Conference Manual

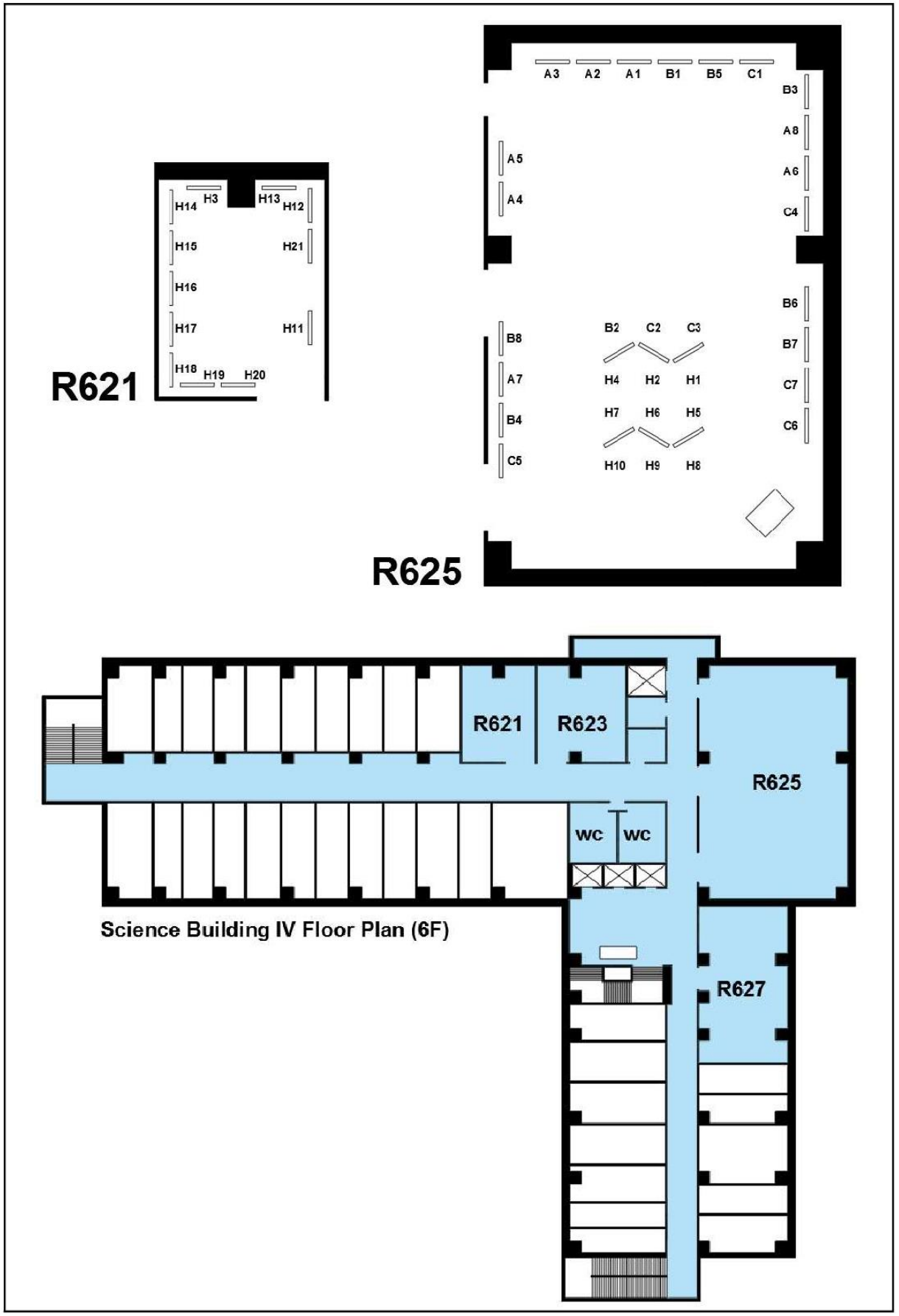
National Central University

2018 Annual Meeting of NCU Physics
Zhongli, Taiwan

Time table

Date	Start	End	Duration	Activities	Location/Room
6/2 (Sat)	13:00	22:00	09 hr	Placement venue (posting poster)	S4-6F
6/3 (Sun)	08:00	08:20	20 min	Registration	S4-625
	08:20	08:30	10 min	Welcome ceremony (Coffee/Tea Break)	
	08:30	11:30	180 min	Poster Session I	S4-625
				Poster Session II	S4-621/S4-625
	11:30	13:00	90 min	Lunch Break	S4-625
	13:00	13:30	30 min	Alumni share	S4-625
	13:30	14:55	85 min	Oral Session I	
	14:55	15:05	10 min	Tea Break	
	15:05	16:00	55 min	Oral Session II	
	16:00	16:10	10 min	Tea Break	
	16:10	16:25	15 min	Advising professor share	
	16:25	16:40	15 min	Thanks and appreciation	
	16:40	16:50	10 min	Group Photo + Closing ceremony	

