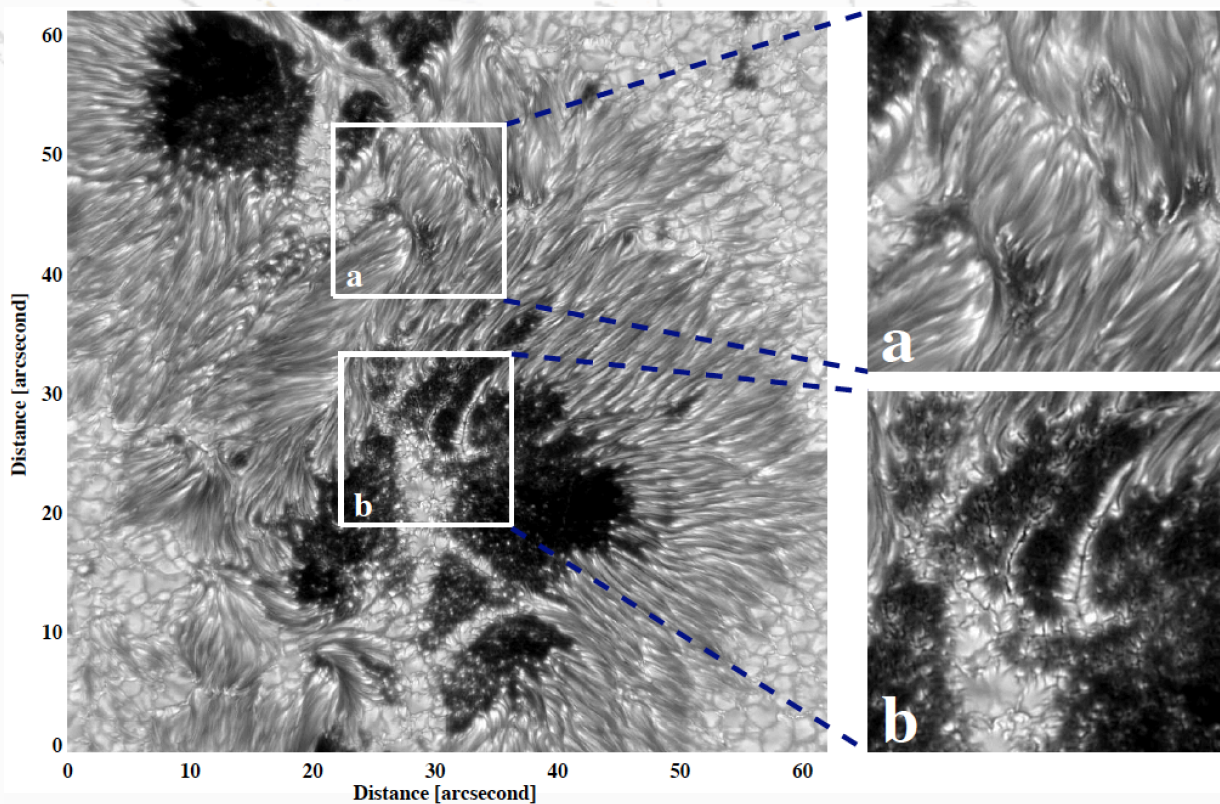


First Ten Years of GST Workshop

NJIT Campus, Newark, USA, March 12-14, 2019



BBSO operation is supported by NJIT and US NSF AGS-1821294 grants. GST operation is partly supported by the Korea Astronomy and Space Science Institute (KASI), Seoul National University, and by strategic priority research program of CAS with Grant No. XDB09000000.

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Jongchul Chae	Seoul National University
Yuangyong Deng	National Astronomical Observatories of China
Yeon-Han Kim	Korea Astronomy and Space Sciences Institute
Haisheng Ji	Purple Mountain Observatory
Haimin Wang	New Jersey Institute of Technology
Vasyl Yurchyshyn	Big Bear Solar Observatory

Local Organizing Committee

Cheryl James	New Jersey Institute of Technology
Erika Norro	Big Bear Solar Observatory

Registered Participants

	Name	Institution
1	Valentina Abramenko	Crimean Astrophysical Observatory (CAS)
2	Kwangsue Ahn	Big Bear Solar Observatory/NJIT (BBSO)
3	Arun Kumar Awasthi	University of Science and Technology of China (USTC)
4	Xianrong Bai	National Astronomical Observatories of China (NAOC)
5	Hua Bao	The Institute of Optics and Electronics (IOE)
6	Carrie Black	National Science Foundation (NSF)
7	Christian Beck	National Solar Observatory (NSO)
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10	Jongchul Chae	Seoul National University (SNU)
11	Liang Chang	Yunnan Observatories (YNAO)
12	Bin Chen	New Jersey Institute of Technology (NJIT)
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14	Xin Cheng	Nanjing University (NJU)
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33	Rui Liu	University of Science and Technology of China (USTC)
34	Jeffrey Newmark	NASA GSFC
35	Valentin Martinez Pillet	National Solar Observatory (NSO)
36	Arik Posner	NASA HQ
37	Thomas Rimmele	National Solar Observatory (NSO)
38	Tanmoy Samanta	Peking University (PKU)
39	Jungjoon Seough	Korea Astronomy and Space Sciences Institute (KASI)
40	Jinhua Shen	Xinjiang Astronomical Observatory (XAO)
41	Sami Solanki	Max Planck Institute for Solar System Research (MPI)
42	Hui Tian	Peking University (PKU)
43	Haimin Wang	New Jersey Institute of Technology (NJIT)
44	Jason Wang	New Jersey Institute of Technology (NJIT)
45	Jiasheng Wang	New Jersey Institute of Technology (NJIT)
46	Ya Wang	Purple Mountain Observatory (PMO)
47	Yuqian Wei	New Jersey Institute of Technology (NJIT)
48	Yan Xu	New Jersey Institute of Technology (NJIT)
49	Xiaoli Yan	Yunnan Observatories (YNAO)
50	Heesu Yang	Korea Astronomy and Space Sciences Institute (KASI)
51	Xu Yang	Big Bear Solar Observatory/NJIT (BBSO)
52	Sijie Yu	New Jersey Institute of Technology (NJIT)
53	Vasyl Yurchyshyn	Big Bear Solar Observatory/NJIT (BBSO)
54	Tuanhui Zhou	Purple Mountain Observatory (PMO)



Workshop Program

	Day 1 – Tuesday, March 12 <i>112 Eberhardt Hall</i>
8:00-8:45 am	Registration (sign-in) <i>Coffee and Fruit</i>
	Session 1: Opening Remarks
8:45 am	Atam Dhawan (Senior Vice Provost for Research, NJIT)
8:55 am	Carrie Black (National Science Foundation)
9:05 am	Keynote Talk: First Ten Years of Goode Solar Telescope Wenda Cao (Director, Big Bear Solar Observatory/NJIT)
	Session 2: Sunspot Studies (Chair: Vasyl Yurchyshyn)
9:30 am	Invited Talk: Photospheric Resonator Model of Three-Minute Umbral Oscillations Jongchul Chae (SNU)
9:50 am	Origin of Internally Excited 3 Minute Umbral Oscillations Kyuhyoun Cho (SNU)
10:05 am	Physical Nature of Spiraling Patterns in a Pore Juhjung Kang (SNU)
10:20 am	Coffee Break
10:35 am	Invited Talk: BBSO/GST Observations of Fine Structures and Fast Dynamics in Sunspot Light Bridges Hui Tian (PKU)
10:55 am	Vortex Formations and its Associated Surges in a Sunspot Light Bridge Heesu Yang (KASI)
11:10 am	Invited Talk: Joint GST and EOVS Study of Super Strong Magnetic Fields in Active Region 12673 Haimin Wang (NJIT)
11:30 am	High-resolution Observations of Dynamics of Superpenumbral Hα Fibrils Ju Jing (NJIT)
11:45 am	Observation of Penumbra Formation Around a Pore Debi Prasad Choudhary (CSUN)



12:00 pm	Lunch (Campus Center Atrium)
	Session 3: Solar Flares I (Chair: Haimin Wang)
1:00 pm	Invited Talk: High-resolution Observations of Photospheric Structural Evolution Associated with a Flare Chang Liu (NJIT)
1:20 pm	Invited Talk: High-resolution He I 10830 Å Narrowband Imaging for an M-Class Flare - The Evolution of Multiple Hot Channels Ya Wang (PMO)
1:40 pm	Invited Talk: Magnetic Vector Rotation in Response to the Energetic Electron Beam during a Flare Yan Xu (NJIT)
2:00 pm	Invited Talk: Studies of Two M-Class Flares Observed by GST Xiaoli Yan (YNAO)
2:20 pm	Joint GST and EOVS Observation of an M1.4 Flare on 2017 September 6 Yuqian Wei (NJIT)
2:35 pm	Group Photo
2:45 pm	Coffee Break
	Session 4: Small-Scale Activity (Chair: Jongchul Chae)
3:00 pm	Invited Talk: Origin of Solar Spicules and Their Role in Coronal Heating Tanmoy Samanta (PKU)
3:20 pm	Invited Talk: Magnetic Field Dynamics and Varying Plasma Emission in Large-Scale Coronal Loops Vasyl Yurchyshyn (BBSO)
3:40 pm	Fine-Scale Emerging Flux Elements Observed by 1.6m Telescope at BBSO Jiasheng Wang (NJIT)
3:55 pm	Flame-like Ellerman Bombs and their Connection to UV Bursts Yajie Chen (PKU)
4:10 pm	Break
4:25 pm	Invited Talk: Ellerman Bombs: Observations and Simulations Jie Hong (NJU)
4:45 pm	GST Data-Based Diagnostics of Solar Plasma in the Quiet Sun Photosphere Valentina Abramenko (CAO)
5:00 pm	A Collapsing Granule and the Excitation of Oscillations in the Photospheric and Chromosphere Hannah Kwak (SNU)



5:15 pm	<i>High Resolution and Multi-Wavelength Observation of an Anemone Jet</i> Tuanhui Zhou (PMO)
5:30 pm	End of Day 1

