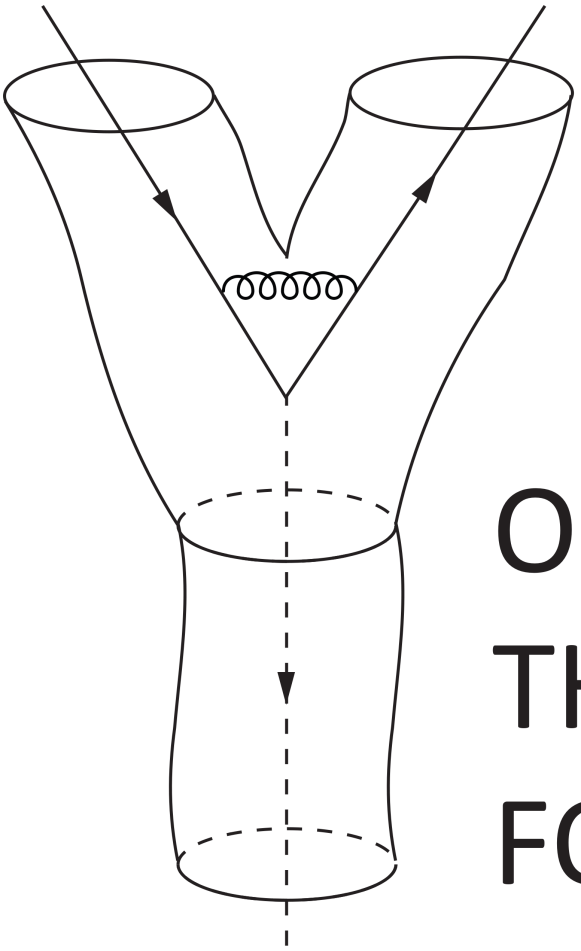

OUNG THEORISTS' FORUM

4th Young Theorists' Forum

December 14-15th 2011

Durham University

List of Sponsors

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Programme Outline

The Young Theorists' Forum 2011 kicks off on Wednesday 14th December with a free buffet lunch. This will be held in the Bransden Room in the IPPP, Department of Physics.

There will be a series of 15 and 30 minute talks with the final 2 or 5 minutes (respectively) designated for questions. Talks will be collected into parallel sessions punctuated by tea breaks. These will all be held on the ground floor the Department of Mathematical Sciences. A detailed session timetable and a full list of abstracts and participants can be found below.

One of the highlights of the forum is the "Poster and Pizza" session on Wednesday night. This will be held in the Bransden Room in the IPPP.

After the sessions on Thursday morning, we are delighted to welcome Sean Hartnoll from Stanford University, who will be giving a plenary talk to round off the Forum in style.

Wednesday 14th December

12.00	Welcome Buffet *(Bransden Room)*	
13.00	Gravity and Cosmology *(CM101)*	Amplitudes and Quantum Information *(CM107)*
15.30	Tea and Coffee *(CM103 & CM105)*	
16.00	(Beyond the) Standard Model Phenomenology *(CM107)*	Strings and Solitons *(CM101)*
19.00	Poster and Pizza *(Bransden Room)*	

Thursday 15th December

09.00	Supersymmetry *(CM101)*	Lattice Field Theory *(CM107)*
11.00	Tea and Coffee *(CM103 & CM105)*	
11.30	Sean Hartnoll *(CM101)*	

Programme of Parallel Sessions

Session 1a: Gravity and Cosmology

Chairs: Alexander Cockburn and James Edwards

13.00 **Sarah Chadburn** *Durham*
Cosmic strings in extra dimensions

13.15 **Gianluca Delfino** *Nottingham*
Graviton scattering amplitudes in Pure Connection Formulation

13.30 **Paul Dempster** *Liverpool*
Dimensional reduction as a technique for generating black objects

13.45 **Joseph Elliston** *Queen Mary*
Evolution of fNL to the adiabatic limit

14.15 **Jonathan Pearson** *Manchester*
Generalized parameterization of modified gravity and dark energy