Map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Science Building IV Floor Plan (6F)

Number	Introduction
A1	**Constructing 3D Water Surface by Fourier Transform Profilometry:** Measuring 3D water surface deformation is an important scientific and engineering issue. Past studies on water surface employ either one of array of gauges to do point measurements. The information is limited and the gauges could perturb the fluid motions which further introduces additional measurement errors. In this work, using Fourier Transfrom Profilometry which is often used in 3D sensing and machine vision, the 3D water surface evolution can be constructed by a projector and a camera. In Fourier Transfrom Profilometry, a sinusoidal grating is projected onto the diffusive water surface. The depth information is encoded into a deformed fringe pattern. The detail reconstruction procedure and the 3D water surface evolution are presented. Hsien-Chou Lin, Wei-Ming Chen, Chung-Chi Huang
A2	**Visualizing Wave Scattering by Acoustically Levitated Particles through Schlieren Imaging:** Contactless levitation of matters in air has a wealth of potential applications requiring high purity and less contamination. One of the method, acoustic levitation, with less restrictions in material properties, has attracted great attentions in recent years. The levitation force, which balances the gravitational force, resulting from the scattering of strong acoustic wave by the objects, is called acoustic radiation force. However, the stability of levitation is still one of the problem. In this work, using Schlieren imaging to visualize sound wave, we studied the perturbation of acoustic standing wave field by adding the levitated particles with various geometries and sizes. The wave-particle interactions at stable and unstable levitation fields are presented and discussed. Lai-Xiang Guo, Ching-Wen Hsueh, Cheng-Yang Wang
A3	**Shape of A Resonance Droplet on Faraday Wave:** Our goal is to make the droplet oscillate on the Faraday wave, analyze the resonance frequency, and observe its oscillating motion. We choose this goal because we find some moments the droplet drops on the vibrating surface, the droplet doesn't coalescence. We want to find the relationship between droplet and the fluid it drops on. We want to use function generator and amplifier to amplify the low frequency signal. When the signal inputs to speaker, the water tank on the speaker oscillates vertically and produces Faraday wave. Then we drop a droplet on the fluid surface. When the air layer between the droplet and the fluid surface is squeezed by droplet and fluid surface, the fluidity of air layer will be poor. Therefore, the droplet doesn't coalescence. Last, we analyze the aspect ratio of the droplet every moment and try to find its deformation period. We will change the parameters we input to generate the wave and try to write down a formula to express the droplet motion. Ya-Ting Huang, Hung-An Ting, Tse-Yuan Chen
A4	**Vortex Rings Collision with Phase Difference:** We can easily see a vortex around our life. For example, we can see it near the flapping wings of the buds or birds, and behind the airfoil of a moving plane, even a tornado we can see on the news. The main principle of a vortex is the velocity difference and viscosity of fluid. The vortex line of a vortex ring is a closed path. The simplest way to generate a vortex ring is that injecting a group of fluid into stationary fluid. Wei-Shuo Lo, Zhi-Yi Zhuo

