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PCPV 2013

An ICTS Program on CP Violation in Elementary Particles and Composite Systems

Workshop: 19 – 23 February, 2013
Fountain Hotel, Mahabaleshwar, India


Lecturers for School

- S. Raichaudhury, India
- N. Sinha, India
- A. Vutha, Canada
- A. D. Singh, India
- K. V. P. Lata, India
- M. Abe, Japan
- G. Gopakumar, Japan

Organizers

- B. P. Das
 A. Dighe
 S. Lamoreaux
 N. Mahajan
 R. Rangarajan
 B. K. Sahoo (Convener)
 Y. Sakemi
 A. I. Sanda
 A. V. Singh

Topics for School

- ❖ Particle physics models
- ❖ Nuclear and atomic EDMs
- ❖ Molecular and solid state EDMs
- ❖ Principles of EDM measurements

Workshop Speakers

- ❖ Y. Suzuki, Japan
- ❖ M. Bona, UK
- ❖ H. Murayama, Japan
- ❖ P. Paradisi, Italy
- ❖ E. A. Hinds, UK
- ❖ G. Castelo-Branco, Portugal
- ❖ D. Budker, USA
- ❖ P. S.-Wellenbun, Switzerland
- ❖ A. Vutha, Canada
- ❖ A. Josphura, India
- ❖ T. Fukuyama, Japan
- ❖ A. Soni, USA
- ❖ G. Mohanty, India
- ❖ E. Shintani, USA
- ❖ D. Mukherjee, India
- ❖ K. Jungmann, The Netherlands
- ❖ T. Mibe, Japan
- ❖ A. V. Titov, Russia
- ❖ J. Hisano, Japan
- ❖ P. Geltenbort, France
- ❖ and more

Topics for Workshop

- ◆ Models of CP violation
- ◆ CP violation in K and B mesons
- ◆ EDMs from particle physics
- ◆ EDMs of atomic and molecular systems
- ◆ EDMs of solids
- ◆ Nuclear aspects of CP violation
- ◆ EDMs using lattice QCD
- ◆ CP and T violations at colliders
- ◆ CP violation in cosmology
- ◆ CP violation in neutrinos
- ◆ Unexpected results for CP violation



Topics & Time-table for the School

Atomic and molecular physics:

1. Atomic electric dipole moments (EDM): Introduction to simple atomic systems, basics of atomic many-body calculations, P and T violation, P and T violating interactions, atomic EDMs, Schiff theorem, electron EDM and relativistic effects, closed-shell atomic EDMs and implications, and ionic EDMs.
2. Molecular EDM: Introduction to molecular calculations, molecular EDMs.
3. Experimental techniques: Brief historical review of EDM measurements. Muon EDM experiment: experimental scheme, statistical sensitivity, systematic error sources. Molecular beam experiments. YbF experiment: experimental scheme, statistical sensitivity, systematic error sources. Nuclear EDM experiments. ^{199}Hg experiment. Solid-state EDM experiments. Brief review of upcoming experiments: Ra lattice experiment, Cs lattice experiment, HfF^+ ion trap, ThO molecular beam.

Particle physics

1. Introduction to particle physics: Discrete symmetries and their violation, K and B meson systems, Weak interactions.
2. Particle physics models: Lagrangian and a discussion of the CKM and PMNS matrices, Examples of CP violation in Physics Beyond the Standard Model.
3. Particle physics aspects of EDMs: Introduction to CP violation, examples of Lagrangians with CP violation; Basic ideas about strong CP-violation; electron and neutron EDMs; Atomic EDMs.

Date	9:30-11:00 AM	11:15 AM-12:45 PM	12:45-2:30 PM	2:30-4:00 PM	4:00-5:30 PM
7.2.13	Part Phys (SR)	At Phys (DA)			
8.2.13	Part Phys (SR)	At Phys (DA)	L	At Phys Tu (DA)	
9.2.13	Part Phys (SR)	At Phys (DA)	U	At Phys Tu (DA)	
10.2.13	Part Phys (SR)	At Phys (KL)	N	Part Phys Tu (PP)	
11.2.13	At Phys (KL)	Part Phys (SR)	C	At Phys Tu (KL)	
12.2.13	At Phys (KL)	Part Phys (SR)	H	Part Phys Tu (PP)	
13.2.13	At Phys (KL)	Part Phys (SR)		Part Phys Tu (PP)	
14.2.13	STUDENTS DAY OUT AROUND MAHABALESHWAR TOURIST PLACES				
15.2.13			R	Part Phys (NS)	
16.2.13	Expt Tech (AV)	Part Phys (NS)	E	Expt Tech (AV)	
17.2.13	Expt Tech (AV)	Mol Phys (MA)	A	Part Phys (NS)	Expt Tech(AV)
18.2.13	Mol Phys (GG)	Mol Phys (MA)	K	Part. Phys (NS)	