	Day 2 – Wednesday, March 13 <i>112 Eberhardt Hall</i>
8:15 am	<i>Arrival/Coffee</i>
	<i>Session 5: GST coordination with NASA Space Solar Missions</i> <i>(Chair: Su-Chan Bong)</i>
8:30 am	<i>Keynote Talk: The First Orbits of the Parker Solar Probe</i> Arik Posner (NASA)
8:55 am	<i>Invited Talk: KASI Contributions to the GST and NASA Space Solar Missions</i> KyungSuk Cho (KASI)
9:15 am	<i>Invited Talk: Coupling of the Solar Atmosphere as Revealed by Observations and Radiative MHD Simulations</i> Mark Cheung (LMSAL)
9:35 am	<i>Invited Talk: Coronagraph Observations through BITSE and CODEX</i> Jeffrey Newmark (GSFC)
9:55 am	<i>Investigating the Source of Slow Solar Wind seen from Remote-Sensing Observations</i> Ryun-Young Kwon (KASI)
10:10 am	<i>Coffee Break</i>
	<i>Session 6: GST coordination with other Ground-Based Facilities</i> <i>(Chair: Wenda Cao)</i>
10:25 am	<i>Keynote Talk: Towards First Light with the Daniel K. Inouye Solar Telescope</i> Thomas Rimmele (NSO)
10:50 am	<i>Invited Talk: Maximizing GST Science with NSO Synoptic Observations</i> Frank Hill (NSO)
11:10 am	<i>Invited Talk: Introduction to the AIMS</i> Yuanyong Deng (NAOC)
11:30 am	<i>Why We Need an Eight-Meter Class Solar Telescope?</i> Haisheng Ji (PMO)



11:45 am	<i>The Development of 2-m Ring Solar Telescope</i> Liang Chang (YNAO)
12:00 pm	<i>Lunch (Campus Center Atrium)</i>
	<i>Session 7: Instrumentation and Data Processing</i> <i>(Chair: Yuanyong Deng)</i>
1:00 pm	<i>Keynote Talk: The Present, and Plans for Adaptive Optics with the GST in Big Bear</i> Nicolas Gorceix (BBSO)
1:25 pm	<i>Invited Talk: Current and Future Challenges in High-Resolution Solar Physics: Instrumentation, Data & Data Analysis</i> Christian Beck (NSO)
1:45 pm	<i>Invited Talk: Machine Learning for Space Weather Forecasting and Solar Data Mining</i> Jason Wang (NJIT)
2:05 pm	<i>Data Processing of the Near Infrared Imaging Spectropolarimeter</i> Kwansu Ahn (BBSO)
2:20 pm	<i>Multi-Channel Phase Diversity Speckle Image Processing Technology for AO Corrected Solar Images</i> Hua Bao (IOE)
2:35 pm	<i>Coffee Break</i>
	<i>Special Talk: Dr. Sami Solanki</i> <i>(Chair: Haimin Wang)</i>
2:50 pm	<i>The Sun's Magnetic Field: Producing Space Weather and Varying the Sun's Brightness</i> Sami Solanki (Max Planck Institute)
3:50 pm	<i>Break</i>
	<i>Session 8: Filament Eruptions</i> <i>(Chair: Haisheng Ji)</i>
4:00 pm	<i>Invited Talk: Double-Decker Filament Configuration Revealed by Mass Motions</i> Rui Liu (USTC)
4:20 pm	<i>Invited Talk: Formation of Magnetic Flux Rope Prior to the Eruptions</i> Xin Cheng (NJU)
4:40 pm	<i>Mass Motion in a Prominence Bubble Revealing a Kinked Flux Rope Configuration</i> Arun Kumar Awasthi (USTC)
4:55 pm	<i>Spectroscopic and Imaging Observations of Small-Scale Reconnection Events</i> Dong Li (PMO)



5:10 pm	End of Day 2
7:00 pm	Workshop Dinner (Iberia Peninsula Restaurant, 63-69 Ferry St, Newark, NJ 07105)

	Day 3 – Thursday, March 14 112 Eberhardt Hall
8:15 am	Arrival/Coffee
	Session 9: Solar Flares II (Chair: Haisheng Ji)
8:30 am	Invited Talk: A Brief Summary of CO Observations with CYRA in the Last Two Years Xianyong Bai (NAOC)
8:50 am	Spectral Diagnosis of Mg II and Hα Lines During the Initial Stage of an M6.5 Flare Nengyi Huang (NJIT)
9:05 am	He I 10830Å Counter-Streaming Motions in Active Region Magnetic Arcades Xu Yang (NJIT)
9:20 am	Magnetic Energy Releasing and Contraction of Flare Loop during the Initial Phase of the Flares Jinhua Shen (XAO)
9:35 am	Workshop Summary and Discussion Haimin Wang (NJIT)
10:35 am	End of the Workshop
	Poster Session
Poster	What Regulates the Dynamical Evolution of the Expanding Solar Wind? Jungjoon Seough (KASI)
Poster	Progress of BITSE Development in KASI Su-Chan Bong (KASI)



GST Data-Based Diagnostics of Solar Plasma in the Quiet Sun Photosphere

Valentina Abramenko

Crimean Astrophysical Observatory

(Tuesday March 12th, 2019, 5:15pm, Eberhardt Hall)

Data from high-resolution solar instrument Goode Solar Telescope at Big Bear Solar Observatory (BBSO/GST), augmented by data from Solar Dynamics Observatory Helioseismic and Magnetic Imager (SDO/HMI) and Hinode Solar Optical Telescope SpectroPolarimeter (SOT/SP), allowed us to analyse complexity and turbulence in areas of weak magnetic fields outside active regions. Results of analysis of multi-scale and turbulent properties of photospheric magnetic fields and granulation patterns in undisturbed solar photosphere will be discussed. Different types of magnetic environment were explored: coronal hole (CH) areas, a quiet sun (QS) intranetwork area, a QS/network area, and an area with small pores. The property of multifractality (or, in other words, intermittency) was revealed for i) magnetic field structures in CHs on scales 400-1500 km; ii) granulation patterns in all environments on scales less than 600 km. The degree of multifractality tends to be stronger as the magnetic environment becomes weaker. Analysis of the magnetic flux dispersal on scales less than 1000-2000 km revealed the regime of super-diffusivity for all data sets. The regime of super-diffusion becomes stronger from the QS/network to the QS/intranetwork to the CH. Both the multifractality and the super-diffusivity on very small scales are necessary conditions for the fast (turbulent) dynamo action. The results show that the most favorable conditions for the fast small-scale dynamo action are met outside the network, inside vast areas of weakest magnetic fields, which supports the idea of nonlocal, deep turbulent dynamo.

Notes:



Data Processing of the Near Infrared Imaging Spectropolarimeter

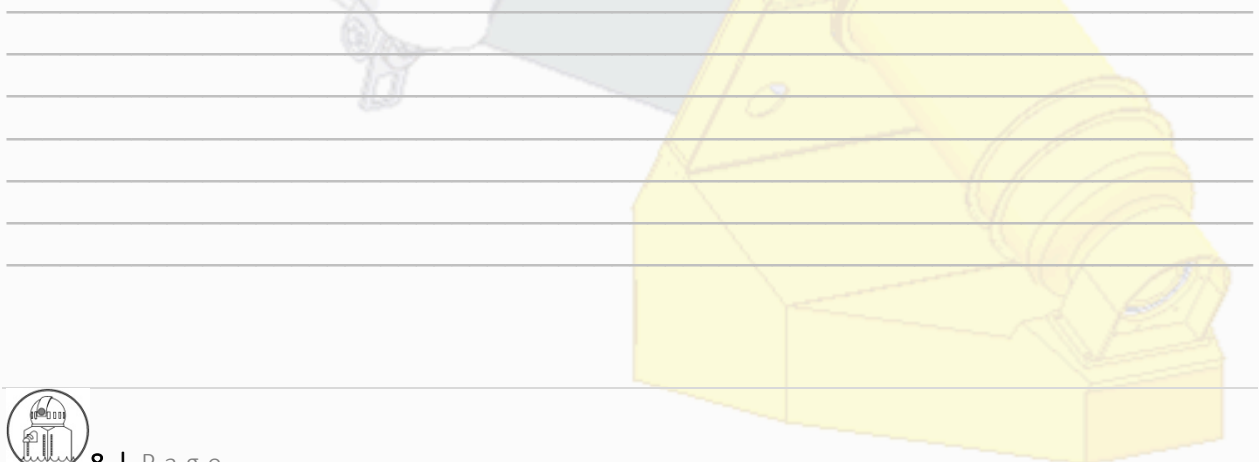
Kwangsu Ahn

Big Bear Solar Observatory/NJIT

(Wednesday March 13th, 2019, 2:05pm, Eberhardt Hall)

The Near Infrared Imaging Spectropolarimetry (NIRIS) has been operational for years, and there are many new scientific outcomes from the instrument. In terms of data processing, there have been several challenges and solutions, and we are still seeking improvements on the quality of the data. We would like to presents the progress of the data processing for the magnetograph from the preparation of the datasets to the inversion techniques to deduce physical parameters, as well as ongoing efforts to enhance the viability of the data.

Notes:



Mass Motion in a Prominence Bubble Revealing a Kinked Flux Rope Configuration

Arun Kumar Awasthi

University of Science and Technology of China, Hefei, Anhui, China

(Wednesday March 13th, 2019, 4:40pm, Eberhardt Hall)

Quiescent filaments are observed to have a lifetime of several days. In view of a continuous mass drain, driven by solar gravitation, one or more efficient mechanisms of mass loading back into the prominence must be at play. Although prominence bubble, observed at the chromospheric height (often observed as a cavity), is known to be an active location for the formation of 'plumes' which carry the prominence material upward, its formation mechanism and magnetic field configuration is not comprehensively known. We investigate the dynamical activities of the material inside a bubble, located just above the spicule height in the prominence, which was recorded in the H α line center and in ± 0.4 Å wings by the 1-m NVST telescope on October 20, 2017. Flow map derived using the NAVE procedure, along with the Doppler map, revealed a rotational motion of the material inside the cavity; comprised of the blue-shifted material (towards the observer) to be exhibiting prevalent upward motion, while the red-shifted mass to be exhibiting a downward motion. This led us to infer a kinked flux rope configuration of the investigated prominence bubble. In the absence of any discernible enhancement in the EUV emission in due course of the development of the bubble, we further propose that the prominence bubble is the site of an emerging flux rope.

