Sixth Sydney meeting

Report of Contributions

Contribution ID: **2**　　　　　　　　　　　　　　　　　　　　　　Type: **not specified**

Direct dark matter detection

Wednesday 26 July 2023 09:30 (1 hour)

Presenter: O'HARE, Ciaran (Sydney)

Session Classification: Lectures

Contribution ID: **3** Type: **not specified**

Direct dark matter detection

Thursday 27 July 2023 09:30 (1 hour)

Presenter: O'HARE, Ciaran (Sydney)

Session Classification: Lectures

Contribution ID: 4   Type: **not specified**

What a flavour (and CP) symmetry can do for you

Wednesday 26 July 2023 11:00 (1 hour)

Symmetries are a very important ingredient of the Standard Model of particle physics. In this talk, we discuss the role that symmetries can play in the flavour sector. We give different examples of possible symmetries and their phenomenological impact, e.g. the prediction of lepton mixing parameters, constraints on and correlation with the size and sign of the baryon asymmetry of the Universe as well as signals of flavour violation in the lepton and quark sector.

Presenter: HAGEDORN, Claudia (IFIC)

Session Classification: Talks

Contribution ID: **5**   Type: **not specified**

Unitarizing scattering amplitudes in theories of compact Extra Dimensions

Thursday 27 July 2023 11:00 (1 hour)

Scattering amplitudes are paramount to understanding the validity of quantum field theories. In this talk I will discuss scattering amplitudes of massive spin-2 particles. I will contrast the unitarity violating scales of theories of massive gravity and compact extra dimensions. I will also demonstrate how scattering amplitudes in extra dimensions can be obtained via the double copy prescription that relates gauge theory and gravity amplitudes.

Presenter: SENGUPTA, Dipan (University of Adelaide)

Session Classification: Talks

Contribution ID: **6** Type: **not specified**

The Hyper-Kamiokande Experiment

Thursday 27 July 2023 14:00 (1h 15m)

Hyper-Kamiokande is a next-generation water Cherenkov detector in Japan whose construction started in early 2020 and is expected to complete in 2027.

The detector has a fiducial volume more than 8 times the size of the currently-running Super-Kamiokande detector for a total of about 188 kton fiducial volume. The full experiment includes an upgraded J-PARC neutrino beam, and a near detector suite with upgraded and new detectors. Hyper-Kamiokande

has an extremely diverse science program and will be able to measure neutrino oscillations with beam and atmospheric neutrinos with unprecedented statistical precision. The large size of the detector will also significantly improve the study of astrophysical neutrinos, like solar or supernova neutrinos, as well as provide contributions to multi-messenger astronomy, dark matter searches and also search for proton decays in a variety of final-state decays.

Presenter: DI LODOVICO, Francesca (University of London (GB))

Session Classification: Talks

Contribution ID: **7**   Type: **not specified**

Ultralight Dark Matter and g-2

Wednesday 26 July 2023 14:00 (1 hour)

If dark matter is ultralight, the number density of dark matter is very high and the techniques of zero-temperature field theory are no longer valid. The dark matter number density modifies the vacuum giving it a non-negligible particle occupation number. For fermionic dark matter, this occupation number can be no larger than one. However, in the case of bosons the occupation number is unbounded. If there is a large occupation number, the Bose enhancement needs to be taken into consideration for any process involving particles which interact with the dark matter. Because the occupation number scales inversely with the dark matter mass, this effect is most prominent for ultralight dark matter. In fact, the Bose enhancement effect from the background is so significant for ultralight dark matter that, if dark matter is a dark photon, the correction to the anomalous magnetic moment is larger than experimental uncertainties for a mixing parameter of order 10^{-16} and a dark photon mass of order 10^{-20} eV. Furthermore, the constraint on the mixing parameter scales linearly with the dark photon mass and so new significant constraints can be placed on the dark matter mass all the way up to 10^{-14} eV. Future experiments measuring $g-2$ will probe even smaller gauge mixing parameters.