14.45 **James Reid** *Aberdeen*
Towards Conformal Loop Quantum Gravity

15.00 **Danielle Wills** *Durham*
Cosmic structure and the D-brane vector curvaton

Session 1b: Amplitudes and Quantum Information

Chair: Steven Wells

13.00 **David Edward Bruschi** *Nottingham*
Voyage to Alpha Centauri: entanglement degradation of cavity modes due to motion

13.30 **Terry Farrelly** *Cambridge*
Quantum Walks and Particles

13.45 **Timothy Goddard** *Durham*
Scattering Amplitudes in $\mathcal{N} = 4$ SYM

14.00 **Reinke Sven Isermann** *Hamburg*
New relations for scattering amplitudes in Yang-Mills theory at loop level

14.30 **Antony Lee** *Nottingham*
"Shaking Out" Entanglement

14.45 **Robert Mooney** *Queen Mary*
Form Factors in $\mathcal{N} = 4$ sYM

Session 2a: (B)SM Phenomenology

Chair: James Currie

16.00 **Samuel Abreu** *Edinburgh*
Sudakov factorisation and resummation

16.15 **Matthew Brown** *Southampton*
Minimal Universal Extra Dimensions and the Higgs

16.45 **Jonathan Davis** *Durham*
How to look for Dark Matter

17.15 **Kate Elliott** *Glasgow*
On-Shell Methods for Loop Calculations

17.30 **Andrew Fowlie** *Sheffield*
Bayesian Implications of Current LHC Limits for the Constrained MSSM

17.45 **Jason Hammett** *Southampton*
Precision Calculations of Leptoquark Production at the LHC

18.00 **Nathan Hartland** *Edinburgh*
Reweighting NNPDFs

18.30 **Antonio Morais** *Glasgow*
Constraining GUT Scenarios using the First and Second Generation Sfermion Masses

Session 2b: Strings and Solitons

Chairs: Rafael Maldonado and Gurdeep Sehmbi

16.00 **James Allen** *Durham*
Dyonic Instantons on D4-branes

16.15 **Benedict Crampton** *Imperial*
Braneworlds without Branes

16.45 **Mareike Haberichter** *Manchester*
Classically Spinning Skyrmions

17.15 **Viraf Mehta** *Liverpool*
Light Z's from string-derived models

17.45 **Sam Palmer** *Heriot-Watt*
Monopoles and M-Theory Selfdual Strings

18.00 **Christiana Pantelidou** *Imperial*
Spatially Modulated Phase transitions

18.15 **Paul Richmond** *King's College London*
(2,0) Supersymmetry and the Light-cone Description of M5-branes

Session 3a: Supersymmetry

Chair: Ilán Fridman Rojas

09.00 **Daniel Busbridge** *Durham*
Supersymmetry breaking, hybrid $\mathcal{N} = 1/2$ theories, and the nature of *.inos

09.30 **Patrik Svantesson** *Southampton*
E_6SSM vs MSSM gluino phenomenology

10.00 **David Twigg** *Cambridge*
Seiberg Duality and the Superconformal Index

10.30 **Chris Wymant** *Durham*
SUSY Searches at Colliders

Session 3b: Lattice Field Theory

Chair: Matthew Yip

09.00 **Brian Colquhoun** *Glasgow*
NRQCD and the Upsilon Spectrum

09.15 **Gordon Donald** *Glasgow*
Semileptonic form factors from lattice QCD

09.45 **Shane Drury** *Southampton*
Charm as a Sea Quark in Domain Wall Lattice Simulations

10.00 **Wynne Evans** *Swansea*
The Charmonium Potential at Non-zero Temperature

10.15 **Enrico Rinaldi** *Edinburgh*
Scalar mass corrections from compact extra dimensions on the lattice

10.45 **Pol Vilaseca** *Trinity College Dublin*
A life in Technicolor

Black holes and strongly correlated superconductors

Sean Hartnoll (Stanford)

The description of states of matter whose excitations remain strongly interacting at arbitrarily low energy scales remains a serious challenge for theoretical physics. Yet such exotic states of matter are believed to underlie some nonconventional superconductors and other important materials. Recent work has used the tools of the string theoretic 'Holographic Duality' to study these systems. I will give an overview of Holographic Duality and its potential usefulness in this context. I will discuss attempts to use black hole physics to characterize, via the duality, strongly correlated states of matter and the emergence of superconductivity from such states.