Notes:



A Brief Summary of CO Observations with CYRA in the Last Two Years

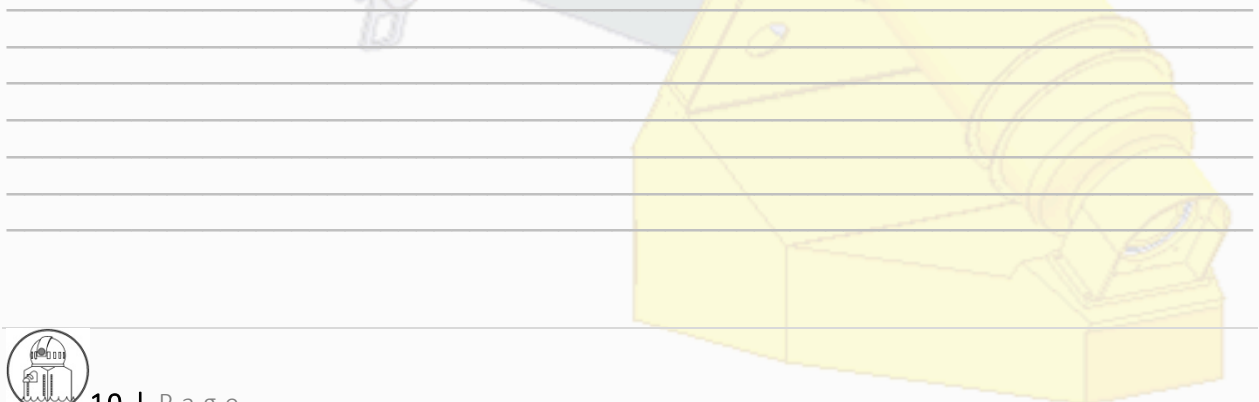
Xianyong Bai

National Astronomical Observatories, Chinese Academy of Sciences

(Thursday March 14th, 2019, 8:30am, Eberhardt Hall)

It is well known that the CO lines near 4.67 microns form near the temperature minimum region, which provides a unique tool to diagnose the coolest components of the solar atmosphere. In the talk, I would like to make a brief summary of the CO observations with CYRA during the period of Sep. 14-28, 2017 and Sep. 02-14, 2018. The data calibration and reduction method so as to correct different kinds of instrumental effect will be presented. Moreover, some preliminary results on the sunspot and pore regions with CO lines will be shown.

Notes:



Multi-channel Phase Diversity Speckle Image Processing Technology for AO Corrected Solar Images

Hua Bao

The Institute of Optics and Electronics, Chinese Academy of Sciences

(Wednesday March 13th, 2019, 2:20pm, Eberhardt Hall)

Traditional adaptive optics (AO) could effectively correct the atmospheric turbulence of ground layer, but the upper atmosphere as well as no-common path aberration still degenerate the image qualities of AO corrected results distinctly. In order to get high resolution AO corrected solar images, a multi-channel phase diversity speckle (PDS) image processing technology is effectively carried out in this paper. The reconstructed results of AO solar images captured by china 1m new vacuum solar telescope (NVST, Fuxian Solar Observatory) verified the reliability of our method.

Notes:



Current and Future Challenges in High-Resolution Solar Physics: Instrumentation, Data & Data analysis

Christian Beck

National Solar Observatory (Boulder)

(Wednesday March 13th, 2019, 1:25pm, Eberhardt Hall)

Instrumentation in high-resolution solar physics has evolved from large, but generally simple spectrograph systems in the past primarily to much more complex imaging instruments in the present day. The characteristic properties of the data acquired in terms of spatial resolution, field of view, wavelength and spectral coverage have evolved along with the technical changes in instrumentation. The change of data properties has subsequently led to completely different approaches in the data analysis. I revise the evolution of instrumentation in high-resolution observations in solar physics from my personal experience over the last 15 years to the current and future state. I will present the common characteristics of current high-resolution observational data. Using the recent paper of Grant et al. 2018 on Alfvén wave dissipation in the solar chromosphere as an example, I outline which challenges such data provide for the data analysis right now and what changes are to be expected in the future.

Notes:



Progress of BITSE Development in KASI

Su-Chan Bong

Korea Astronomy and Space Science Institute

(Poster)

Balloon-born Investigation of Temperature and Speed of Electrons in the corona (BITSE) is a technology demonstration balloon flight mission for the Korea Astronomy and Space Science Institute (KASI) and the NASA to develop a next generation diagnostic coronagraph in collaboration. The BITSE coronagraph will utilize spectral information to simultaneously measure electron density, temperature, and velocity. KASI has been developing filter wheel assembly, focal plane assembly, electronics box, and flight and ground softwares. We successfully finished environment test of the each developed parts, and are integrating the coronagraph. The BITSE is scheduled to be launched in September 2019. After the BITSE, we plan to develop a coronagraph with similar design (Coronal Diagnostic Experiment, CODEX) and install on the International Space Station (ISS) in 2022.

Notes:



First Ten Years of Goode Solar Telescope

Wenda Cao

New Jersey Institute of Technology/Big Bear Solar Observatory

(Tuesday March 12th, 2019, 9:05am, Eberhardt Hall)

NJIT has built, and now operates the highest-resolution solar telescope ever built – the Goode Solar Telescope (GST) at BBSO. This 1.6-m clear aperture GST is the first facility-class solar telescope built in the U.S. in a generation. Benefitting from the long periods of local excellent seeing at Big Bear Lake, the GST, equipped with high-order adaptive optics, routinely collects diffraction-limited spatial resolution ($\sim 0.1''$) photometric, spectroscopic and/or polarimetric data, with a high cadence (< 40 s), across the spectrum from 0.4 - 5.0 μm . Since acquiring its first light in 2009, GST has provided the community with open access to observations of the photosphere, chromosphere and up to the base of the corona with the unprecedented resolution, targeting at the fundamental nature of the solar activity and the origin of space weather.

GST's users have kept a stable growth since it attained the first light. Current users are distributed over 15 universities and 10 national institutes/observatories in 9 countries. More than 150 scientific papers have been published resulting from the GST data. The GST actively supports campaign observations with other large ground-based telescopes and space missions, including ALMA, VLA, GREGOR, DST, McP, Hi-C II and CLASP-2 rocket missions, as well as NASA IRIS and Hinode missions. Joint observations account for 60 - 80% of the total available GST observing time annually.

The GST will dominate high-resolution U.S. ground-based observations at least until the 4-m clear aperture DKIST acquires its first light in 2020. Even when the DKIST is operational, the GST will still play an essential role in joint with the DKIST campaign observations, which allow maximizing the scientific output. The GST is also the pathfinder for the DKIST. Like the flagship DKIST, the GST is an off-axis Gregorian telescope – comparable designs have made the GST an ideal testbed for various DKIST instrumentation and technologies.

This presentation briefly reviews the scientific and instrumental achievement accomplished with GST in the past ten years, and envision the collaborative prospects with other large ground-based facilities and NASA space solar missions in the future.

Notes: _____



Photospheric Resonator Model of Three-Minute Umbral Oscillations

Jongchul Chae

Seoul National University

(Tuesday March 12th, 2019, 9:30am, Eberhardt Hall)

The velocity oscillations observed in the chromosphere of sunspot umbrae look like a resonance in that their power spectra are sharply peaked around a period of about 3 minutes. What resonance leads to the observed 3 minute oscillations? To find an answer to this question, we have investigated the behavior of the acoustic waves that are driven by the motion of a piston at the lower boundary, and propagate in a nonisothermal atmosphere that consists of the lower layer (photosphere) where temperature rapidly decreases with height and the upper layer (chromosphere) where temperature slowly increases with height. We have obtained the following results: 1) the lower layer (photosphere) acts as a resonator of acoustic waves. The bottom end is established by the piston, and the top end, by the reflection at the interface between the two layers. 2) The top end partially reflects and partially transmits acoustic waves of frequencies around the acoustic cutoff frequency at the temperature minimum. 3) The resonance occurs at one frequency around this cutoff frequency, and its frequency is mainly determined by the distance between the driving position and the temperature minimum. The power spectrum of velocity oscillation observed in the chromosphere can be fairly well reproduced by this model.

Notes:



The Development of 2m Ring Solar Telescope

Liang Chang

Yunnan Observatories, Chinese Academy of Sciences

(Wednesday March 13th, 2019, 11:45am, Eberhardt Hall)

The 2-meter ring solar telescope is being designed to verify theory and feasibility of ring primary mirror in solar observation. In this presentation, we will introduce development of 2-meter ring solar telescope.

Notes:



Flame-like Ellerman Bombs and their Connection to UV Bursts

Yajie Chen

School of Earth and Space Sciences, Peking University

(Tuesday March 12th, 2019, 4:45pm, Eberhardt Hall)

Ellerman bombs (EBs) are compact transient brightenings in the H α wing images without obvious signals in the H α core images. They are generally believed to result from magnetic reconnection in the lower solar atmosphere. EBs present flame-like structures when they are observed near the solar limb. Recent observations from the Interface Region Imaging Spectrograph (IRIS) reveal another type of small-scale reconnection events in the lower atmosphere called UV bursts, and UV bursts can be heated up to more than 104 K. The relationship between EBs and UV bursts is still under debate. We investigate the spatial and temporal relationship between flame-like EBs and UV bursts using joint near-limb observations between the Big Bear Solar Observatory (BBSO) and IRIS. Some EBs are connected to UV bursts, and the UV bursts have a tendency to appear at the upper parts of the flame-like EBs. The intensity variations of EBs and the corresponding UV bursts match well, though the percentages of intensity changes are different. This indicates that UV bursts and EBs may be formed at different heights during the same reconnection processes.

Notes:



Formation of Magnetic Flux Rope Prior to the Eruptions

Xin Cheng
Nanjing University

(Wednesday March 13th, 2019, 4:20pm, Eberhardt Hall)

Magnetic flux rope (MFR) is a volumetric plasma structure with the magnetic field lines wrapping around a central axis inside. It is generally believed to be a fundamental structure producing coronal mass ejections and flares. Recent observations found that the MFR may exist prior to and even act as a driver of solar eruptions. However, how the MFR is exactly formed is still an unsettled issue. In this talk, I will address this problem through multi-case studies.