Presenter: EVANS, Jason (Shanghai Jiaotong University/TDLI)

Session Classification: Talks

Contribution ID: **8**   Type: **not specified**

On dual formulation of axion physics and the θ-vacua

Wednesday 26 July 2023 12:00 (30 minutes)

Presenter: SAKHELASHVILI, Otari (Sydney University)

Session Classification: Talks

Contribution ID: **9**   Type: **not specified**

Galaxy clusters: giant dark matter particle colliders

Wednesday 26 July 2023 16:00 (30 minutes)

Galaxy clusters are the largest gravitationally bound objects in the Universe. Because of their high density and high local velocity dispersion, they are ideal environments for probing the nature of dark matter. The specific properties of dark matter can have great effects on both clusters as a whole as well as on the galaxies residing in them. For example, if the self-interaction cross-section is non-zero, such effects include (but are not limited to) offsets in merging clusters, rounder cluster haloes, modified gravitational lensing, subhalo evaporation, and the flattening of density profiles. In this talk I will present my work studying some of the effects of self-interacting dark matter on simulated galaxy clusters.

Presenter: SIRKS, Ellen (The University of Sydney)

Session Classification: Talks

Contribution ID: **10**   Type: **not specified**

Probing the early universe with stochastic gravitational wave backgrounds

Wednesday 26 July 2023 16:30 (30 minutes)

Presenter: MALHOTRA, Ameek

Session Classification: Talks

Contribution ID: **11**   Type: **not specified**

Searching for Features in the Primordial Power Spectrum

Wednesday 26 July 2023 17:00 (30 minutes)

Presenter: WONS, Julius

Session Classification: Talks

Contribution ID: **12**   Type: **not specified**

Connecting Inflation to Particle Physics with Next Generation CMB and LSS Observations

Thursday 27 July 2023 17:00 (30 minutes)

The CMB and the large scale structure of the universe provide powerful probes that constrain models of inflation. It is well-known that the relations between inflationary model parameters and observables depend on the duration of the reheating epoch, which also determines the reheating temperature. While current observations are not sensitive enough to extract any knowledge about these quantities, a detection of tensor modes with next-generation CMB observations would simultaneously constrain the scale of inflation and the reheating temperature within a given class of models, providing the first ever measurement of the reheating temperature. This constraint can be translated into a measurement of the inflaton coupling if the latter is comparable to the electron Yukawa coupling in the Standard Model or smaller, as one may expect if inflation happens in a dark sector. Constraining this microphysical parameter would provide a unique opportunity to shed light on the embedding of a given model of inflation into underlying theories of particle physics. Further improvement can be achieved if data from optical and 21cm surveys are added.

Presenter: DREWES, Marco

Session Classification: Talks

Contribution ID: **14**   Type: **not specified**

Search for lepton flavour violation at Belle II with B0 -> tau ell

Thursday 27 July 2023 16:20 (20 minutes)

Presenter: Ms CHEEMA, Priyanka (University of Sydney)

Session Classification: Talks

Contribution ID: **15**   Type: **not specified**

Miniclusters from axion string simulations

Wednesday 26 July 2023 15:00 (30 minutes)

The properties of axion miniclusters and of the ensuing voids between them can have very strong implications for the discovery of axions and the dark matter of the Universe. These properties can be strongly affected by the dynamics in the early Universe, such as the axion string network and the non-linear dynamics around the QCD phase transition. In this talk we briefly discuss the phenomenology of miniclusters and their implications to current experiments, in the different approaches used in the literature.

Presenter: PIEROBON, Giovanni

Session Classification: Talks

Contribution ID: 16   Type: **not specified**

Towards B to pi tau nu at Belle II with SL tagging

Thursday 27 July 2023 16:40 (20 minutes)

Presenter: HUANG, Andre Hao Yuan

Session Classification: Talks

Contribution ID: **17**　　　　　　　　　　　　　　　　　　　Type: **not specified**

The Belle II experiment

Thursday 27 July 2023 15:50 (30 minutes)

Presenter:　HSU, Chia-Ling (The University of Sydney)

Session Classification:　Talks