List of Abstracts

Session 1a: Gravity and Cosmology

Sarah Chadburn (Durham): *Cosmic strings in extra dimensions*

Cosmic strings are a network of long, line-like objects stretching across space, that are likely to have formed in the early universe and may still exist today. Closed loops of cosmic string can break off from the original long strings. The loops will then begin to oscillate, emitting gravitational radiation signals that may be observable from earth. I shall discuss how we model the dynamics of cosmic string loops, and how their behaviour is affected when they move in different spacetime backgrounds, in turn affecting the signal we would detect. In particular, we look at their motion in spacetimes with extra dimensions, such as those predicted by string theory.

Gianluca Delfino (Nottingham): *Graviton scattering amplitudes in Pure Connection Formulation*

We show how the newly introduced formulation of gravity as a Pure Connection theory provides a natural framework for approaching the problem of graviton scattering. We review the latest developments in this novel approach and show how to compute scattering amplitudes using the so called "helicity methods". Furthermore we evaluate, in the new formulation, the MHV amplitude for a 4-gravitons scattering process and verify that it matches the known value coming from Einstein-Hilbert perturbative gravity.

Paul Dempster (Liverpool): *Dimensional reduction as a technique for generating black objects*

One of the most fertile techniques in modern physics is that of dimensional reduction, which has matured greatly since its introduction by Kaluza, Klein, et al. at the beginning of the last century. It is now de rigueur for anyone working in string or M-theory as a way of reconciling the 10 or 11 spacetime dimensions required by these models to the 4 which most of us observe. I shall discuss some of the ways that one can use this technique and its reverse process, dimensional oxidation, to generate black objects in supergravity theories with diverse dimensionality and field content (of which black holes in GR are a familiar subclass).

Joseph Elliston (Queen Mary): *Evolution of fNL to the adiabatic limit*

For multi-field inflation, cosmic observables evolve during the super-horizon epoch and one interesting outcome of this is its capacity to generate large local non-Gaussianities. For a given inflationary model to become predictive it is necessary that one follows the evolution of observables until they become conserved. This may be possible if there exists and appropriate adiabatic limit. I will illustrate how this works in practice with numerous examples, graphs and give a basic cook-book for how to build your own model with large local non-Gaussianity, including showing the potential features needed in order to get positive or negative fNL.

Jonathan Pearson (Manchester): *Generalized parameterization of modified gravity and dark energy*

There is currently a plethora of modified gravity and dark energy theories attempting to marry the observed apparent acceleration of the Universe with a gravitational theory. Most of these theories are constructed by "Lagrangian engineering", where explicit Lagrangian densities are written down, field equations computed and free parameters fitted or constrained by data. We will discuss a new framework where an effective gravitational action is written down which incorporates all possible theories with a particular field content; this is inspired by a particle physicists way of dealing with theories, where potentials are written down in generality under very few guiding symmetry considerations. The framework enables us to identify all possible free parameters which can be fit to data and produce observable predictions (at least in principle) – this could allow us to immediately rule out entire classes of theories. We will give an overview of our formalism, in particular to our language and notation. We then proceed with some explicit examples: if the dark sector does not contain any extra fields, or if scalar fields are present.

James Reid (Aberdeen): *Towards Conformal Loop Quantum Gravity*

The classical theory obtained in the low energy limit of Loop Quantum Gravity is notably sensitive to the "size" of the quanta of area and volume. Conformal Loop Quantum Gravity seeks to cure this pathology. In my talk, I was discuss the problem of extending the existing classical theory to a quantum theory by constructing a conformal loop representation. Tantalising links with twistor theory, geometric quantization and conformal geometry will be highlighted in particular.