DA: Dilip Angom
NS: Nita Sinha
GG: Geetha Gopakumar

SR: Sreerup Raichaudhury
AV: Amar Vutha
PP: Particle physics

KL: K. V. P. Latha
MA: Minori Abe

Time-table for the Workshop

Tuesday, 19th Feb 2013

Morning session

Sl. No.	10:15-10:30	Inauguration session	
1.	10:30-11:15	G. Castelo-Branco	CP Violation in the Quark and the Lepton Sectors
Tea break			
2.	11:30-12:15	D. P. Roy	Probing the Neutrino Mass Hierarchy & the CPV phase δ in the Foreseeable Future Experiments
3.	12:15-13:00	M. Nakahata	Recent Results on Neutrino Oscillations and CP Violation Measurement in Neutrinos

Lunch break

Afternoon session

4	14:15-15:00	D. Budker	Nuclear-Resonance Detection of Axion Induced Oscillating Electric Dipole Moments
5	15:00-15:35	K. Jungmann	Radium atoms to search for EDMs
Tea break and Snacks			
6	15:45-16:30	M. Bona	Status of CKM in the light of recent results
7	16:30-17:05	P. Paradisi	CP and flavour violation in the charged leptonic sector
8	17:05-17:50	TBA	TBA

Dinner (19:30 onwards)

Wednesday, 20th Feb 2013

Morning session

9.	09:30-10:15	G. Mohanty	Experimental results on CP violation in the quark sector
10.	10:15-11:00	J. Hisano	Neutron EDM in Physics beyond the Standard Model
Tea break			
11.	11:15-12:00	A. Soni	Charming CP & all that
12.	12:00-12:45	A. Kundu	Going beyond Mahabaleshwar: Search for CPT Violation

Lunch break

Afternoon session

13.	14:15-15:45	Discussion by G. Castelo-Branco	Models of CP violation
Tea break and Snacks			
14.	16:00-16:45	P. Geltenbort	Ultra-Cold Neutrons and Searches for an Electric Dipole Moment
15.	16:45-17:20	P. Schmidt-Wellenburg	Search for a neutron electric dipole moment at PSI
16.	17:20-17:55	E. Shitani	Nucleon EDM in lattice QCD

Dinner (19:30 onwards)

Thursday, 21th Feb 2013

Morning session

17.	09:15-10:00	T. Mibe	Measurement of muon $g-2$ /EDM
18.	10:00-10:45	U. Yajnik	Baryon asymmetry of the Universe and CP violation
Tea break			
19.	11:00-11:35	TBA	CP violation results from BaBar
20.	11:35-12:10	A. Lytle	$K \rightarrow \pi\pi$ decays from lattice QCD

Lunch break and Outing

Dinner (19:30 onwards)

Friday, 22nd Feb 2013

Morning session

21.	09:30-10:15	Ed. Hinds	Search for the electron EDM
22.	10:15-11:00	B. P. Das	Theory of the Electric Dipole Moments of Atoms and Molecules
Tea break			
23.	11:10-11:55	A. V. Titov	Study of T, P- nonconservation effects and hyperfine constants in diatomics and solids by the relativistic pseudo-potential/core-restoration method
24.	11:55-12:30	M. K. Nayak	Theoretical studies of P & T violations in heavy polar molecules
25.	12:30-13:05	M. Abe	Molecular orbital based calculations for the search of the electron EDM using the Coupled-Cluster method in the Dirac-Coulomb approximation

Lunch break

Afternoon session

26.	14:25-15:00	M. Jung	A robust limit for the EDM of the electron
27.	15:00-16:30	Discussion by T. Fukuyama Moderated by B. P. Das	New Physics from EDMs
Tea break and Snacks			
28.	16:45-17:10	A. Petrov	Hyperfine interaction in diatomics as a factor of influence on EDM experiments
29.	17:10-17:35	M. Chikamori	³ He comagnetometer in ¹²⁹ Xe active spin maser for EDM measurement
30.	17:35-18:00	S. Kanda	Ultra cold Muon for J-PARC and muon (g-2)/EDM experiment
			Discussion Session On "Top and Higgs CP Violation" Led by A. Soni

Dinner (19:30 onwards)

Saturday, 23rd Feb 2013

Morning session

31.	09:30-10:15	A. Vutha	The electron EDM search using thorium monoxide
32.	10:15-10:50	T. Aoki	Ultracold Rb-Sr atoms and FrSr molecules toward the search for an electron EDM
Tea break			
33.	11:05-11:40	Y. Ichikawa	Experimental search for atomic EDM in ¹²⁹ Xe at Tokyo Tech
34.	11:40-12:15	T. Fleig	Electron Electric Dipole Moment P, T-Odd Constant for HfF ⁺ from Relativistic Correlated All-Electron Theory
35.	12:15-12:40	K. V. P. Lata	Electric Dipole Moments of Some Closed-shell Atoms
	12:40-12:50	Concluding session	

Lunch



Good Bye