Number	Introduction
A5	**Wave-Particle Interaction in 2D Faraday Wave:** Faraday wave is a widely investigated nonlinear system for its nonlinear phenomena, like ordered and disordered patterns, and horizontal oscillon motions in the disordered states. However, when adding particles on the water surface, the response of the water surface through the wave-particle interaction is an unexplored and interesting issue, like how patches with different sizes interact with the oscillons, and how oscillons escape from the suppression of particles. In this work, we experimentally investigated the wave-particle interaction in the 2D Faraday wave, parametrically generated by vertically oscillating a water tank. With different packing fractions, waves are suppressed and sustain in different spatial scales. The structural pattern of oscillons is topologically and geometrically changed, which in turn shears and deforms particle packing structures leading to new pattern formations. Xiang-Wei Shao, Chun-Cheng Chu, Chi-Hsien Chou
A6	**Breaking Waves: The Role Played by the Wind:** We want to explore how the air field above water influences the breaking waves. We use the paddle to generate breaking wave in the inclined tank. From the view of the moving frame, the steepening of a crest is based on the conservation of energy. As the crest front steepens, it becomes harder for fluid elements to climb over the crest. The crest curls forward. Some air is then surrounded by the curling crest, which eventually forms the white cap of the breaking wave after the curling part falls. As the wind is added into the system, the waveform is then influenced by the wind, and different directions of the wind give different consequences. Wind flowing along the wave makes the wave higher, while the wind against the wave direction cause the curling of crest front more obvious. These waveform changes are compared with the air field tracked by adding smoke and using the PIV method. Yan-Ru Chen, Hsin-Mei Ho, Yun-Xuan Zhang
A8	**Structure Rearrangement of 2D Granular Bed Driven by Fluid Flow:** In nature, the sand will move and form a river, but how does the sand move? How does the dislocation affect the movement? There is a paper talking about this phenomenon in macrostructure. We use beads to simulate this situation and observe its pattern change. In order to see the motion under particles level. Kwok-Shing Wong, Kai-Chen Kuo
B1	**Seeing the Invisable:** For searching the invisible fluid field with our eyes, Schileren imaging is one way to make it visible instead of the time consuming and large wind tunnel. Schileren image is result from the gradient of the refraction index causing by the pressure difference and the gradient will bend the light through the convex lens with an angle. Thus, with the knife edge on the focus point, we can measure the varying light intensity through a camera. After recording the image, we can analyze it with Matlab. We want to see the fluid field around the wing, seeing the field without interrupting the test section. We will analyze that the situation in different initial condition. Yun-Hsiu Lu, Dong-Chang Lin

Number	Introduction
B3	**The Attraction Power of Water Column:** We all know the hair dryer can carry a ping pong ball. It is because Bernoulli's principle, the ball moves in Y-dimension based on the different pressure. Once we change the air flow field which is generated by hair dryer into water column, the ball can still stay in air stably. But it does not affect by Bernoulli's principle. Our group want to analyze this phenomenon. We want to know what happened in the beginning when ball and water attach each other by using High-speed camera to record this phenomenon and analyzing by Tracker. To make the analyze more complete we will change some parameter, like the diameter of the ball, the pressure of water column etc. Cheng-Wei Shih, Xin-Liang Zheng
B5	**The Coalescence of Bubbles:** When two bubbles come into contact, the "coalescence" of them will be happened, and this motion can be divided into four parts. First, the liquid boundary in the middle of the bubbles is broken to produce a small channel. Second, the channel in the middle of the two bubbles becomes larger and start expanding on the vertical direction. Third, the newly formed bubble contracts vertically and expands horizontally. Final, the above behaviors cause vertical-horizontal circulation until becomes a stable spherical. Chen-Yu Tao, Cheng-Yi Lin
C1	**Relationship of Faraday Waves Pattern and Parameters:** When giving a critical amplitude, nonlinear standing waves appear on liquids. It is called Faraday waves. The viscosity and depth of fluid, the shape and size of the container or the amplitude and frequency of the supplied wave could lead to different graph. We prepare two kinds of containers, round and square. We focus on the pattern and explore the wave numbers difference when changing frequency. Shake round container would produce n-fold pattern, we also concern the relationship among the pattern, frequency, wave number, dynamic viscosity, etc. Hung-Wen Huang, Yong-Lin Lo
C4	**Swimming by Reciprocal and Nonreciprocal Motion at Low Reynolds Number:** In fluid mechanics, the Reynolds number is the ratio of the fluid inertia force to the viscous force. In general, everyone knows that an object cannot move forward by reciprocal motion at low Reynolds number. However, the fact is not as simple as everyone thinks. In non-Newtonian some liquids fluid, the object is still possible to move forward by reciprocal motion at low Reynolds number. In this experiment, we aim to exam discuss whether object in different liquids can move forward by reciprocal motion or by non-reciprocal motion by a swimming robot. Kuan-Yun Chiu, Wei-Ju Wang

