# Recent Understanding in Harmonic Maps

Titles and Abstracts

The Graduate Center, CUNY 365 Fifth Avenue New York, NY 10016 Science Center, Room 4102

Thursday, December 6th, 2012 9:00am till 4:00pm

9:30-10:00:	Coffee
10:00–11:00: 11:15–12:15:	Tristan Rivière Fanghua Lin
12:15-1:15:	Lunch
$\begin{array}{c} 1:15-2:15:\\ 2:30-3:30:\end{array}$	John Bolton John C. Wood
3:30-4:30:	Discussion

### **Tristan Rivière**, ETH Zürich The analysis of conformal-minimal surfaces

In the early XXth century Wilhelm Blaschke, in order to merge minimal surface theory and conformal invariance, proposed to study the broad class of surfaces critical points to the  $L^2$  norm of the mean curvature. The study of these critical points, the so called Willmore surfaces, originally called conformal-minimal surfaces, has become particularly active in the last 10 years and we shall present some of the main progresses that have been made in this direction. While presenting this relatively recent developments, we shall stress in particular the influence that the analysis of lower order conformally invariant problems, such as minimal surface, harmonic maps, CMC surfaces...had on our understanding of Willmore surfaces.

#### Fanghua Lin, Courant Institute (NYU)

A Harmonic Map Problem with Partial Free Boundary conditions

This is a preliminary report on a recent joint work with Changyou Wang. Here we consider a harmonic mapping problem with some what unusual boundary conditions that arise in the study of higher dimensional phase transition problems. We shall discuss several basic issues concerning such maps.

## John Bolton, Durham University (UK)

### Almost complex surfaces in the product of two 3-spheres

It has been shown by Butruille that there are just four 6-dimensional manifolds which admit a homogeneous non-Kähler, nearly-Kähler structure. One of these is the nearly Kähler 6-sphere, and (branched) almost complex surfaces (real 2-dimensional) in this space have been studied by several authors.

In joint work, F. Dillen, B. Dioos, L. Vrancken, and I have instigated the study of almost complex surfaces in another of these manifolds, namely the product  $S^3 \times S^3$  of two 3spheres. Since all almost complex surfaces in nearly Kähler manifolds are minimal, almost complex surfaces are particularly nice examples of harmonic maps.

I will describe the homogeneous nearly-Kähler structure on  $S^3 \times S^3$  (in particular, the metric is not a product metric), give some examples of almost complex surfaces, and then classify the almost complex 2-spheres in  $S^3 \times S^3$ .

### John C. Wood, University of Leeds (UK) Harmonic maps into exceptional symmetric spaces

We show that a harmonic map from a Riemann surface into the exceptional symmetric space  $G_2/SO(4)$  has a lift into one of the three flag manifolds of  $G_2$  if and only if it is 'nilconformal', i.e., has nilpotent derivative.

We find relationships with almost complex maps from a surface into the 6-sphere. this enables us to construct many examples of nilconformal harmonic maps into  $G_2/SO(4)$  which are not of finite uniton number.

This is work with Martin Svensson (Odense, Denmark).

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