Danielle Wills (Durham): *Cosmic structure and the D-brane vector curvaton*

The theory of inflation explains the appearance of the seeds of cosmic structure by the process of gravitational particle production. In string theory, inflation may be realised in the open string sector by the motion of D-branes, or in the closed string sector by the motion of light scalar fields that parameterise the geometry of the compact dimensions. A vector field naturally lives on the world-volume of the various D-branes which appear in these models, and in this talk I will discuss the role that this field may play in the cosmological evolution. In particular, the changing gravitational background induced by the inflaton may cause this vector field to undergo gravitational particle production, such that under suitable conditions, it may affect or generate the seeds of structure. This will give rise to interesting signatures in the spectrum and bispectrum of the curvature perturbation.

Session 1b: Amplitudes and Quantum Information

David Edward Bruschi (Nottingham): *Voyage to Alpha Centauri: entanglement degradation of cavity modes due to motion*

We propose a scheme to investigate whether motion degrades entanglement. We compute the degradation analytically for a Dirichlet scalar field in a Minkowski cavity for trajectories grafted from inertial and uniformly accelerated segments of small acceleration, giving explicit results for sample travel scenarios. Degradation of observable magnitude occurs for massless transverse quanta of optical wavelength at Earth gravity acceleration and for kaon mass quanta already at microgravity acceleration. We outline a space-based experiment for observing the effect and its gravitational counterpart.

Terry Farrelly (Cambridge): *Quantum Walks and Particles*

To model physical systems it is often sensible to discretize space and time. Here we will take a look at quantum walks, which arise when the evolution operator for a single particle in discrete space-time is taken to be local and unitary. We will see that spin arises naturally and that in the continuum limit these particles behave like fermions.

Timothy Goddard (Durham): *Scattering Amplitudes in $\mathcal{N} = 4$ SYM*

Why study a theory which is patently wrong? What's wrong with good old Feynman diagrams? What even is a Momentum Twistor? These and several other questions you never thought to ask will be answered in this whistle-stop tour of scattering amplitudes in $\mathcal{N} = 4$ SYM. I will highlight some of the recent advances in understanding and uncovering of hidden structure in this theory, before finishing by looking at some analytic results in a toy model setting using powerful new tools.

Reinke Sven Isermann (Hamburg): *New relations for scattering amplitudes in Yang-Mills theory at loop level*

The calculation of scattering amplitudes is important for the analysis of scattering processes at particle colliders as well as for our understanding of perturbation theory. In this talk I will present a series of new relations for scattering amplitudes in quite general gauge theories at loop level. The existence of these relations can be understood from the analysis of certain large momentum shifts of tree amplitudes and loop level integrands. As an example, a concrete relation for the integrand at one-loop will be discussed.

Antony Lee (Nottingham): *"Shaking Out" Entanglement*

One of the main challenges in Quantum Information is the reliable creation of sources of entanglement. Entanglement is a pivotal feature of Quantum Mechanics that allows us to make vast improvements in information processing over classical procedures. We show that when introducing a Relativistic "shaking" motion to Cavity QED, a strongly entangled two-mode squeezed state can be generated. This has strong links to the Dynamical Casimir Effect and could also be a way to test the equivalence principle of General Relativity using Quantum Field Theory.

Robert Mooney (Queen Mary): *Form Factors in $\mathcal{N} = 4$ sYM*

Great progress has been made in recent years in understanding the mathematical structure of scattering amplitudes and correlation functions in Planar $\mathcal{N} = 4$ sYM at strong and weak coupling. Form Factors in some weak sense interpolate between these quantities, and present a possible path to extend some results to other, less supersymmetric theories. I provide an introduction to their computation at weak coupling, the supersymmetric relations between them and their relation to deformations of the original theory.