Number	Introduction
B6	**When the Balls Hit the Fan: The Fluctuation Theorem** In closed system, an event with lower entropy could happen in short time and specific space. From the perspective of thermodynamic, the possibility is related to the entropy of event and how long we measure. The Fluctuation Theorem is to calculate the value of possibility events occur. A system, composed by airsoft pellets, is used to simulate the behavior of granular gas. We use shaker to make airsoft pellets move like ideal gas. The probe is assembled with motor which given sine wave signal. When the airsoft pellets hit the fan, the motor generates induced current, which we can convert into energy flux. We measure energy flux between granular gas and probe to prove Fluctuation Theorem. Wei-Hao Chen, Zi-Xiang Su
B7	**The Fluctuation Theorem With a Pachinko-Like Setup:** The fluctuation theorem(FT) can be considered a generalization of the second law of thermodynamics for finite system. It clearly confirms the probability that a system returns energy to its power supply for a small time. In the beginning, this theorem has been assumed to hold in a large-particle and stochastic system. However, we devise an experiment setup to provide a deterministic, one-particle, chaotic system and find that one driven particle is sufficient for the FT to hold. What's more, we also simulated the experiment result and change the restitution coefficient of collisions. Simulation shows that one particle can confirm FT and the theorem would break down for small restitution coefficient. Cheng-Hang Wu, Hsin-Chun Hsieh
C2	**Brownian Motion:** Brownian motion was first discovered by the botanist Robert Brown in 1827. It wasn't explained until Einstein published his theorem in 1905. In 1908, Langevin obtained the same equation for Avorgadro's number based on Newtonian approach. According to Einstein relation, we can estimate Boltzmann constant by the experimental value of diffusion constant. Furthermore, we also want to measure the lateral and rotational behavior of non-spherical particles. Po-Han Lin, Wu-Cheng Chiang
C5	**Pattern Formation and Defect Research of Granular Particles:** The study of atomic and molecule is important at this tiny scale. However, the dynamics of the atomic and molecule are too small for us to observe. Furthermore, it is unlikely to measure the large number of individual quantity of each molecule. A good approach is doing same experiments in macroscopic granular system. We use the circular particles to simulate the gas molecules and a vibration table as the thermal energy input. The main research is to see the impact of the input energy, defect evolution and quenching effect. This is important since we can use the system to simulate a thermodynamics system with different temperature. Yen-Yu Fu, Hio-Ian U

Number	Introduction
B2	**A Simple Way to Determine Particle Size with Dynamic Light Scattering:** Dalton said, "Every substance is made by atom." Therefore, we know that our body consist of different kinds of atom. However, how to prove it? Thus, we found a way to determine particle size with dynamic light scattering. We can use this simple optical setup to prove that there are so many tiny particle existing, even if we can't feel it in our regular life. In our experiment, we analyzed the scattered light though autocorrelation function. Then, we can obtain the particle size by the function that represent the decay of the correlogram. Meng-Han Kuo, Zi-Xin Lin
C6	**Single Lens Microscope:** Compound microscopes had been invented in 1650s, reaching magnification of 20 to 30 times. However, a simpler microscopy consisting only a glass bead as the objective achieved magnification over 200times in 1670s. The single lens microscope was produced by Antoni van Leeuwenhoek, who was the first person observed and sketched the living bacteria in the history. The magnifying power of a lens depends on the focal length of it, and the focal length was determined by its aperture. We construct a microscope composed of a few millimeter glass bead, an LED illumination system and a cellphone camera for performing the image of, especially, the world of micrometer scale. Considering so narrow a field of view, we aim to exam the possibility of seeing the microorganisms in Leeuwenhoek records. The quality of a microscope is not only quantified by magnification, but other quantities, such as distortion, resolution and contrast, along with modulation transfer function, which can be measured by corresponding test targets and image analysis. Through the adjustment of illumination system, and the relative position of the cellphone, ball lens, and specimen, the image magnified 100 times with fair resolution and tolerable distortion can be obtained. Yu-Tzu Liao, Lyu-Jhen Jhang
C7	**Dynamic Light Scattering:** Dynamic light scattering (DLS) is a method to measure the size of particles. When a light incident into the sample will be scattered by the particles, the intensity of the scattered light will be the function of time because of the Brownian motion of the particles. we will find out the decay rate of intensity autocorrelation function and then calculate the size of the particle. The advantages of DLS are such as can measure the tiny particles that can be difficult to measure by other method, the price of DLS is lower than other method etc. Our goal is using DLS to determine the size of different cells or other smaller particles. Yan-Tang Huang, Hao-Jun Lu

High Energy

Room A / S4-625

Number	Introduction
B4	**The 3000NTD Muon Detector:** The desktop muon detector is a self contained instrument. It is use the plastic scintillator as the detection medium and use the silicon photomultiplier to collect light. These detectors can be powered by the battery and conjunction with the provided software to make interesting physics measurements. Chih-Kuang Lu, Yo-Ting Tsai
B8	**Measurement of the Planck Constant with A Watt Balance:** In this experiment, we use the Watt balance to measure the precise Planck constant. The Watt balance is controlled by the electrical force in two different modes which are velocity mode and force mode. The velocity mode is measuring the relation between the electromagnetic force which is driven by a given voltage in a magnetic field and the velocity of the motion of the balance. The force mode is balancing the weight of an object against an electromagnetic force which is generated by coil with current in a magnetic field. Combing these two modes, we can find the ratio of power in classical mechanical unit to the power in electromagnetic unit. Because the Planck constant is proportional with the power, and the Planck constant in electromagnetics is known precisely already. Thus, we can find the Planck constant in mechanics. After finding the precise Planck constant by the measurement, the usual SI unit of mass can be redefined by the fixed value Planck constant. I-Hsin Chiu, Yu-Ju Lin

