

# Resurgence and localization in string theory and quantum field theory workshop Talk Schedule

Events for:  
**Monday, March 16th - Friday, March 20th**

## Monday, March 16th

10:00am **Stavros Garoufalidis - 102**

**Title:** Chern-Simons theory, analytic continuation and number theory

**Abstract:** Eight years ago, we formulated a conjecture relating the asymptotic expansion of the Kashaev invariant of a knot (and Chern-Simons theory with complex gauge group), with resurgence analysis and number theory. At the same time, Zagier formulated his Quantum Modular Form conjecture for the Kashaev invariant of the knot. We will review these conjectures and recent developments in complex Chern-Simons theory and number theory. Joint work (in several collaborations) with T. Dimofte, F. Calegari, R. Kashaev, D. Zagier"

11:00am **Coffee Break**

11:30am **Ricardo Schiappa - 102**

**Title:** On the Resurgent Asymptotics of Gauge and String Theories

12:30pm **Lunch - SCGP Cafe**

2:30pm **Mithat Unsal - 102**

**Title:** What is QFT? Resurgence, transseries, and Lefschetz thimbles

3:30pm **Coffee**

## Tuesday, March 17th

10:00am **Sergei Lukyanov - 102**

**Title:** Winding energies in two-parameter deformation of  $O(4)$  non-linear sigma model

**Abstract:** The problem of calculation of Casimir energies in winding sectors of the so-called SS-model is beyond the scope of traditional methods (TBA, NLIE) of integrable 2D QFT. We will propose the solution which is based on remarkable correspondence between classical and quantum integrable systems

11:00am **free discussion - 102**

11:30am **Lunch**

1:00pm **Gerald Dunne - 102**

**Title:** Resurgence of Mathieu, Lam'e and  $N=2$  Gauge theories

**Abstract:** Resurgent asymptotic analysis using trans-series has recently been applied to a wide variety of problems in physics, including matrix models, SUSY theories, Chern-Simons theories, integrable models and topological string theory, exact quantization conditions in quantum mechanics, and asymptotically free quantum field theories. In this talk I will present a general review of the basic ideas underlying resurgence and describe several applications. One of the more remarkable features of resurgence is the capacity to relate fluctuations about different non-perturbative sectors in a precise quantitative manner. This talk is in conjunction with the Simons Center workshop "Resurgence and localization in string theory and quantum field theory," running this week.

2:15pm **Ovidiu Costin - 102**

**Title:** Transseries and resurgence in general nonlinear ODEs with examples from the Painleve systems

**Abstract:** I will speak about the classical notions of transseries, Ecalle-Borel summability, resurgence, medianizations, that I will attempt to clarify using a newer analytical approach. The approach is well-suited for the rigorous study of general differential and partial differential equations and problems arising in mathematical physics. I will discuss a number of new results obtained in this way. The techniques are illustrated on the Painlevé equations, with new results on P1.

3:30pm **Coffee**

**Wednesday, March 18th**

10:00am **Konstantin Zarembo - 102**

**Title:** Non-perturbative effects and phase transitions in  $N=2^*$  super-Yang-Mills theory at large- $N$ .

**Abstract:** The partition function of  $N=2^*$  theory on  $S^4$  and some select observables can be computed exactly using localization. The large- $N$  solution of the resulting matrix model has remarkably rich structure that illustrates in a simplified setting generic features expected of a strongly interacting planar QFT. The solution is completely non-perturbative at weak coupling, where it can be interpreted in terms of OPE with calculable condensate contributions, and terminates at a quantum phase transition at a finite 't Hooft coupling. As the coupling grows the system undergoes an infinite sequence of secondary transitions that accumulate at strong coupling.

11:00am **Coffee Break**

11:30am **André Voros - 102**

**Title:** Exact-WKB method to analytically solve 1D Schrödinger equation (polynomial potential)

**Abstract:** We review how general 1D quantum anharmonic (polynomial) oscillators are exactly solvable. Our exact-WKB method uses quantum vs classical zeta-regularizations in parallel, to yield a set of Bohr–Sommerfeld-like, but exact, quantization conditions. Here, such formulae do not merely specify the eigenvalues; some evaluate the spectral determinants, and others the wave functions, at any values of the spectral parameter. Connections with the Bethe Ansatz for integrable systems will be discussed.

12:30pm **Lunch - SCGP Cafe**

2:30pm **Gokce Basar - 102**

**Title:** Resurgence, ghost instantons and Picard-Lefschetz theory

3:30pm **Coffee**

**Thursday, March 19th**

10:00am **Philip Argyres - 102**

**Title:** Deformations of  $N=2$  SCFTs and their Coulomb branch geometries

**Abstract:** We classify local  $N=2$  supersymmetric deformations of 4d  $N=2$  superconformal field theories (SCFTs), and discuss how they can deform the moduli space of vacua. We present evidence for a "simple singularities" conjecture which governs the behavior of the generic singularities that can occur on the Coulomb branches of  $N=2$  SCFTs deformed by relevant operators. This conjecture puts strong constraints on the existence of dangerously irrelevant operators, accidental IR flavor symmetries, and gaugings of discrete subgroups of the group of flavor automorphisms. We show that it is, nevertheless, compatible with the existence of Coulomb branches with exotic topologies.

11:00am **Coffee Break**

11:30am **Daniele Dorigoni - 102**

**Title:** A short introduction to Alien calculus and its applications to QFT

12:30pm **Lunch - SCGP Cafe**

2:30pm **Nikita Nekrasov - 102**

**Title:** KZB, Elliptic Calogero-Moser and periodic Toda chain from  $N=2$  gauge theory

3:30pm **Coffee**

4:00pm **Ines Aniceto - 102**

**Title:** On the Resurgent Asymptotics of Supersymmetric Gauge Theories

5:30pm **Hold for Math Kangaroo Competition**

6:00pm **Workshop Banquet**

**Friday, March 20th**

10:00am **Kimyeong Lee - 102**

**Title:** The maximally supersymmetric 6-dim theories

11:00am **Coffee Break**

11:30am **Aleksey Cherman - 102**

**Title:** Continuity and resurgence in asymptotically free QFTs

12:30pm **Lunch - SCGP Cafe**

2:30pm **Marcel Vonk - 102**

**Title:** On the Resurgent Asymptotics of Topological String Theories

**Abstract:** Resurgent transseries can shed light on nonperturbative phenomena in many areas of physics. Topological string theories are a priori defined only perturbatively, so this is an area where the application of resurgence and transseries could potentially be very useful. The question is: which equation should such a transseries solve? A natural guess is to use the holomorphic anomaly equation found in the 90s by Bershadsky, Cecotti, Ooguri and Vafa. A complication arises because the holomorphic anomaly equation is an equation in the moduli of the problem, whereas the perturbative expansion is one in a different variable, the string coupling constant. Nevertheless, it turns out resurgence can be very useful. In this talk, I will explain the pros and cons of this approach, and I will summarize some of the results one can obtain.

3:30pm **Coffee**