

Highlights - DTP Annual report 2013-2014

I. HIGHLIGHTS

1. High Energy Physics

- “The status of the constrained minimal supersymmetric Standard Model was studied using all constraints including those from Higgs boson decays and it was shown that it is still possible to have a light stop discoverable at the LHC.”
- “A freezeout temperature for bottomonia, $T_f = 222_{-28}^{+29}$ MeV, was extracted from the CMS data on Υ states.”
- “We carried out analyses of various new physics scenarios in the context of different colliders. We looked into different final states, and a thorough study was done, so as to constrain the new physics effects from the recent experiments”
- “Hadron energy response of the iron calorimeter (ICAL) detector at INO was characterized using detailed detector simulations, and hadron energy resolution was studied as a function of the iron plate thickness.”
- “It was pointed out that the indirect CP asymmetries in $D \rightarrow \pi^+\pi^-$ and $D \rightarrow K^+K^-$ decays may be unequal in a particular class of new physics models.”
- “The equation of state of QCD matter was computed at finite chemical potential and temperature”
- “Excited state spectra of baryons with one or more charm quarks were calculated for the first time using lattice QCD. The spectra obtained have baryonic states with well defined total spin up to 7/2 and the low-lying states closely resemble the expectation from models with an $SU(6) \times O(3)$ symmetry. ”
- “Hadron spectra as well as the ratio of leptonic decay constants were calculated using overlap valence quarks on configurations with improved gluons and staggered sea quarks. ”
- “A new procedure to measure various event-plane correlators in Pb-Pb collisions, which is less demanding in terms of detector acceptance than the one used recently by the ATLAS collaboration, was presented.”

2. CMSP :

- “ Various features of exit probability were studied. (a) In an opinion dynamics model with weighted influence, exit probability and dynamics were calculated. (b) Non-universality in exit probability, induced by range, asymmetry, and fluctuations in inflow dynamics, was shown. (c) Universal features of exit probability in opinion dynamics models with domain size dependent dynamics were analyzed.”
- “A model of assisted hopping of particles on a line with finite-ranged interactions, showing an active-absorbing state transition, was solved exactly”
- “Strategy switches in minority games were studied when there are a large number of rational agents, and they use stochastic strategies”

3. Cosmology and Astroparticle Physics

- “Plausible dark energy models, parametrised by multiple candidate equations of state, using the recently published Cosmic Microwave Background (CMB) temperature anisotropy data from Planck together with the WMAP-9 low-polarisation data and data from low redshift surveys was studied. It was shown that a clear tension exists between dark energy constraints from CMB and non-CMB observations when one allows for dark energy models having both phantom and non-phantom behaviour: while CMB is more favourable to phantom models, the low-z data prefers model with behaviour close to a cosmological constant. The results motivate construction of phantom models of dark energy, which is achievable in the presence of higher derivative operators as in string theory.”
- “Two different probes of the expansion history of the Universe was compared using a Bayesian interpretation of the crossing statistic. The cosmic duality relation was assumed in order to search for inconsistencies between the two probes, and hence to look for underlying systematics.”
- “The phase-space distribution of the Dark Matter (DM) particles in our galaxy was studied. Using the rotation curve of the galaxy, the velocity distribution function (VDF) of the DM was determined, which is a crucial input in the interpretation of direct DM detection experiment event rates. A parametrised, non-Maxwellian, form of the derived local VDF was given.”

- “ The amount of AGN feedback in galaxy cluster cores was estimated using the observed entropy profiles of clusters from the REXCESS survey: the first estimate of the total, as well as radial, non-gravitational energy deposition for a large, nearly flux-limited, sample of clusters. Various correlations between integrated cluster properties were calculated.

4. String Theory:

- “Unitarity, Crossing Symmetry and Duality of the S-matrix in large N Chern-Simons theories with fundamental matter was studied. This work unravels various novel features of the S-matrix (in the large N limit) in these theories related to issues of gauge invariance and unitarity. This is a S-matrix for ‘anyons’ that has ‘Fermi-Bose’ duality.”
- “A dynamical entanglement entropy was computed in two dimensional field theory for states with non-zero angular momentum and charge. ”