Surface physics

Room A / S4-623

Number	Introduction
A7	**Dripping Filament Inducing Vortices in Soap Films:** Our system is a vertical soap film on a frame under the gravity. We want to see the pattern on the vertical thin film. Thicker thin film initially drops from the top, which induces parallel dripping filaments. The flow of the dripping generates vortices with different scales. As time evolves, the filaments can change its thickness, shape and flow direction, which in turn affects the vortex pattern. Guan-Zhou Bu, Guan-Chen Liou, De-Chen Nian

Electromagnetism

Room A / S4-623

Number	Introduction
C3	**Ultrasound Transducers to Make Levitation System:** Levitation system is a useful system for research for remote and touchless control of objects. In addition, it has many applications such like Holograph, animal research, etc. We use the transducers to produce the 40kHz waves to give out the “Radiation pressure force”, and after balancing between this force and gravity, we can levitate things, and we do some researches that can do better in touchless system. Chih-Hsiang Yeh, Wei-Cheng Hong

Biophysics

Room A / S4-625

Number	Introduction
H1	**Manipulation of the Bacterial Flagellar Motor:** The bacterial flagellar motor rotates and drives the flagellum making the bacteria to swim in the aqueous environment. As we know, the ion-motive force is one of the important energy formats in the bacteria and the flagellar motor is driven by the ion-motive force, which could be proton or sodium ion. The torques generated by the motor is very large which makes the manipulation of it is very difficult. In our experiment, we set up a microscopy and a magnetic tweezer allowing us to manipulate flagellar motor under the microscopy. This magnetic tweezer is structured by electromagnet and it can generate a strongly magnetic field to manipulate the motor rotating clockwise or counterclockwise. By manipulating the rotation of flagellar motor, we want to investigate the relation ion flux through bacterial flagellar motor and the rotational mechanism. Chao-Kai Tseng
H2	**Probing the Fundamental Steps of a Rotating Bacterial Flagellar Motor:** The bacterial flagellar motor (BFM) is a molecular rotary stepping motor. The rotation step of BFM has been found on de-energized cells in 2005, which have 26 steps per revolution. In order to probe the BFM steps in the physiological conditions, there is a need to develop new experimental techniques and protocol. First, a new strain has been constructed to remove the viscous load from the filament and allowing nano-particle labeling on the hook. Second, we set up the high speed interferometric scattering (iSCAT) microscopy to track the nanometer gold particles attached on the hook of BFM. Finally, we use the Cheng – Kenndy nonlinear filter and the t – student test to reconize the steps signal from the noisy raw data. By combing these two new tools and the analyzsis method, we aim to probe the fundamental process of torque generation in BFM. No Chen

Surface physics

Room B / S4-621

Number	Introduction
H3	**A Deformable Surface in Contacting: The Source of Timescales:** We study the characteristic timescales on kinds of deformable particles. The deformable and spherical surfaces of the particles are able to response the force when we contact them, and the dynamic extrusion may cause some phase shift between responding force and deformation. The phase shift causes the characteristic timescales of deformable particles. We study these timescales in the situation of compression, dynamic unidirectional extrusion, and shearing extrusion. Chen-En Tsai
H4 (S4-625)	**The Growth of Calcium Oxide Thin Films on Tantalum(001):** In the field of heterogeneous catalysis, calcium oxide as a catalyst support is little studied, particularly, the calcium oxide film grown on metal surfaces. One of the reasons is that it is difficult to grow such a high-quality calcium oxide film; the lattice constant of the calcium oxide film is too large to form a defect-free one. For example, when growing calcium oxide films on the molybdenum (Mo) surface, Mo atoms are transferred into the calcium oxide film, which changes the structure of the calcium oxide layer and even the absorption mechanism of further deposited gold atoms. We therefore propose to grow a high-quality calcium oxide film on a tantalum(Ta) (001) surface. The structure of Ta, whose lattice constant is 2.9% shorter than calcium oxide, is similar with calcium oxide. We could avoid the atoms transfer from substrate because of the difference of lattice constant. Lu-Hsin Lee