Session 2a: (B)SM Phenomenology

Samuel Abreu (Edinburgh): *Sudakov factorisation and resummation*

Resummation methods allow to increase the precision of perturbative calculations in kinematic regions affected by large logarithmic contributions by resumming them to all orders in perturbation theory. We will show how large Sudakov logarithms appear in physical quantities such as the Drell-Yan and the DIS cross section and how resummed expressions can be derived based on the factorisation of these quantities into hard, collinear and soft contributions.

Matthew Brown (Southampton): *Minimal Universal Extra Dimensions and the Higgs*

Theories involving "universal" extra spatial dimensions are natural extensions of the Standard Model with interesting phenomenology. I will explain the motivation for these models and discuss the minimal case, involving one extra dimension, in some detail. I will describe how I helped create a software implementation of this model to greatly ease calculations and finally how my collaborators and I are using data from LHC Higgs searches to constrain the model's parameter space.

Jonathan Davis (Durham): *How to look for Dark Matter*

The presence of Dark Matter in our universe is well-motivated by gravitational data, but the identity of this illusive substance remains largely a mystery. I review the current status of so-called Direct Detection experiments, which aim to detect and identify Dark Matter particles (commonly known as WIMPs) via non-gravitational means. My talk is intended for a general audience, and will hopefully prove both interesting and informative for all attendees, especially for model-builders for whom a good understanding of the current experimental status is vital.

Kate Elliott (Glasgow): *On-Shell Methods for Loop Calculations*

In recent years there have been many developments in using on-shell methods to calculate scattering amplitudes at NLO and beyond. In this talk an overview of the developments in this area are given. Why these methods are useful in phenomenology, and how they are implemented is discussed along with outstanding problems and how they are being solved.

Andrew Fowlie (Sheffield): *Bayesian Implications of Current LHC Limits for the Constrained MSSM*

I explain how we identify the regions of the Constrained Minimal Supersymmetric Standard Model's parameter space that are in best agreement with experimental data, using Bayesian statistics. I show how we construct likelihood functions for experimental constraints, including the latest LHC 1/fb results. I present our probability maps on the (m_0, $m_{1/2}$) plane of the CMSSM, with and without the latest LHC 1/fb results.

Jason Hammett (Southampton): *Precision Calculations of Leptoquark Production at the LHC*

One of the consequences of grand unification is the appearance of additional particles; beyond those seen in the standard model. With the development of the LHC we are now capable of producing collisions with sufficient energy that some of these additional beyond-the standard-model (BSM) particles can be produced. One particular type of BSM particle which could be produced is the leptoquark and its key interaction is to couple a quark directly with a lepton, an interaction which would provide new event signatures at the LHC.

Currently, within perturbative quantum field theory, most calculations of leptoquark production have only been done to leading order (LO). Thus an important area of research is to improve the accuracy of our theoretical predictions by performing these calculations at next-to-leading-order (NLO). The primary purpose of this talk will be to describe how these higher order calculations can be done.

Nathan Hartland (Edinburgh): *Reweighting NNPDFs*

The determination of accurate parton distribution functions from global fits to deep inelastic and hadronic collision data, is a key ingredient in the analysis of new experiments. In this talk I shall discuss the fitting methodology of the NNPDF (Neural Network parton distribution function) collaboration, and demonstrate a novel method of including new data into an existing NNPDF parton set, the reweighting method.

Antonio Morais (Glasgow): *Constraining GUT Scenarios using the First and Second Generation Sfermion Masses*

We discuss Grand Unification Theories (GUTs), focussing on the standard $SU(5)$, $SO(10)$ and E_6 candidates. We will review the matter content of the representations and examine the mass spectrum of the first and second generation of squarks and sleptons. We will also provide a testable comparison of the alternative group structures and discuss how the first and second generation can be used to constrain the third generation. Constraints on the parameter space coming from Charge and Colour Breaking minima (CCB) and Unbounded From Below (UFB) conditions on the scalar potential will also be addressed.