Notes:



Coupling of the Solar Atmosphere as Revealed by Observations and Radiative MHD Simulations

Mark Cheung

Lockheed Martin Solar & Astronomy Laboratory

(Wednesday March 13th, 2019, 9:15am, Eberhardt Hall)

I will give an overview of lessons learned from recent observations by new generation ground-based telescopes (such as the Goode Solar Telescope) and UV/EUV observations by the Solar Dynamics Observatory (SDO) and the Interface Region Imaging Spectrograph (IRIS). These lessons motivate the development of data-inspired and data-driven MHD simulations, which are helping us better understand the physical mechanisms by which magnetic flux emerges, transports, reconnects, releases energy, and heats the solar atmosphere.

Notes:



Origin of Internally Excited 3 minute Umbral Oscillations

Kyuhyoun Cho

Seoul National University

(Tuesday March 12th, 9:50am, Eberhardt Hall)

The umbral oscillations of velocity are common phenomenon in solar chromosphere. It is widely accepted that their identity is upward propagating slow magnetoacoustic waves. Up to now, many studies have suggested that the umbral oscillations are generated by external driving sources. In this study, we propose the evidence for the internal excitation case of the umbral oscillations. We investigate the umbral velocity oscillation data observed by the Fast Imaging Solar Spectrograph (FISS) of 1.6 m Goode solar Telescope (GST) at the Big Bear Solar Observatory (BBSO). The umbral velocity oscillations were observed by the Fe I 5435 Å line which is a magnetically insensitive line formed at the temperature minimum region. As a result, we found several oscillation patterns that are supposed to be generated by internal excitations, not external origins. Their apparent oscillation centers are located inside the umbra and the oscillation patterns exhibit relatively small coherent size (~ 2000 km) and short lifetimes (~ 8 min). Moreover, we found spatially and temporally associated umbral dots below the oscillation centers. The identified umbral dots show conspicuous morphological and dynamical changes which can be interpreted as small-scale magnetoconvection inside the sunspot. In addition, we inferred the depth of the oscillation source located at about 2000 km below the photosphere from the horizontal propagation of the oscillation patterns. Our results support that the magnetoconvection associated with umbral dots can generate the 3 minute umbral oscillations and give us a clue about the internal structure of the sunspot.

Notes:



KASI Contributions to the GST and NASA Space Solar Missions

KyungSuk Cho

Korea Astronomy and Space Science Institute

(Wednesday March 13th, 2019, 8:55am, Eberhardt Hall)

From 2004, the Korea Astronomy and Space Science Institute (KASI) participated in the construction of 1.6 m Goode Solar Telescope (GST) with NJIT. The first experience was to develop the Fast Imaging Solar Spectrograph (FISS) with the SNU group and the softwares for the correlation tracker system and the high-order adaptive optics systems of GST. In 2010, KASI extended its scientific focus to space observations. As a part of the activity, KASI made an agreement with NASA and started initial setup of the data system to store, use, and disseminate the Solar Dynamic Observatory (SDO) data for Asian region. Since 2017, KASI and NASA have been developing a solar coronagraph system, which is expected to be installed on the International Space Station (ISS). For the purpose of technical demonstration, we will perform a stratospheric balloon experiment in 2019 September. In this talk, I will introduce KASI's contributions to the ground solar telescope and the space solar missions in the past 15 years.

Notes:



Observation of Penumbra Formation around a Pore

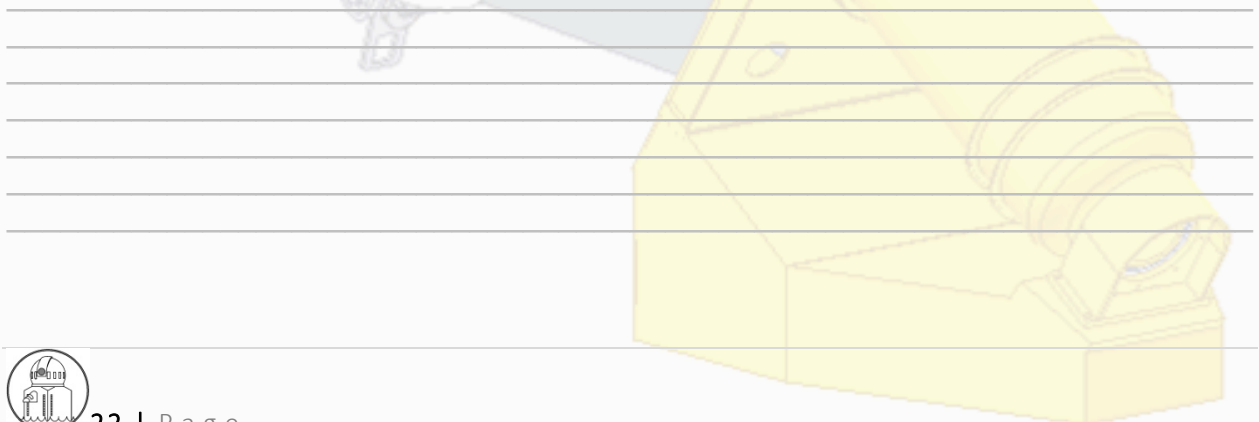
Debi Prasad Choudhary

California State University Northridge

(Tuesday March 12th, 2019, 11:45am, Eberhardt Hall)

We present the results of the observation of penumbra formation around a pore near a sunspot in Active Region 12553. The observations were carried out at Goode Solar Telescope at Big Bear Solar Observatory in TiO and H-alpha wavelengths on 2016 June 16. The TiO images show that the formation of penumbra occurred between the pore and the penumbra of main sunspot during a period of about five hours. The granular structures were elongated at the site of penumbral formation. The average life time of penumbral fibrils were about 2 to 5 minutes. The wavelength scanned H-alpha images showed a inclined canopy structure around the pore. The fibrils are visible unto wavelengths of 0.1 nm both side of the line center. More fibrils are visible in the red wing of H-alpha line profile compared the blue wing. We shall discuss the penumbral formation process using these observations.

Notes:



Introduction to the AIMS

Yuanyong Deng

National Astronomical Observatories, Chinese Academy of Sciences

(Wednesday March 13th, 2019, 11:10am, Eberhardt Hall)

In the talk, I would like to introduce a new solar telescope named AIMS, which is led by Huairou Solar Observing Station and is already funded by National Natural Science Foundation of China since 2015. The scientific goals, instrumental configuration as well as the candidate site of the telescope will be presented, especially focused on its latest progress. Moreover, I will show the data processing from the original data observed by the telescope to scientific data, which can be easy to use by the scientist. The coordinated observation with the other ground or space based solar telescope will also be discussed.

Notes:



The Present, and Plans for Adaptive Optics with the GST in Big Bear

Nicolas Gorceix

New Jersey Institute of Technology/Big Bear Solar Observatory

(Wednesday March 13th, 2019, 1:00pm, Eberhardt Hall)

Adaptive optics (AO) is the enabling technology for large aperture telescopes. In BBSO, AO purifies the turbulent light passing through the GST to its focal plane instrumentation. Here we review the status, plans for, and potential of the third generation AO in Big Bear. The regularly operating AO facility instruments in BBSO are called classic AO (CAO) and ground layer AO (GLAO), which both use a single deformable mirror (DM) conjugated to the pupil. The observer can switch between CAO and GLAO with a mouse click. CAO corrects the isoplanatic patch to the diffraction limit, while GLAO can correct a much wider field but not to the diffraction limit. The operation of, and the relative advantages of each will be discussed. Multi-conjugate AO (MCAO) with three DMs conjugated to the pupil, 3 km and 8 km, respectively, have trebled the corrected field of view over that of CAO. This is the first such successful MCAO system at a solar observatory. Results from this MCAO system, called CLEAR, will be shown and discussed, including our current work to connect CLEAR to our focal plane instrumentation. Progress on a much wider field version of CLEAR for the near-IR will be presented. This version of CLEAR has a field comparable to that of NIRIS so that NIRIS will reach its full capability being fed diffraction limited light across its entire field. Lastly, our new single DM off-limb AO system has enjoyed a successful first light by locking on H-alpha prominence light, while leaving sufficient H-alpha light for science. Results and scientific potential for off-limb AO will be sketched.

Notes:



Maximizing GST Science with NSO Synoptic Observations

Frank Hill

National Solar Observatory

(Wednesday March 13th, 2019, 10:50am, Eberhardt Hall)

The GST, like all high-resolution solar telescopes, has a field of view that covers just a few percent of the solar disk in exquisite detail. GST observations also typically cover a few hours in time. Since the Sun exhibits phenomena on a wide range of spatial and temporal scales, GST observations are frequently supplemented with data from synoptic observations that cover the entire visible disk and are acquired continually over many years. A major source of synoptic observations is provided by the National Solar Observatory (NSO), which operates a Global Oscillation Network Group (GONG) site near the GST at BBSO. GONG provides one-minute cadence full-disk images of the solar Doppler velocity, line-of-sight magnetic field, and H α intensity. All of these data provide context for the high-resolution GST images, providing information on the conditions around the GST observations in space and time. NSO is also installing the suite of SOLIS instruments at BBSO, which will provide full-disk vector magnetic field measurements in the photosphere and chromosphere. NSO is now developing a construction plan for a new ground-based solar observing network that would replace GONG and SOLIS and provide space weather forecasting data. Since BBSO is an excellent synoptic observing site due to its consistently good daytime seeing and high clear time fraction, it is likely that a site of this new network will be located near the GST. The co-location of high-resolution and synoptic instruments greatly enhances the scientific productivity of a solar observatory such as BBSO.