Number	Introduction
H5	**Battery Fabrication of Prussian Blue Analogue Co_3 [Co(CN)_6]_2 Nanocrystals:** Prussian Blue (PB) was found that not only can be used to make Lithium battery but also Sodium battery. The reason is that it offers large enough space to store Lithium or Sodium ions during charging and discharging. The experiment can be divided into two parts. One is the determination of the physics property. It aims to analyze the structure and the lattice size of Prussian Blue Analogue Co 3 [Co(CN) 6] 2 by using XRD. Also, it is believed that the color transform from purple to pink by absorbing the water because its structure changes. It is important for making battery since the battery should contain no water. The other one is battery testing. The Co 3 [Co(CN) 6] 2 sample was introduced as cathode and Lithium as anode in CR2032 battery. It aims to know the voltage and the capacity after doing 100 or 200 cycles of charging and discharging test and try to improve to be better and better. Cheng-Yu Tsai
H6	**Superconductivity Enhanced by An Applied Magnetic Field in Ni-Doped In Nanoparticles:** This experiment use deposition machine to manufacture the nanoparticle of Indium and Nickel. Then put the sample in the XRD machine to analyze the structure and particle size of my sample. The sample I expect is like the center of Indium particles and some Nickel particles attach around it. Due to the proximity effect, the physical properties of indium nanoparticles would be changed. Ting-Yang Chen
H7	**Domain Wall Motion in TmIG Manipulate by Spin Wave:** Domain wall manipulation is vital in magnetic transistors. This research focus on the spin wave manipulation, which has low energy dissipation in compare with pure spin current and spin polarized current. The main goal of this research is to find in which condition spin wave can move the domain walls. Shao-Yu Huang
H8	**Electron Properties of Graphene Under the Effect of Magnetic Field:** In this study, we investigate the electron properties of graphene plane under the influence of magnetic field. The single-band tight-binding model with Green's function method is employed to calculate the electron properties. Due to the broken of translation invariant, the Bloch boundary condition and the Peierls substitution are applied to include the effect of magnetic field under a periodic lattice. We present our calculation by density of states and band structure to show the effect of magnetic field under various intensity. Shih-Chuan Lien

Solid state physics

Room A / S4-625

Number	Introduction
H9	**Graphene Growth through Direct Magnetron Capacitive Coupled Radio-Frequency Plasma Enhanced Chemical Vapor Deposition:** Graphene, a two-dimensional material with carbon atoms arranged into a regular honeycomb lattice, has attracted great scientific and technological interest due to its excellent electrical and mechanical properties. In order to realize the practical applications, graphene needs to be synthesized in low cost. Plasma-enhanced chemical vapor deposition (PECVD) is a low-temperature and short-time method suitable for graphene growth. In our work, we control the plasma to achieve the best condition to grow graphene with the analysis of OM, SEM and Raman. Practically, there are two kinds of way for plasma generating, CCP and ICP. In general, CCP has a problem about low dissociated rate. So we use "magnetron" CCP to enhance the dissociated rate and study its effect. Also, the effect of plasma power, growth time, and argon partial pressure have been studied in this work. Yu-Chen Chang
H10	**Doping Graphene with High Energy Ion Implantation through Stopping Layer:** Modify the surface of the graphene may influence electrical properties. Doping other kinds of the element on the graphene is one way to modify the surface. We offer a new way to do doped graphene with the ion implanter. Compared to the doped graphene by chemical vapor deposition (CVD), the way can help us to ensure the impurity of elements doping on the graphene and control easily and not limited by the thermal equilibrium. We use the polymethyl methacrylate (PMMA) which is easy to remove with acetone to become the stopping layer acting the role to lower the beam energy. The result is composed of vacancy and substitution on the graphene. With two parameters, the value of dose and different thickness of stopping layer coating on the graphene, we can change the proportion of the substation and the vacancy because of the difference of passing energy. Eventually, the results can be measured with the Raman spectrum and the Hall Effect. Che-Men Chu

