

**MATH 6390 SECTION 351, SPRING 2012, SYLLABUS
TOPICS IN TOPOLOGY
VOLUME CONJECTURE AND ITS RAMIFICATIONS**

FACULTY: WEIPING LI
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1. BASIC COURSE INFORMATION

Prerequisites: Some basic differential geometry and topology knowledges

Textbooks: The course is research oriented and study research papers.

Content: hyperbolic 3-manifolds, hyperbolic volume and Gromov norm.

Part I: Mathematical Physics from Witten, Kashaev and Gukov's approaches to the topology and geometry;

Part II. Volume functions and hyperbolic volume for $SL(2, C)$ -characters. Character varieties and canonical components, Chern-Simons classes and regulators from K -theory;

Part III. Colored Jones invariants from Hecke algebra and quantum group point views, and L^2 -invariants and quantum invariant.

Class Time: MW 10:30am–12:00pm noon, start from January 9, 2012.

Class Room: MSCS .

Office Hours: MWF 2:30pm-3:30pm.

Syllabus Attachment:

<http://academicaffairs.okstate.edu/faculty-a-staff/46-syllabus-attachment>

2. OFFICE AND POLICIES

2.1. Main Office. Main office of Math Department 401 MS, phone number: 405-744-5688. Fax number: 405 - 744 - 8275.

Classroom and Email

Class attendance is essential to your success in the course. You are responsible for all the material covered in the class.

No cellphone ring or call during the class time in the classroom.

All your emails will be answered to everyone in the class unless you specify the No Reply (This is to avoid the asymmetry information for other students).

2.2. Missed Work Policy. MATHEMATICS DEPARTMENT MODEL POLICY ON MISSED WORK

(A) A student shall be offered reasonable accommodation in the event that he or she misses a major assessment activity for a valid and documented reason.

(B) Appropriate documentation shall be provided by the student in a timely fashion to support his or her request for accommodation.

(C) Major assessment activities are those such that a zero on that activity could reasonably be foreseen to impact the students grade substantially; this category includes, but is not limited to, exams.

(D) Valid reasons include official University activities, activities associated with military service, illness, family emergencies, mandatory court appearances, and any other events of comparable gravity.

(E) Reasonable accommodation means that the student will be given the opportunity to earn a grade on the assessment activity that is based on criteria as similar as possible to those used to grade his or her classmates. This opportunity should normally be made available in a timely fashion.

3. PROJECT

Everyone in the class will be assigned to a project. The project report is expected to finish **before April 20, 2012** (the week before Pre-Final Week).

3.1. Requirements for the Project. The project report must be written clearly on

- (1) identifying the problem(s),
- (2) presenting the background and history on the problem(s),
- (3) identifying the method(s) used before and in the article,
- (4) the new (innovation) contributions and goal(s) as well as the new findings in the article, and
- (5) the main contribution(s) and summary of the article you choose.

3.2. Choose one of the articles below for your Project.

- (1) The complex volume of $SL(n, \mathbb{C})$ -representations of 3-manifolds, by Stavros Garoufalidis, Dylan P. Thurston, Christian K. Zickert, arXiv:1111.2828
- (2) Nahm sums, stability and the colored Jones polynomial, by Stavros Garoufalidis, Thang T.Q. Le, arXiv:1112.3905
- (3) Local coordinates for $SL(n, \mathbb{C})$ character varieties of finite volume hyperbolic 3-manifolds, by Pere Menal-Ferrer, Joan Porti, arXiv:1111.4338
- (4) Quantizations of Character Varieties and Quantum Knot Invariants, by Adam S. Sikora, arXiv:0807.0943
- (5) Genus-1 Virasoro conjecture along quantum volume direction, by Xiaobo Liu, arXiv: 1106.3735
- (6) Geodesics, volumes and Lehmer's conjecture, by Mikhail Belolipetsky, arXiv:1106.1834
- (7) The higher order terms in asymptotic expansion of color Jones polynomials, by Shengmao Zhu, arXiv:1104.0403
- (8) The Kashaev and quantum hyperbolic link invariants, by Stephane Baseilhac, Riccardo Benedetti, arXiv:1101.1851
- (9) The Volume Conjecture, Perturbative Knot Invariants, and Recursion Relations for Topological Strings, by Robbert Dijkgraaf, Hiroyuki Fuji, Masahide Manabe, arXiv:1010.4542
- (10) Approximations to the volume of hyperbolic knots, by Stefan Friedl, Nicholas Jackson, arXiv:1102.374

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