Notes:



Ellerman Bombs: Observations and Simulations

Jie Hong

Nanjing University

(Tuesday March 12th, 2019, 4:25pm, Eberhardt Hall)

Ellerman bombs (EBs) are short-lived, small-scale solar activities that occur in or near active regions. In this talk, we will show recent observations and simulations of EBs. The GST/FISS and IRIS observations show clear evidence of heating in the lower atmosphere, indicated by the wing enhancement in H α , Ca II 8542 Å, and Mg II triplet lines and also by brightenings in images of the 1700 Å and 2832 Å ultraviolet continuum channels. Considering these particular features, we propose a two-cloud model to fit the observed line profiles and find a temperature increase of 600–2300 K in EBs relative to the quiet Sun. Radiative hydrodynamic simulations of EBs using both non-thermal and thermal models can generate line profiles that are similar to observations. However, in non-thermal models we find dimming in the H α line wings and continuum when the heating begins, while for the thermal models dimming occurs only in the H α line core, and with a longer lifetime. This difference in line profiles can be used to determine whether an EB is dominated by non-thermal heating or thermal heating. We will also talk about the relation of EBs and UV bursts.

Notes:



Spectral Diagnosis of Mg II and H α Lines during the Initial Stage of an M6.5 Flare

Nengyi Huang

New Jersey Institute of Technology

(Thursday March 14th, 2019, 8:50am, Eberhardt Hall)

Recent studies have shown special spectral properties during the initial stage of flare emission, such as the enhanced absorption in He I 10830 Å line and a strong red shift in H α . Using the high resolution imaging spectroscopic data obtained by Interface Region Imaging Spectrograph (IRIS), we investigate the Mg II emission lines during an M6.5 flare (SOL2015-06-22T18:23), which was well covered by the joint observation of IRIS and Goode Solar Telescope at Big Bear Solar Observatory (BBSO/GST). On the leading edge of the propagating ribbon, Mg II h and k lines are characterized by blue wing enhancement and strong broadening. On the other hand, red shifts in Mg II and H α are found in the following areas of the flare ribbons. Numerical modeling, by combining RADYN and RH, suggests that the Mg II line broadening is possibly caused by unresolved turbulence with velocities about 10 to 30 km/s. The enhanced blue wing is likely due to a decrease of temperature and an increase of electron density, as a consequence of electron precipitation. Based on the observations and simulation results, we discuss the possible response of the lower atmosphere to the electron precipitation, in terms of the evolution of temperature, electron density, and turbulence velocities.

Notes:



Why We Need an Eight-Meter Solar Telescope?

Haisheng Ji

Purple Mountain Observatory/Big Bear Solar Observatory

(Wednesday March 13th, 2019, 11:30am, Eberhardt Hall)

In this talk, we will introduce some notable results of high-resolution observations made by GST and NVST. We will show that, in order to finally understand the mechanism of coronal heating, we need to develop capability to well resolve fine magnetic structure of about 0.1 arcsecond.

Notes:



High-resolution Observations of Dynamics of Superpenumbral H α Fibrils

Ju Jing

New Jersey Institute of Technology

(Tuesday March 12th, 2019, 11:30am, Eberhardt Hall)

We present unprecedented high-resolution H- α observations of a small solar pore in NOAA Active Region 12661, using the 1.6~m Goode Solar Telescope (GST) equipped with high-order adaptive optics at Big Bear Solar Observatory (BBSO). The observations reveal copious fine-scale chromospheric superpenumbral fibrils (with a cross-sectional width of $\sim 0.15''$) around the pore, along with associated transit and intermittent flows with apparent speeds of 5-20 km/s. The wavelet analysis suggests that the observed flows along fibrils are not likely a manifestation of oscillations, but rather collections of actual mass motions. The observed flow is interpreted as siphon flow. In addition, the three-dimensional potential field model indicates that the pore and the surrounding fibrils are enclosed by fan field lines forming a separatrix dome configuration. Such a magnetically confined configuration may help to maintain the steadfastness of the superpenumbra.

Notes:



Physical Nature of Spiraling Patterns in a Pore

Juhyung Kang

Seoul National University

(Tuesday March 12th, 2019, 10:05am, Eberhardt Hall)

Recent works have reported spiraling wave patterns in umbrae of sunspots, but the origin of this phenomenon is elusive. Here we show that the spiraling wave patterns can be generated in an untwisted thick magnetic flux tube of cylindrical geometry. We investigate the Doppler velocity maps of a pore. One and two-armed spiraling wave patterns have been detected in the pore. The patterns have the cycle periods of about 160 seconds and last for about 2 cycles. In our theoretical model, the non-zero azimuthal modes excited by the driving sources located at 1600 km below the photosphere can account of the spiral structures. The one-armed spiraling wave pattern is produced by the slow body sausage ($m=0$) and kink ($m=1$) modes, and the two-armed spiraling wave pattern is driven by the slow body sausage ($m=0$) and fluting ($m=2$) modes.

Notes:



A Collapsing Granule and the Excitation of Oscillations in the Photospheric and Chromosphere

Hannah Kwak

Seoul National University

(Tuesday March 12th, 2019, 5:00pm, Eberhardt Hall)

We present an impulsively collapsing granule and associated oscillations in the photosphere and chromosphere. Our observations were carried out using the Fast Imaging Solar Spectrograph (FISS) and the TiO 7057Å broadband filter imager of the 1.6 meter Goode Solar Telescope of Big Bear Solar Observatory. Our main findings are as follows: (1) In the photospheric TiO images, we found a granule which becomes dark compared to neighboring granules and collapses within several minutes. (2) Above the dark granule, a downflow of 1km/s is identified in the photosphere. (3) After the downflow, oscillations of velocity occur in the photospheric and chromospheric layers. (4) The period of the oscillations is close to 4 minutes in both of the layers but slightly shorter in the chromosphere. There exist phase differences between the oscillations in the photosphere and chromosphere, and it implies that the oscillations propagate upward. Based on our results, we suggest that impulsive collapse of a granule can generate acoustic waves in the solar quiet region.

Notes:



Investigating the Source of the Slow Solar Wind Seen from Remote-Sensing Observations

Ryun-Young Kwon

Korea Astronomy and Space Science Institute

(Wednesday March 13th, 2019, 9:55am, Eberhardt Hall)

We investigate the source of the slow solar wind by seeking the origin of open magnetic fluxes on the solar surface. While coronal holes have been well established as the source of the open magnetic flux that is responsible for the fast solar wind, the origin of the slow wind remains unknown. We relate this issue to the open flux problem, in which potential field source surface (PFSS) solutions and magnetohydrodynamic models systematically underestimate the interplanetary magnetic flux (e.g., Linker et al. 2017). First of all, we derive the coronal magnetic field strength from the wave and shock properties observed in EUV and white-light images. The results are considered as an averaged magnetic field strength in the corona and used to estimate the degree of the hidden open magnetic flux in the PFSS solution. Second, the footpoints of streamers (and pseudo streamers) are found after the passage of EUV waves as the stationary front lying along the boundary of coronal holes and active regions. The photospheric magnetic fluxes within the area are determined to be compared with the missing open magnetic flux in the PFSS solution. Last, we find the candidates of the source of the open magnetic flux among the small-scale magnetic fragments comparing the SDO HMI magnetograms with EUV images. Whereas the majority of the magnetic fragments are associated with the small-scale closed-loops observed in EUV passbands, some of them are seen to be open magnetic fluxes. We look for the regions that are likely to be the source of the slow wind among the open magnetic fluxes we found and discuss the role of GST, SDO, and CODEX observations in further investigation of the source of the slow wind in the Parker Solar Probe era.

Notes:



Spectroscopic and Imaging Observations of Small-Scale Reconnection Events

Dong Li

Purple Mountain Observatory, CAS

(Wednesday March 13th, 2019, 4:55pm, Eberhardt Hall)

We present spectroscopic and imaging observations of small-scale reconnection events on the Sun. Using Interface Region Imaging Spectrograph (IRIS) observations, one reconnection event is first detected as IRIS jets with fast bidirectional velocities in the chromosphere and transition region, which are identified as non-Gaussian broadenings with two extended wings in the line profiles of Si IV, C II and MgII k. The magnetograms under the IRIS jets from helioseismic and magnetic images simultaneously exhibit magnetic flux cancellation, supporting the idea that the IRIS jets are driven by magnetic reconnection. Atmospheric Imaging Assembly images also show an extreme ultraviolet (EUV) brightening shortly after the underlying IRIS jets, i.e. in the 131-, 171-, 193-, 211- and 94- Å channels, implying that the overlying EUV brightening in the corona is caused by the IRIS jets in the chromosphere and transition region. We also find another three reconnection events, which show the same features during this IRIS observation. A new result is that the process of magnetic reconnection is detected from the photosphere through the chromosphere and transition region to the corona.

Notes:



High-resolution Observations of Photospheric Structural Evolution Associated with a Flare

Chang Lui

New Jersey Institute of Technology

(Tuesday March 12th, 2019, 1:00pm, Eberhardt Hall)

The structural evolution of the photosphere not only play an important role in contributing to the accumulation of free energy in the corona that powers solar flares, but also may response to the restructuring of coronal field as a result of flare energy release. A better understanding of these issues may be achieved by high-resolution observations of the photospheric structure covering the entire flaring period, which are, however, still rare. Here we present photospheric vector magnetograms and TiO and H-alpha images from before to after a major flare, taken by the 1.6 m Goode Solar Telescope at Big Bear Solar Observatory. In the pre-flare state, a small-scale magnetic structure of opposite-polarity configuration is seen near the footpoints of sheared magnetic loops; its magnetic fluxes and currents enhance till the flare start time and decline afterwards. During the main phase, as one flare ribbon sweeps across a sunspot, its different portions accelerate at different times corresponding to peaks of flare hard X-ray emission. Also, changes of photospheric fields occur at the arrival of the flare ribbon front, thus propagating analogously to flare ribbons. In general, the horizontal field increases and the field lines become more inclined to the surface. We suggest that (1) the small-scale flux emergence between the two sheared flux systems triggers the flare reconnection, (2) the differential sunspot rotation is driven by the moving surface Lorentz-force change, and (3) photospheric fields respond nearly instantaneously to magnetic reconnection in the corona.