Optics

Room B / S4-621

Number	Introduction
H11	**Measurement of the Absorption Cross Section of Carbon Dioxide Near 4.3 μm Using a Quantum Cascade Laser:** In general, FTIR is widely used for measurement of the absorption cross section of gas species, however, it is too heavy to be used for portable measurement. In this work we used a pulse quantum cascade laser to measure the absorption cross section of CO 2 near 4.3 μm. We will compare our measurement results with those values provided by Hitran and demonstrate that quantum cascade laser is suitable for quick and portable measurement of concentration of CO 2 in the air in different environments. Ting-Wei Chien
H12	**Construction of Ring Regenerative Amplifier:** To improve the eight-pass amplifier in 100TW Ti: Sapphire Laser system of High-Field Physics and Ultrafast Technology Laboratory, we design and set up ring regenerative amplifier and plan to use 50 mJ, 532 nm, 10 ns pump lase to amplifier 1 J, 800nm, 200ps seed pulse to over 5mJ. Wei-Chen Lin

Optics

Room B / S4-621

Number	Introduction
H13	**Autofocusing System by Internal Reflected Laser Beam:** When we study in microscopic physics, the focal plane may move due to several environmental parameters, such as thermal extension of the objectives. Also, our sample may not totally perpendicular to the stage. For longtime measurement and horizontal observation, the focal plane may shift several microns. We can use an internal reflected laser beam to measure if the plane keeps at the same one. Its position would be measured by a QPD. By the signal from QPD, FPGA can do a PID feedback control to a piezo stage, which can control the height of the sample, to move the focal plane to the original one, so that we can always keep our observation at same height to the sample. Wenqi Lin

Astronomy

Room B / S4-621

Number	Introduction
H14	**The Analysis of Star Formation in Seyfert Galaxies:** I am using data from ALMA and SDSS to research on the star formation of Seyfert galaxies. Seyfert galaxies are classified into one of the groups of AGN (Active Galactic Nucleus), which has a very bright nucleus to emit strong electromagnetic wave and another unique property. With the emitting EM wave, I aim to estimate several features of the star formation in Seyfert galaxies, such as the rate of formation, spatial distribution, the relation to AGN at center of galaxies, etc. To find the reasons behind the results of star formation of Seyfert Galaxies is a very important in the field of astronomy and physics, and we still have a lot of questions on its origin. The high-resolution data from ALMA allows us to research on it. Feng-Yi Chiang
H15	**Systematically Searching for Millihertz Quasi-Periodic Oscillations for Neutron Star Low Mass X-Ray Binaries:** Some of neutron star X-ray binaries (NS LMXBs) exhibit millihertz quasi-periodic oscillations (mHz QPOs) prior to their type I X-ray bursts. Such oscillation is believed owing to the meta-stable nuclear burning on the surface of neutron star. This research is to systematically search for the mHz QPOs for the neutron star X-ray binaries. The preliminary results using XMM-Newton observation data for the NS LMXBs 4U 1636-536 and 4U 1608-522 are present in this report. Ka-Ho Tse

High Energy

Room B / S4-621

Number	Introduction
H16	**Searching for the Standard Model Higgs Boson Produced through Vector Boson Fusion and Decaying to at sqrt{s}= 13TeV:** The search for the Higgs boson decaying into a Z boson and a photon with the subsequent decay of Z into a pair bottom quarks will be presented in this poster. Due to the large background contribution to the inclusive production, we investigate the feasibility of the search of this kind of final state in the production of vector boson fusion. The search strategies and work-in-progress results with pp collisions at sqrt{S} = 13TeV will be shown. Chun-Yu Chang

High Energy

Room B / S4-621

Number	Introduction
H17	**Performance of Jets at CEPC:** After the Higgs discovery, precise measurements become vital for the experimental particle physics. A powerful Higgs/Z factory, the Circular electron-positron Collider is proposed. Adequate reconstruction and detector design are fundamental to this project. Arbor algorithm has been optimized to fulfill the CEPC physics requirements and is used as the core for the CEPC physics reconstruction. With a particle flow algorithm oriented detector design, we will present the current performance of jets at CEPC. Crucial studies to be covered in the future will also be discussed in this poster. Pei-Zhu Lai
H18	**Search of Higgs to Zγ with Proton-Proton Collisions at 13 TeV:** This poster presents the results and new study of Higgs to Zγ with the data recorded by the CMS experiment at the LHC from proton-proton collisions at 13 TeV with integrated luminosity of 35.9 fb-1 in 2016. We are improving the analysis method to deal with the full run-II data. Based on the framework of 2016 analysis, we are developing the MVA method to improve dijet category and utilizing the kinematic information to improve overall analysis. This is also the first look on the dijet MVA in the Higgs to Zγ. Ming-Yan Lee

