SNS-B COURSE PROPOSAL

Title of the Proposal: Lectures on Higgs bundles and related topics

Proposed by: Cristian Anghel

Level: M1/M2

Academic Year: 2017 – 2018

Semester: Spring

Please choose one Master Program that suits the best your proposal (for Master courses only)
Fundamental structures and applications to algebra, geometry and topology

Is it a continuation of a previous SNS-B Course? YES

Description of the Course Proposal; the Course Outline:

The course is at the same time a continuation of the introductory AG-course "Algebraic curves and surfaces by examples" from the spring term 2016-2017 and a bridge towards a future M2 proposal for the 2018-2019 term on the "Topology of alebraic varieties". The main theme is related to Higgs bundles and two important and beautifully connected areas: Hodge theory and geometric structures on surfaces. If elected, as well as in the previous years, notes will be available in real time on my web-page. As prerequisites, apart the above mentioned AG-course, a good familiarity with functional analysis and differential geometry is highly desirable.

The (maximal) outline is the following:
• preliminaries on complex manifolds
• the Newlander-Nirenberg integrability thm (in the real analytic case)
• complex and holomorphic vector bundles
• Chern classes, special hermitian metrics
• Higgs bundles-motivation from physics; Higgs versus flat bundles
• a crash course on Hodge theory
• flat bundles, surface group representation and geometric structures
• what is a moduli problem? examples of deformation problems
• let's put things together: a non-abelian Hodge theory

List of five relevant Publications of the Proposer:

1. C. Anghel, I. Coanda, N. Manolache: *Globally generated vector bundles with small c_1 on projective spaces* . Memoirs AMS, to appear.
2. C. Anghel, N. Buruiana: *On large families of bundles over algebraic surfaces* . J. Geom. and Phys. Volume 100, Pages 92-95, 2016
3. C. Anghel, N. Manolache: *Globally generated vector bundles on $\mathbb{P}^n$ with $c_1 = 3$* . Mathematische Nachrichten, Vol. 286, Issue 14-15, pages 1407-1423, 2013.
4. C. Anghel: *Fibres vectoriels stables avec $\chi = 0$ sur une surface abelienne simple*. Math. Ann. 315, 497-501 (1999).
5. C. Anghel: *La stabilite de la restriction a une courbe lisse d'un fibre de rang* 2 *sur une surface algebrique* . Math. Ann. 304, 53-62 (1996).