Session 2b: Strings and Solitons

James Allen (Durham): *Dyonic Instantons on D4-branes*

I will discuss BPS solutions in the field theory on two D4-branes, specifically instantons with a non-zero scalar field. I'll describe the moduli space of all possible BPS solutions and find it explicitly for two instantons. The dynamics of slow moving instanton-like fields can then be approximated by geodesic motion in this space, although the scalar field will also induce a potential.

Benedict Crampton (Imperial): *Braneworlds without Branes*

Some of the simplest backgrounds for Supergravity are the inhomogeneous hyperboloids, obtained by analytically continuing the famous sphere reductions. We can consider two very different sets of fluctuations about these backgrounds. The first is a rare example of a Pauli reduction, i.e. a consistent truncation to the complete set of Kaluza-Klein zero modes. Though these reductions are very interesting for a variety of reasons, the hyperboloids are non-compact, so don't make much physical sense: in particular, they don't reproduce 4D gravity. Performing a careful analysis of 4D gravitational waves, we are led to a second, very peculiar set of fluctuations that give the correct Newton's Law. The problem can be recast in the language of 1D Quantum Mechanics, with a seemingly pathological potential. I'll comment on the interpretation of both sets of fluctuations in this language.

Mareike Haberichter (Manchester): *Classically Spinning Skyrmions*

Skyrmions arise as topological soliton solutions in the Skyrme model which has been shown to be a low energy effective theory of QCD in the large N_c limit. If quantized suitably, they can be used to describe structure and properties of nucleons and nuclei. We argue that the semiclassical rigid-body quantization, commonly used in the literature, has several shortcomings and that removing this simplification may result in a more accurate description of nucleons and nuclei. We present an extensive numerical study of spinning, arbitrarily deforming Skyrmions of topological charge $B = 1 - 4$. Some preliminary results on spinning Skyrme solutions of higher topological charge will be discussed as well.

Viraf Mehta (Liverpool): *Light Z's from string-derived models*

We will construct an Heterotic string model that augments the Standard Model gauge group with an additional $U(1)$ symmetry. A discussion of how $U(1)$s occur in free fermionic models will be followed by an explicit construction where the additional symmetry forbids Proton Decay Mediating Operators, induced in many other extensions of the Standard Model, while allowing for light neutrino masses through a Type-III seesaw mechanism.

Sam Palmer (Heriot-Watt): *Monopoles and M-Theory Selfdual Strings*

The D-brane interpretation of monopoles gives physical insight into the Nahm transform which constructs them. The Nahm equation is an equation for the D1-brane fields and the Nahm transform switches perspective to the D3-brane worldvolume, where the monopole lives. In M-theory a similar situation occurs when an M2-brane ends on an M5-brane along

a one dimensional intersection, the 3-form field strength on the M5-brane is hodge-dual to itself, hence the name 'selfdual string'.

Christiana Pantelidou (Imperial): *Spatially Modulated Phase transitions*

Recently, there has been considerable discussion in the literature about applications of AdS/CFT to condensed matter systems. In this talk, I'll focus on one of them, namely the striped phase. Starting off with an enriched Einstein-Maxwell theory, one can study the stability properties of electrically or magnetically charged AdS-RN black holes in the top-down and bottom-up approach. It turns out that one can find instabilities corresponding to a spatially modulated phase transitions.

Paul Richmond (King's College London): *(2,0) Supersymmetry and the Light-cone Description of M5-branes*

The M5-brane remains a mysterious object. Its worldvolume description is known to arise from a six-dimensional CFT with (2,0) supersymmetry. However, very little is known about six-dimensional quantum field theories. In this talk I will outline work to construct a non-Abelian system of equations that furnish a representation of the (2,0) supersymmetry tensor multiplet. The resulting on-shell conditions lead to a novel system of equations which propagate in one null and four space directions. Following more recent work, I will then show how these equations reduce to motion on instanton moduli space. Subsequently quantising the system leads directly to a previous light-cone proposal of the (2,0) theory.