Gravity

Room B / S4-621

Number	Introduction
H19	**Hidden Symmetry of Sigma Model in Gravitational Theories:** Stationary spacetime configurations in gravitational theories coupled to dilaton and Maxwell fields contain certain hidden symmetry. By applying the dimensional reduction, the effective theory can be formulated as a sigma-model on the target space of fields. In such formulation, one can explore the hidden symmetry by solving the corresponding Killing equations. We will examine the group structure for the Einstein- Maxwell-dilaton theory and discuss the generalization for the other gravitational theories. Yu-Yen Chang

Thermodynamics

Room B / S4-621

Number	Introduction
H20	**Nonequilibrium Fluctuations in a Time-Varying Stiffness Virtual Potential by Feedback Trap in Electrical Circuits:** We report the activity of the thermal fluctuation in electrical circuit driving by a time-varying stiffness virtual potential by feedback trap. By measuring the work produced by repeated cycles composed of the compression and expansion processes for the virtual potential, the probability distribution of work produced by feedback trap can be obtained and studied. The Jarzynski equality also be descript by discussing the mean values of work also shows. Its applicability on a heat engine and an information engine driving by feedback control also be discussed. Hsin Chang

Number	Introduction
O1	**Extracting Black Hole's Horizon Effect with Its Ringdown:** Black holes are the one-way stations in our Universe. Once the event horizon is crossed, there is no way to get out. This notion forms the fundamental pillar of black-hole mechanics. However, recent developments of black-hole physics reveal that the event horizon may not form an eternal confinement if nonclassical effects are taken into account. Some energy may be able to escape from the event horizon in the form of black-hole radiation or echoes by exotic compact objects. This emission is a kind of horizon effects, which challenges the central belief about black holes. As the recent direct detections of gravitational waves provide opportunities to test the nature of black holes, it is interesting and necessary to investigate the generation of gravitational waves by these nonclassical black holes. In this presentation, I will discuss how a nonclassical black hole "looks" like in gravitational-wave detectors and demonstrate the ability to extract or constraint horizon effects if the ringdown, oscillation of the event horizon when a black hole perturbed, of a supermassive black hole is detected. Lai Kwun Hang
O2	**The Tale of How A Pair of CUHK Physics X ESSC Students Teach HKPHO to Senior Secondary School Students:** HKPHO is a physics competition for students studying in Form 4 or below[1]. The competition focuses mainly on Motion of point particles, Mechanics, Energy and Work, and Momentum and Impulse. Some training materials[2][3] are provided by the organizers, but we notice that the materials are exam-oriented, and explanations for some physics concepts are skipped, which we found unsatisfactory. In this "research", we attempt to teach high school students the related topics by making use of CUHK Physics and ESSC teaching methods. We first equip the students with the necessary mathematical tools (Vectors and calculus). This is to allow the students to understand the various proofs in later physics-related chapters and appreciate the beautifulness of Physics. We also extracted the essence of the teaching styles of CUHK Physics Lecturers and Professors and implemented them in our teaching, including using hand-written notes, innovating original questions and doing simulations. We also try to relate the physics taught to daily life applications, and point out their usage in ESSC. While the research outcome is probably best measured by the students' result in the 2018 HKPHO, positive changes in the students' interests towards science are found, which is an indication of success in the research. [1] https://www.hkage.org.hk/en/competitions/detail/4286 [2] https://www.hkage.org.hk/file/competitions/316/HKPHO_Booklet1_en.pdf [3] https://www.hkage.org.hk/file/competitions/316/HKPHO_Booklet2_en.pdf Li Ka Yue Alvin, Yau Chun Yin Victor

Number	Introduction
O3	**Best Excitation of Surface Plasmon Polaritons on 2D Achiral Nanohole Arrays and Its Role:** We have studied the dependence of rotation angle and ellipticity on sample orientation and incident polarization from metallic nanohole arrays. The arrays have fourfold symmetry and thus do not possess any intrinsic chirality. With extrinsic chirality, we explore the best excitation condition for surface plasmon polaritons (SPPs) by using experiment and finite-difference time-domain (FDTD) simulation. Our results have indicated that outgoing reflection arises from the interference between nonresonant background, which preserves the input polarization, and SPP radiation damping, which is linearly polarized but carries a different polarization defined by the vectorial field of SPPs. The best excitation of SPPs happens when the field of the incident light has the best overlapping with that of the propagating SPPs. We analytically formulate the outgoing waves based on temporal coupled mode theory (CMT), which shows that polarization conversion depends on the interplay between absorption and radiative decay rates of SPPs and the sample orientation. Xiaoyu Guo, Zhaolong Cao, and H. C. Ong

NCU Department of Physics

中央物理小年會網站

小年會主辦人：廖致超
技術協力：張用威
美術編輯：余欣鴻