Notes:



Double-Decker Filament Configuration Revealed by Mass Motions

Rui Lui

University of Science and Technology of China

(Wednesday March 13th, 2019, 4:00pm, Eberhardt Hall)

It is often envisaged that dense filament material lies in the dips of magnetic field lines belonging to either a sheared arcade or a magnetic flux rope. But it is also debated which configuration correctly depicts filaments' magnetic structure, due to our incapacity to measure the coronal magnetic field. In this paper, we address this issue by employing mass motions in an active-region filament to diagnose its magnetic structure. The disturbance in the filament was driven by a surge initiated at the filament's eastern end in the NOAA active region 12685, which was observed by the 1-m New Vacuum Solar Telescope (NVST) in the H α line center and line wing ($\pm 0.4 \text{ \AA}$). Filament material predominately exhibits two kinds of motions, namely, rotation about the spine and longitudinal oscillation along the spine. The former is evidenced by antisymmetric Doppler shifts about the spine; the latter features a dynamic barb with mass extending away from the H-alpha spine until the transversal edge of the EUV filament channel. The longitudinal oscillation in the eastern section of the filament is distinct from that in the west, implying that the underlying field lines have different lengths and curvature radii. The composite motions of filament material suggest a double-decker host structure with mixed signs of helicity, comprising a flux rope atop a sheared-arcade system.

Notes:



Coronagraph Observations through BITSE and CODEX

Jeffrey Newmark

NASA GSFC

(Wednesday March 13th, 2019, 9:35am, Eberhardt Hall)

Understanding solar wind sources and acceleration mechanisms is an overarching solar physics question. Current models are highly under-constrained due to the limitations of the existing data, particularly in the $\sim 3\text{-}10 R_{\odot}$ range. This paper describes our development of a new coronagraph designed to deliver the first global, comprehensive data sets that will impose crucial constraints, taking multiple daily measurements in this critical range to answer targeted essential questions, including: Are there signatures of hot plasma released into the solar wind from previously closed fields? What are the velocities and temperatures of the density structures that are observed so ubiquitously within streamers and coronal holes? To provide these crucial measurements, NASA's Goddard Space Flight Center (GSFC), in collaboration with the Korea Astronomy and Space Science Institute (KASI), will develop a next generation coronagraph. This new technology imaging coronagraph uses multiple filters to obtain simultaneous measurements of electron density, temperature, and velocity within a single instrument. This will be the first time all three have been measured simultaneously for this field of view. To achieve these objectives the team developed a next generation solar coronagraph using a methodical process: 1) ground-based eclipse measurements demonstrating the basic technique; 2) a scientific balloon technology demonstration (BITSE flight in 2019); and, 3) an International Space Station based orbital mission, CODEX.

Notes:



The First Orbits of the Parker Solar Probe

Arik Posner

Heliophysics Division, NASA HQ

(Wednesday March 13th, 2019, 8:30am, Eberhardt Hall)

On November 6, 2019, the Parker Solar Probe has reached its first perihelion, at a record-breaking distance of 35.9 solar radii. Its four sophisticated instruments survived the encounter and recorded a treasure trove of encounter data, including plasma, magnetic field, and energetic particles, while also recording the light scattered back from the plasma and dust in the corona and inner heliosphere. Part of encounter-1 observations has been returned to Earth for analysis, and much more will be broadcasted in the upcoming weeks and months. Named after the individual who first predicted the existence and large-scale structure of the solar wind, on its future 23 orbits between now and the end of 2024, it is set to probe even deeper down into the corona until it reaches a distance of just under ten solar radii from the photosphere. While Parker Solar Probe may reach some of the science goals relying on the data from the on-board suite, the scientific outcome will be much enhanced by coordination with relevant observations from other sources and the theory and modeling community. Observational assets may include ground-based solar remote sensing observations such as GST, and campaigns from space-based platforms of the Heliophysics System Observatory and beyond. Contributions from theory and modeling would span predicting and/or simulating the solar and heliospheric environment in advance of a PSP solar encounter, which may include the entire span of Heliophysics, from the solar interior through its atmosphere and the solar wind, out to the Earth's and other planets' magnetospheres and ionospheres, and ultimately out to the interstellar boundary. The goal of this presentation is to provide the audience with a glimpse of the initial data of the mission along with information that may guide the science coordination process.

Notes:



Towards First Light with the Daniel K. Inouye Solar Telescope

Thomas Rimmele

National Solar Observatory

(Wednesday March 13th, 2019, 10:25am, Eberhardt Hall)

The construction of the 4m Daniel K. Inouye Solar Telescope (DKIST) on Haleakala, Maui is entering its final phase. The 4m primary and the secondary mirror of the main telescope have been installed. First star light with the primary has been achieved. Imaging and wavefront sensing at Gregorian focus is in progress. The integration of the optical path that directs the light to the instrument laboratory will follow. The first solar light initiative that promises to produce first diffraction limited images and movies with the Visible Broadband Imager working in conjunction with the high order adaptive optics system is scheduled for September of 2019. Operations are scheduled to begin in mid 2020. Significant effort is directed towards planning of the operations, including development of a data center, and preparing the community for the tremendous science opportunities that DKIST will provide. DKIST's superb resolution and polarimetric sensitivity will enable astronomers to unravel many of the mysteries the Sun presents, including the origin of solar magnetism, the mechanisms of coronal heating and drivers of the solar wind, flares, coronal mass ejections and variability in solar output. The design allows DKIST to operate as a coronagraph at infrared wavelengths where the sky background is low and bright coronal emission lines are available. We will present the DKIST project status and discuss some of the many challenges encountered. We also will touch on ideas on how NSO/DKIST and GST might continue the longstanding existing collaboration.

Notes:



Origin of Solar Spicules and Their Role in Coronal Heating

Tanmoy Samanta

Peking University, Beijing, CHINA

(Tuesday March 12th, 2019, 3:00pm, Eberhardt Hall)

GST observations provide key insight on one of the most debated and important subjects in solar physics: understanding the generation mechanism of the prevalent chromospheric spicules/transition region network jets, and their possible contribution to coronal heating. Using unprecedented observations from GST, we found that the dynamical interaction of magnetic fields in the partially ionized lower solar atmosphere generates these high-speed jets and energizes the upper solar atmosphere. Our observation provides the most direct evidence to one of the many proposed hypotheses of spicular origin, magnetic reconnection. In addition, our observation reveals a complete mass cycling process between the chromosphere and corona, which is missing in previous observations.

Notes:



What Regulates the Dynamical Evolution of the Expanding Solar Wind?

Jungjoon Seough

Korea Astronomy and Space Science Institute

(Poster)

The solar wind plasmas possess temperature anisotropies that cannot be described by the prediction of double-adiabatic theory. It is commonly accepted that the pervasive features of temperature anisotropy observed in the solar wind are thought to result from a combination of physical mechanisms including the expansion, turbulent heating, kinetic instabilities, and Coulomb collisions. In this study, we develop an expanding box model of velocity moment-based quasilinear kinetic analysis that includes the above-mentioned physical ingredients. By incorporating the local kinetic physics into the large scale expansion and/or Parker spiral magnetic field in the present model, we describe how the solar wind temperature anisotropy is formed and evolves in interplanetary space.

Notes:



Magnetic Energy Releasing and Contraction of Flare Loop during the Initial Phase of the Flares

Jinhua Shen

Xinjiang Astronomical Observatory

(Thursday March 14th, 2019, 9:20am, Eberhardt Hall)

For the X1.7 class flare on 2013 May 13 (SOL2013-05-13T01:53), its initiation process was well observed by the Atmospheric Imaging Assembly (AIA) on board the Solar Dynamic Observatory and the Extreme UltraViolet Imager (EUVI) on board STEREO-B. The initiation process incorporates the following phenomena: an X-ray precursor that started ~9 minutes before flare onset, two hot magnetic loops (as seen with AIA hot channels) forming a sigmoidal core magnetic structure (as seen with the EUVI), a rapidly formed magnetic flux rope (MFR) that expands outward, and a flare loop that contracts inward. The two hot magnetic loops were activated after the occurrence of the X-ray precursor. After activation, magnetic reconnection occurred between the two hot magnetic loops (inside the sigmoid structure), which produced the expanding MFR and the contracting flare loop (CFL). The MFR and CFL can only be seen with AIA hot and cool channels, respectively. For this flare, the real initiation time can be regarded as being from the starting time of the precursor, and its impulsive phase started when the MFR began its fast expansion. In addition, the CFL and the growing postflare magnetic loops are different loop systems, and the CFL was the product of magnetic reconnection between sheared magnetic fields that also produced the MFR.

Notes:



The Sun's Magnetic Field: Producing Space Weather and Varying the Sun's Brightness

Sami Solanki

Max Planck Institute for Solar Science Research

(Wednesday March 13th, 2:50pm, Eberhardt Hall)

The single quantity responsible for the continuing unrest and activity of the Sun is its tangled and dynamic magnetic field. It produces many fascinating phenomena, including massive coronal mass ejections that influence space weather and changes in the Sun's radiative output, which has been invoked as a driver of the Earth's climate and a contributor to global change. In this talk an overview of the magnetic field of the Sun will be given and selected recent advances in our knowledge will be presented. The second half of the talk will address some of the ways that the variable and violent Sun influences the Earth and its space environment.

Notes:



BBSO/GST Observations of Fine Structures and Fast Dynamics in Sunspot Light Bridges

Hui Tian
Peking University

(Tuesday March 12th, 2019, 10:35am, Eberhardt Hall)

Observations from the GST telescope have revealed unprecedented details and fast dynamics in sunspot light bridges. (1) We examined the high-resolution TiO images and discovered a new type of fine structures in light bridges: striking knot-like dark structures within the central dark lane. These dark knots divide the central dark lane into multiple sections, and they appear to be very common in narrow light bridges. The evolution of these highly dynamic dark structures could provide detailed information about the magnetoconvection in light bridges. (2) Through a detailed analysis of the spectropolarimetric data taken by the NIRIS instrument, we found unambiguous evidence of small-scale flux emergence in a light bridge. An H-alpha jet is clearly triggered by the interaction between the emerging flux and the background field. (3) Through joint GST and IRIS observations, we identified unambiguous evidences of magnetic reconnection in light bridges: frequently occurring inverted Y-shaped jets in the H-alpha wing images and UV burst-type profiles of the transition region lines. We also demonstrated that the surge-like activity above light bridges has two components: the ever-present short and slow surges likely to be related to the upward leakage of magnetoacoustic waves from the photosphere, and the occasionally occurring long and fast surges that are obviously caused by the intermittent reconnection jets.