Session 3a: Supersymmetry

Daniel Busbridge (Durham): *Supersymmetry breaking, hybrid $\mathcal{N} = 1/2$ theories, and the nature of *.inos*

The accessible mass spectra at the low scale in SUSY models with Majorana gaugino masses is severely restricted by the form of the RG equations. In particular, if it is assumed that the observable spectrum is due to the evolution of some theory defined at the high scale, then a 'forbidden zone' of low scale mass configurations arises. Interestingly, it may be possible to access such configurations if instead, the gauginos are allowed to acquire a Dirac mass.

I will motivate the MRSSM (Minimal R-symmetric Supersymmetric Standard Model), where all fermions, including the gauginos and Higgsinos, are Dirac particles. I will then outline how the extra fields required by the MRSSM can be understood as completing an $\mathcal{N} = 2$ gauge and Higgs sector.

Patrik Svantesson (Southampton): *E_6SSM vs MSSM gluino phenomenology*

The E_6SSM is a promising model based on the $SU(3) \times SU(2) \times U(1) \times U(1)'$ subgroup of E_6. It gives a solution to the MSSM μ-problem without introducing massless axions, gauge anomalies or cosmological domain walls. The model contains three families of complete 27's of E_6, giving a richer phenomenology than the MSSM. In my talk I will present a study of typical gluino decays. The E_6SSM generically has gluino cascade decay chains which are about 2 steps longer than the MSSM's due to the presence of several light neutralino states. This implies less missing (and more visible) transverse momentum in collider experiments and kinematical distributions such as M_{eff} and m_{T2} are different. Scans of parameter space and MC analysis suggest that current SUSY search strategies and exclusion limits has to be reconsidered for models with longer decay chains such as the E_6SSM.

David Twigg (Cambridge): *Seiberg Duality and the Superconformal Index*

The matching of superconformal indices is an important test of Seiberg duality. After a short introduction to Seiberg duality, I will introduce the index and methods for calculating it before moving on to the problem of testing index matching. I will finish by describing the relationship between the classic field theoretic tests of Seiberg duality and index matching.

Chris Wymant (Durham): *SUSY Searches at Colliders*

Phenomenologists working in SUSY and beyond are busy interpreting the first big collection of DATA at CERN. In this talk I'll give a quick introduction to this process: namely what steps come in between building a model and knowing its current viability at colliders.

Session 3b: Lattice Field Theory

Brian Colquhoun (Glasgow): *NRQCD and the Upsilon Spectrum*

Lattice nonrelativistic QCD (NRQCD) is an effective theory that can be used to describe heavy quarks. The upsilon spectrum contains many states that can be determined using NRQCD, which can be compared to experiment. An understanding of b quarks on the lattice, along with experimental results, is important in the determination of elements of the Cabibbo-Kobayashi-Maskawa matrix — a further incentive for lattice upsilon studies, as the same action can be used for results in B physics. I will, in a talk suitable for those with little exposure to lattice field theory, discuss recent work that has taken place on the upsilon spectrum using NRQCD on lattice configurations with $2+1+1$ quark flavors in the sea.

Gordon Donald (Glasgow): *Semileptonic form factors from lattice QCD*

Weak interactions between different flavours of quark are described by the CKM matrix. Because quarks are bound inside hadrons, we require non-perturbative lattice QCD calculations of the strong interaction between the constituent quarks to extract CKM elements from flavour physics experiments. I will describe our lattice calculation of the vector and axial vector form factors in D_s to ϕ semileptonic decays, compare our results to BaBar's experimental results and explain how they can be used to extract a value of V_{cs}.

Shane Drury (Southampton): *Charm as a Sea Quark in Domain Wall Lattice Simulations*

This project is to determine whether by adding the charm quark to the sea in Domain Wall Fermion lattice simulations do we gain more accuracy over error, or do any improvements get swamped by the error. We simulate charmed mesons and baryons with valence charm quarks and calculating many quantities on the lattice. By analysing these quantities we can determine the error as a function of the mass of the valence charm and determine if it is feasible to push it up to its physical value.

