? Why are neutrinos and photons (solutions of the Maxwell system) so different and, yet, so similar?

The speaker will approach the study of first order systems of PDEs from the perspective of a spectral theorist using techniques of microlocal analysis and without involving geometry or physics. However, a fascinating feature of the subject is that this purely analytic approach inevitably leads to differential geometric constructions with a strong theoretical physics flavour.

References

- [1] See items 98-101, 103 and 104 on my publications page <http://www.homepages.ucl.ac.uk/~ucahdva/publicat/publicat.html>
- [2] Futurama TV series, Mars University episode (1999): Fry: Hey, professor. What are you teaching this semester? Professor Hubert Farnsworth: Same thing I teach every semester. The Mathematics of Quantum Neutrino Fields. I made up the title so that no student would dare take it.

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