Notes:





Joint GST and EOVS Study of Super Strong Magnetic Fields in Active Region 12673

Haimin Wang

New Jersey Institute of Technology

(Tuesday March 12th, 2019, 11:10am, Eberhardt Hall)

Using the joint observations of GST and EOVS, we study the Solar Active Region (AR) 12673 in September 2017, which is the most flare productive AR in the solar cycle 24. GST observations show the strong magnetic fields (above 5500 G) in polarity inversion line (PIL) and apparent photospheric twist. Consistent upward flows are also shown in Dopplergrams of Hinode, HMI and GST at the center part of that section of PIL, while the down flows are observed in two ends, indicating that the structure was rising from subsurface. Combining Non-Linear Force Free Extrapolation and EOVS microwave imaging spectroscopy, we also look into the coronal structure of magnetic fields in this unusual AR, including the evolution before and after the X9.3 flare on September 6, 2017.

Notes:



Machine Learning for Space Weather Forecasting and Solar Data Mining

Jason Wang

New Jersey Institute of Technology

(Wednesday March 13th, 2019, 1:45pm, Eberhardt Hall)

We present a suite of machine learning methods including random forests, multilayer perceptrons and extreme learning machines for performing multiclass prediction of solar flares using physical parameters provided by the Space-weather HMI Active Region Patches (SHARP) and related data products. We then describe the DeepSun project, which aims to provide machine-learning-as-a-service for space weather forecasting, and show how the machine learning methods work using DeepSun web services. Finally, we discuss our recent work of using deep learning to perform solar data mining, as well as future work on solar data and tool integration.

Notes:



Fine-Scale Emerging Flux Elements Observed by 1.6m Telescope at BBSO

Jiasheng Wang

New Jersey Institute of Technology

(Tuesday March 12th, 2019, 3:40pm, Eberhardt Hall)

Magnetic flux emerges in various scales on the Sun, ranging from about 10^{16} Mx in quiet Sun to 10^{22} Mx in active regions. As it is considered to be in the transport stage, emerging flux can provide clues about processes, evolution, and structure of magnetic fields near the solar surface. Also, emerging flux plays an important role in the build-up of magnetic energy, as it often carries currents and is thus twisted. Recent data-driven simulation models show that fragmented small-scale magnetic elements can reach photosphere through convective up-flows and then concentrate. In this work, we primarily use magnetic field data taken by the near-infrared imaging spectropolarimeter (NIRIS) of the 1.6 m Goode Solar Telescope at Big Bear Solar Observatory to study an emerging flux region in NOAA AR 12665 on 2017 July 13. To understand the processes underlying the elementary flux emergence and concentration, we focus on investigating the temporal and structural characteristics of emerging flux in fine scale. Preliminarily, we detect two components of magnetic flux near the magnetic polarity inversion line during the continuous emergence, including confined flux foot-points with opposite polarities and diffused magnetic structure between them. These components are found to have a typical line-of-sight magnetic field of about 1000 and 300 G, respectively. Displacement of chromospheric brightenings in H-alpha line has also been observed at different layers that is cospatial with emerged magnetic pairs, which indicate reconnections between newly emerged field and overlying ambient field.

Notes:



High-resolution He/10830 Å narrowband imaging for an M-Class Flare – The Evolution of Multiple Hot Channels

Ya Wang

Purple Mountain Observatory, Chinese Academy of Sciences

(Tuesday March 12th, 2019, 1:20pm, Eberhardt Hall)

We report the initiation process for a flare-associated filament eruption on July 5, 2012. The data set consists of high-resolution narrowband images in He I 10830 Å and broadband images in TiO 7057 Å taken at Big Bear Solar Observatory with the 1.6 m aperture Goode Solar Telescope. EUV images in different passbands observed by the Atmospheric Imaging Assembly on board the Solar Dynamics Observatory are used to distinguish hot plasma from cool plasma structures during the flare process. High-resolution 10830 Å images clearly show that, below the horizontal fibrils, which correspond to the filament's spine in full-disk H α images, a sheared arch filament system (AFS) lies across the penumbra and surrounding satellite sunspots, between which continuous shearing motion is observed. Before the eruption, three microflares occurred successively and were followed by the appearance of three EUV hot channels. Two hot channels erupted, producing two flaring sites and two major peaks in GOES soft X-ray light curves; however, one hot channel's eruption failed. The 10830 Å imaging enables us to trace the first two hot channels to their very early stage, which is signified by the rising of the AFS after the first two precursors. Continuous flux emergence and localized flare-associated cancellation are observed under the AFS. In addition, EUV ejections were observed during the formation of the EUV hot channels. These observations support the fact that the hot channels are the result of magnetic reconnections during precursors.

Notes:



Joint GST and EOVSa Observation of an M1.4 Flare on 2017 September 6

Yuqian Wei

New Jersey Institute of Technology

(Tuesday March 12th, 2019, 2:20pm, Eberhardt Hall)

We study an M1.4 class flare occurred shortly after the X9.3-class flare on 2017 September 6 in NOAA active region (AR). The flare was well observed by the Expanded Owens Valley Solar Array (EOVSA), the Goode Solar Telescope (GST) at the BBSO, Hinode, and RHESSI. We find a partial eruption of a flux rope in GST H-Alpha images during the flare, with coronal counterparts seen in SDO/AIA images. Microwave spectral imaging observations from EOVSa provide unique measurements of the coronal magnetic field and energy distribution of the nonthermal electrons accelerated to mildly relativistic energies. We compare the location and morphology of the microwave source with H-alpha, EUV, and X-ray data, and discuss implications for energy release and electron acceleration in this flare.

Notes:



Magnetic Vector Rotation in Response to the Energetic Electron Beam during a Flare

Yan Xu

New Jersey Institute of Technology

(Tuesday March 12th, 2019, 1:40pm, Eberhardt Hall)

As one of the most violent forms of eruption on the Sun, flares are believed to be powered by magnetic reconnection, by which stored magnetic energy is released. The fundamental physical processes involving the release, transfer and deposition of energy in multiple layers of the solar atmosphere have been studied extensively with significant progress. Taking advantage of recent developments in observing facilities, new phenomena are continually revealed, bringing new understanding of solar flares. Here we report the discovery of a transient rotation of vector magnetic fields associated with a flare observed by the 1.6-m New Solar Telescope at Big Bear Solar Observatory. After ruling out the possibility that the rotation is caused by line profile changes due to flare heating, our observation shows that the transverse field rotated by about 12-20 degrees counterclockwise, and returned quickly to previous values after the flare ribbons swept through. More importantly, as a consequence of the rotation, the flare loops untwisted and became more potential. The vector magnetograms were obtained in the near infrared at 1560 nm, which is minimally affected by flare emission and no intensity profile change was detected. Therefore, we believe that these transient changes are real, and conclude the high energy electron beams play a crucial role in the field changes. A straightforward and instructive explanation is that the induced magnetic field of the electron beam superimposed on the pre-flare field leads to a transient rotation of the overall field.

Notes:



Studies of Two M-Class Flares Observed by GST

Xiaoli Yan

Yunnan Observatories, Chinese Academy of Sciences

(Tuesday March 12th, 2:00pm, Eberhardt Hall)

We have captured two M-class flares during the observations on 2015 August 22 and 24. One is an eruptive flare and the other is a confine flare. The triggering process of the two flares was studied in detail. For the eruptive flare, we found that a small-scale flux rope emerged from below the photosphere and its eruption produced a M-class flare and a very narrow coronal mass ejection. For the confine flare, we found that a small sheared magnetic structure formed due to the shearing motion between the two sunspots with the opposite polarities and a series of jets triggered the eruption of the sheared structure. The magnetic reconnection between the sheared structure and the large-scale magnetic loops resulting in the M-class flare.

Notes:



Vortex Formations and its Associated Surges in a Sunspot Light Bridge

Heesu Yang

Korea Astronomy and Space Science Institute

(Tuesday March 12th, 2019, 10:55am, Eberhardt Hall)

We report on successive occurrence of 0.5" wide photospheric vortices with strong transverse shear flows at the edge of a sunspot light bridge, and the subsequent ejection of chromospheric surges observed using the Goode Solar Telescope operating at the Big Bear Solar Observatory. We also observed quasi-periodic vortex-associated bright H α plasma blobs moving upward with a speed of up to 4 km/s. The H α surges ejected at the location of the vortices often displayed a hollow cylindrical structure. We argue that the vortices may be formed by the Kelvin-Helmholtz instability triggered by the strong shear flow at the edge of the light bridge, and the swirling motions at the magneto-convective downflowing region. The surges may be a result of either of the magnetic tension force generated by magnetic reconnection, an acoustic impulse of a fast photospheric transverse flow, or Alfvénic waves generated in the process of vortex formation.

Notes:



He I 10830 Å Counter-Streaming Motions in Active Region Magnetic Arcades

Xu Yang

New Jersey Institute of Technology

(Thursday March 14th, 2019, 9:05am, Eberhardt Hall)

We report the first high-resolution observations of counter-streaming motions in active region magnetic arcades with Helium I 10830 Å filtergrams, achieved by the Goode Solar Telescope at Big Bear Solar Observatory. Our observations reveal that the counter-streaming motions are due to unidirectional mass flows along alternative arcade fibrils, rather than the longitudinal oscillations of filament threads as in some solar filaments. Cool plasma injections, rooting in the magnetic network region, are pumped into the fibrils. The apparent speed of the flow is around 15-50 km/s in the He I 10830Å blue wing and 5-15 km/s in the red wing. Co-spatial brightenings in Atmospheric Imaging Assembly 304 Å and 171 Å images are witnessed at the same time, indicating the possible corresponding heating process. We constructed Dopplergrams and analyzed their oscillation behavior. The oscillation power peaks around 4 minutes in the fibrils roots region, however, the injection mass flows seems to be non-periodic.