Wynne Evans (Swansea): *The Charmonium Potential at Non-zero Temperature*

Contradictory results for the charmonium potential have been computed within QCD phenomenology. I will outline the method by which quark–anti-quark potentials can be computed using Nambu-Bethe-Salpeter wavefunctions and the Schroedinger equation. I will also present some preliminary results for the charmonium potential using this method for different temperatures on the lattice.

Enrico Rinaldi (Edinburgh): *Scalar mass corrections from compact extra dimensions on the lattice*

We explore the phase diagram of the $SU(2)$ Yang-Mills theory in 5 dimensions by numerical simulations. The lattice system shows a dimensionally-reduced phase where the extra dimension is small compared to the four-dimensional correlation length. In this phase, at low energies, this system behaves like a four-dimensional gauge theory coupled to an adjoint scalar field. By tuning the bare parameters of the lattice model, we identify lines of constant physics, and analyse the behaviour of the adjoint scalar mass as a function of the compactification and the cut-off scales. The perturbative prediction that the effective theory contains a

light particle with a mass that is independent of the cut-off is tested against nonpertubative results.

Pol Vilaseca (Trinity College Dublin): *A life in Technicolor*

Technicolor (TC) is one of the main extensions of the Standard Model. The internal symmetry group of the SM $SU(3) \times SU(2) \times U(1)$ is enlarged with a new TC group and the Higgs sector is replaced by a strong interacting and confining sector with matter fields (techniquarks) coupled to the TC gauge fields. Chiral symmetry breaking in the TC sector triggers EW symmetry breaking, providing masses to the weak bosons. Extended Technicolor (ETC) interactions provide masses to the SM fermions. Phenomenologically allowed candidates for TC models must display a beta function such that for a large range of scales the coupling constant evolves slowly or "walks" (Walking Technicolor). Lattice Gauge Theory provides a perfect framework for the study of the non-perturbative evolution of the coupling constant.

Samuel Abreu	*Edinburgh*
Øyvind Almelid	*Edinburgh*
Marika Asgari	*Edinburgh*
Matthew Brown	*Southampton*
Daniel Busbridge	*Durham*
Sarah Chadburn	*Durham*
Caroline Clark	*Imperial*
Brian Colquhoun	*Glasgow*
Daniel Coumbe	*Glasgow*
James Currie	*Durham*
Jonathan Davis	*Durham*
Gianluca Delfino	*Nottingham*
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Shane Drury	*Southampton*
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Gurdeep Sehmbi	*Durham*
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Chris Wallace	*Durham*
Steven Wells	*Durham*
Danielle Wills	*Durham*
Matthew Yip	*Durham*
James Allen	*Durham*
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Suphakorn Chunlen	*Durham*
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Omer Gurdogan	*Queen Mary*
Oliver Hall	*Durham*
Mark Harley	*Edinburgh*
Nathan Hartland	*Edinburgh*
Reinke Sven Isermann	*Hamburg*
Paul Jennings	*Durham*
Craig Lawrie	*KCL*
Godfrey Leung	*Nottingham*
Rafael Maldonado	*Durham*
Viraf Mehta	*Liverpool*
Robert Mooney	*Queen Mary*
Katy Morgan	*Durham*
Ellie Nalson	*Queen Mary*
Sam Palmer	*Heriot-Watt*
Andrew Papanastasiou	*Durham*
Ernestas Pukartas	*Lancaster*
Paul Richmond	*KCL*
Craig Robertson	*Durham*
Arron Rumsey	*Lancaster*
Jan Schröder	*Sussex*
Maria Sueiro	*KCL*
Mariusz Szmigiel	*Imperial*
Pol Vilaseca	*TCD*
Lingfei Wang	*Lancaster*
Jennifer Willetts	*Heriot-Watt*
Chris Wymant	*Durham*