

KITP Conference: Frontiers of Quantum Metrology: Fundamental Physics, Unexpected Connections, and Novel Applications

(Oct 9-12, 2023)

Coordinators: Klemens Hammerer, Klaus Mølmer and Marianna Safronova

Monday, Oct 9, 2023

Atomic Clocks & Applications, Chair: Ana Maria Rey (JILA)

8:50am Lars Bildsten (KITP)	Welcome[Video][CC]
9:00am Jun Ye (U Boulder)	Precise engineering of quantum many-body states for atomic clocks and fundamental physics[Video][CC]
9:45am Shimon Kolkowitz (UC Berkeley)	Testing relativity in the lab with a miniature clock network[Slides][Video][CC]
10:30am	Morning Break
11:00am Tanja Mehlstäubler (PTB)	Precision Spectroscopy in Many-Body Ion Systems[Slides][Video][CC]
11:45am Murray Barrett (CQT Singapore)	A 176Lu+ frequency reference[Slides][Video][CC]
12:30pm	Lunch Break

Physics beyond SM, Chair: Daniel Carney (LBNL)

2:00pm Andy Geraci (Northwestern)	Optomechanical and spin-based sensing for Fifth forces, Dark Matter, and other Beyond the Standard Model physics[Video][CC]
2:45pm Swati Singh (Delaware)	Searching for dark matter and dark energy with mechanical systems[Video][CC]
3:30pm	Afternoon Break
4:00pm Surjeet Rajendran (Johns Hopkins)	Gravitational Wave Detection in the Micro Hz Band[Video][CC]
4:45pm Yevgeny Stadnik (U. Sydney)	Searches for ultralight scalar dark matter with precision atomic and optical experiments[Slides][Video][CC]
5:30pm	SHUTTLE TO BWSCI

Tuesday, Oct 10, 2023

9:00am Elina Fuchs (Uni. Hannover)	Searches for light new physics and high-frequency gravitational waves with atomic clocks (remote)[Slides][Video][CC]
9:45am Morgan Mitchell (ICFO)	Quantum limits of field sensing with ordinary and ultracold matter (remote)[Video][CC]
10:30am	Morning Break
11:00am John L. Callas (JPL) Mike Robinson (NASA) Marianna Safronova (Delaware)	FunPAG 2: 2nd Meeting of the Fundamental Physics Program Analysis Group[Video][CC]
12:30pm	Lunch Break

Quantum Correlations & Metrology, Chair: Klaus Molmer (U Copenhagen)

2:00pm Peter Zoller (U Innsbruck)	Optimal and variational quantum metrology and vector field sensing[Video][CC]
2:45pm Ana Maria Rey (JILA)	Quantum-enhanced sensing via emergent collective quantum correlations[Slides][Video][CC]
3:30pm	Afternoon Break
4:00pm Aashish Clerk (U. Chicago)	Harnessing dissipation for enhanced spin-squeezing & quantum metrology[Video][CC]
4:45pm Alice Sinatra (LKB, ENS)	Quantum-enhanced multiparameter estimation and compressed sensing of a field[Slides][Video][CC]
5:30pm	RECEPTION
6:00pm	DINNER
8:00pm	SHUTTLE TO BWSCI

Wednesday, Oct 11, 2023

Atom Interferometers & Applications, Chair: Klemens Hammerer (Uni. Hannover)

9:00am Saïda Guellati-Khelifa (LKB - Sorbonne)	Accurate determination of the fine-structure constant using atom interferometry[Video][CC]
9:45am Tim Kovachy (Northwestern)	Probing Fundamental Physics with Long-Baseline Atom Interferometry[Slides][Video][CC]
10:30am	Morning Break
11:00am James Thompson (CU Boulder)	Hamiltonian Engineering in Matter wave Interferometers: QND, 1-Axis Twisting, 2-Axis Twisting, and Mossbauer-like Collective Recoil[Video][CC]
11:45am Naceur Gaaloul (U Hannover)	Precision Atom Interferometry with Quantum Gases[Video][CC]
12:30pm	Lunch Break

Gravity, Chair: Tim Kovachy (Northwestern)

2:00pm Igor Pikovski (Stevens Institute)	Detecting single gravitons with quantum sensing[Video][CC]
2:45pm Daniel Carney (LBNL)	Experiments in quantum gravity: a biased overview[Video][CC]
3:30pm	Afternoon Break
4:00pm Guglielmo Tino (UniFI and INFN)	Precision tests of gravitational physics using atomic quantum sensors[Slides][Video]
4:45pm Nan Yu (JPL)	Science opportunities and quantum challenges of precision measurements in space[Video]

6:00pm

SPECIAL EVENTS DINNER

8:00pm

SHUTTLE TO BWSCI

Thursday, Oct 12, 2023

Quantum Metrology, Chair: Andrew Jordan (Chapman)

9:00am Monika Schleier-Smith (Stanford)

Optical Control of Entanglement in Arrays of Atomic Ensembles [\[Video\]](#)[\[CC\]](#)

9:45am Lorenza Viola (Dartmouth)

Quantum frequency estimation in spatiotemporally correlated noise environments [\[Slides\]](#)[\[Video\]](#)[\[CC\]](#)

10:30am

Morning Break

11:00am Luca Pezze (CNR)

Advantages of multiparameter distributed quantum sensing [\[Video\]](#)[\[CC\]](#)

11:45am Augusto Smerzi (LENS/U. Florence)

Hierarchies of Bounds for Quantum Metrology: From Cramer-Rao to Barankir [\[Video\]](#)[\[CC\]](#)

12:30pm

Lunch Break

Future Application of Quantum Metrology, Chair: Tanja Mehlstäubler (PTB)

2:00pm John Howell (Chapman)

Doppler Gyros and Super Radar [\[Video\]](#)

2:45pm Mankei Tsang (National U of Singapore) Quantum waveform estimation, detection, and noise spectroscopy [\[Slides\]](#)[\[Video\]](#)

3:30pm **CONFERENCE END, SHUTTLE TO BWSCI *Also available to SB Airport and SB Airbus, Goleta location (See Registration Desk BEFORE THURSDAY to sign up.)**