Notes:



Magnetic Field Dynamics and Varying Plasma Emission in Large-Scale Coronal Loops

Vasyl Yurchyshyn

New Jersey Institute of Technology/Big Bear Solar Observatory

(Tuesday March 12th, 2019, 3:20pm, Eberhardt Hall)

In this study we report detailed observations of magnetic environment at four footpoints of two warm coronal loops observed on 5 May 2016 in NOAA AR 12542 (Loop I) and 17 December 2015 in NOAA AR 12470 (Loop II). These loops were connecting a plage region with sunspot periphery (Loop I) and a sunspot umbra (Loop II). We used Solar Dynamics Observatory (SDO) and Goode Solar Telescope (GST) data to describe the phenomenon and understand its causes. The study indicates loop brightening episodes were associated with magnetic flux emergence and cancellation processes observed in SDO's Helioseismic and Magnetic Imager (HMI) and GST's Near InfraRed Imaging Spectropolarimeter (NIRIS) data. The observed activity was driven by magnetic reconnection between small-scale emerging dipoles and large-scale pre-existing fields, suggesting that the reconnection occurred in the lower chromosphere at the edge of an extended plage region, where the loops were rooted. We suggest that plasma, evaporated during these reconnection events, gradually filled the loops and as it cooled the visible density front propagated from one footpoint of the loop to another at a rate of 90-110 km/s. This study also indicates that at least some of the bright loops seen in SDO Atmospheric Imaging Assembly images rooted in sunspot umbra may be heated due to magnetic activity taking place at the remote (non-sunspot) footpoint.

Notes:



High Resolution and Multi-Wavelength Observation of an Anemone Jet

Tuanhui Zhou

Purple Mountain Observatory

(Tuesday March 12th, 2019, 5:30pm, Eberhardt Hall)

We present a solar jet event obtained by the high resolution based ground and space observation. This event is composed of hot and cool Extra-Ultraviolet (EUV) jets, Ultraviolet (UV) jet, small scale He I 10830 Å surges, H α surge, and corresponding bright patches at different bands from the photosphere, crossing the chromosphere, to the corona. Before the event starts, Goode Solar Telescope (GST) TiO images show that there is a granule continuously develop and split. This event is starting from a He I 10830 Å darkened area and a nearly simultaneous UV bright patch suddenly appears at the splitting granules following with an obvious magnetic cancellation. As a He I 10830 Å surge erupts from darkened area, Solar Dynamics Observatory (SDO) caught that a bright EUV patch is observed co-spatial with the trajectory of it. When more granules gradually develop and split, this UV/EUV bright patch is increasing its temperature and intensity as more He I 10830 Å surges eject from the newly formed lanes. We note that hot EUV jets there are erupting from the bright patches as maximum He I 10830 Å surges eject. As all of these He I 10830 Å surges are entering the higher atmosphere, the corresponding cool EUV jets are observed. We propose a possible physical mechanism for this event. In the scenario, the underneath granular-scale magnetic flux emerges through the photosphere and reconnect with the pre-existing overlying magnetic field at the upper chromosphere to produce small scale localized heating and boost the He I 10830 Å surge transferring energy to heat the corona. In sum, we determine that this mechanism may play a role for the puzzle of the coronal heating.

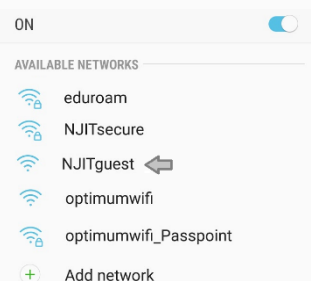
Notes:



NJITguest Wireless Connection

NJIT provides guests of the university with access to wireless networking services. “NJITguest” is recommended to be used by outside guests and alumni when visiting NJIT. The guest network has a self-service portal that will allow for easier access to the Internet. This portal will allow a guest to create a Guest ID which will allow 24 hour access to the “NJITguest” network. Any visitor with access to email and SMS text messages can create an account.

1. To log into the NJIT guest network, select “NJITguest” on the list of available wireless networks. This network has no lock, indicating it is “OPEN” without encryption.



2. A window will open prompting you to sign in. Users who already have an NJIT UCID or Guest ID account may log in by selecting “Guest Sign On”. Select “Request Guest ID” if you are in need of creating an account.

A screenshot of the NJIT Guest Wireless sign-in page. The page has a red header with the NJIT logo and the text 'Guest Wireless'. Below the header, there is a white box with a red border containing the following text: 'NJITguest is an open wireless network for alumni and guests', 'Click the "Request Guest ID" link below if you do not have a Guest ID', and two input fields labeled 'Guest ID or UCID:' and 'Password:'. At the bottom of the white box, there are two buttons: 'Guest Sign On' and 'Request Guest ID' (which is circled in red).

4. You will receive an email and text message with your guest account credentials. Enter your Guest ID and password and click “Guest Sign On.” Note: Guest ID is only active for 24 hours.

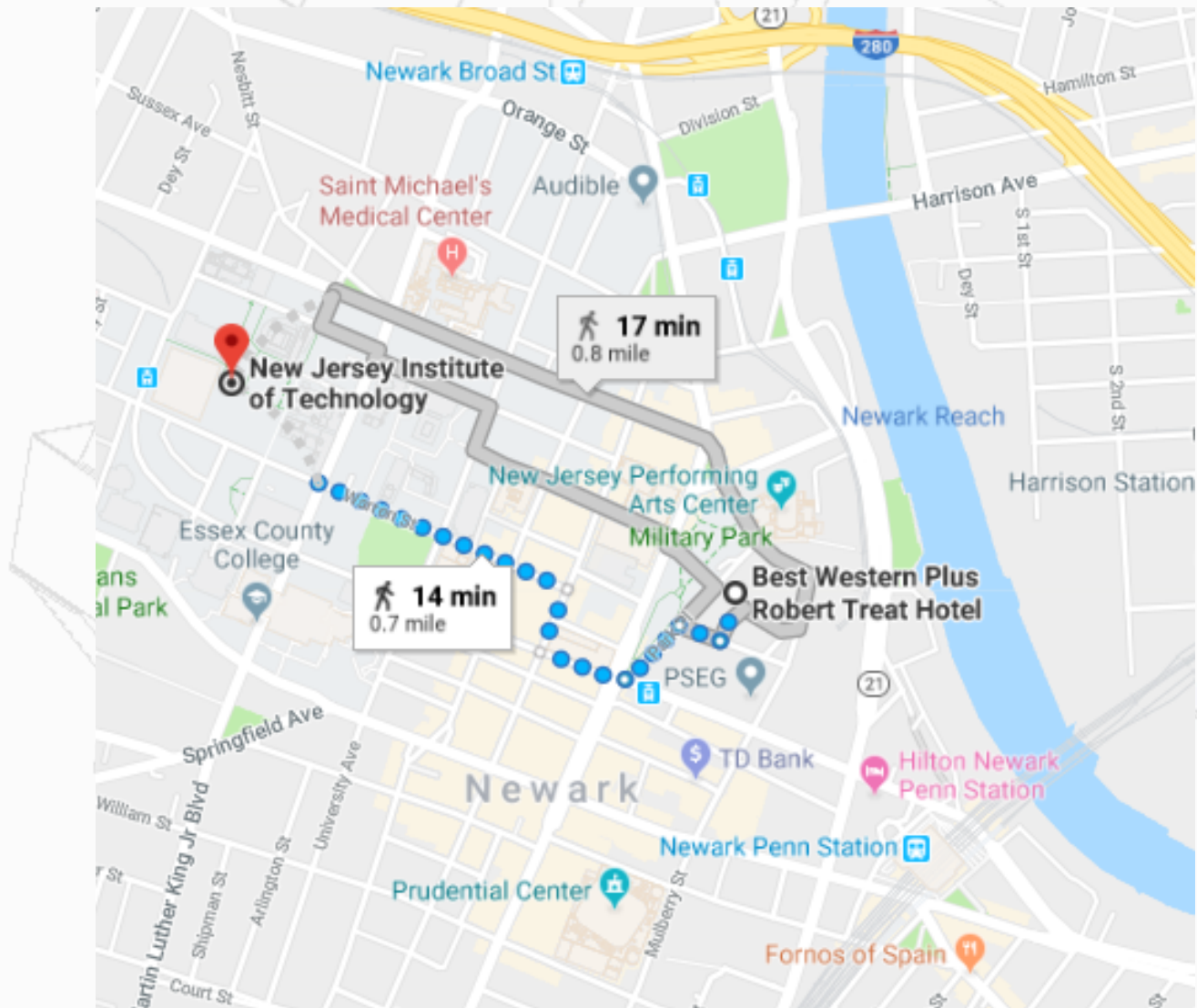
A screenshot of the NJIT Guest Wireless Acceptable Use Policy (AUP) page. The page has a red header with the NJIT logo and the text 'Guest Wireless'. Below the header, there is a white box with a red border containing the following text: 'Acceptable Use Policy for Cyber Resources', 'Please read the AUP', and a scrollable text area with the following sections: 'Introduction:', 'Terminology:', and 'Accept' and 'Decline' buttons at the bottom. A link 'Contact IST Service Desk' is visible at the bottom of the page.

5. Accept the use policy for cyber resources and you will be connected to using the network.



Getting to NJIT from Robert Treat Hotel

The NJIT campus is located within walking distance (15 min) from the Robert Treat Hotel (0.6 miles) via Central Avenue.



If public transportation is preferred, we recommend a short walk (0.3 miles) from the hotel to the Military Park Light Rail Station (underground), from where the second stop is the Warren Street/NJIT Station (\$0.70 Underground Fare), which is located in front to one of the campus entrances. To get to the Campus Center or the Eberhardt Hall, you may walk around the construction site to reach the campus green or enter the building in front of the station and exit it the other side on the campus green.



Getting to Iberia Restaurant from RTH

The Iberia Peninsula Restaurant is located within walking distance (14 min) from the Robert Treat Hotel (0.7 miles), see map below. If preferred, you can also get an Uber or Lyft.

Best Western Plus Robert Treat Hotel

50 Park Pl, Newark, NJ 07102

↑ Head southeast toward E Park St

171 ft

➤ Turn right toward E Park St

203 ft

⤵ Turn left onto E Park St

200 ft

➤ Turn right onto Mulberry St

440 ft

⤵ Turn left onto Raymond Blvd

0.1 mi

➤ Turn right onto NJ-21 S

0.1 mi

⤵ Turn left onto Market St

0.1 mi

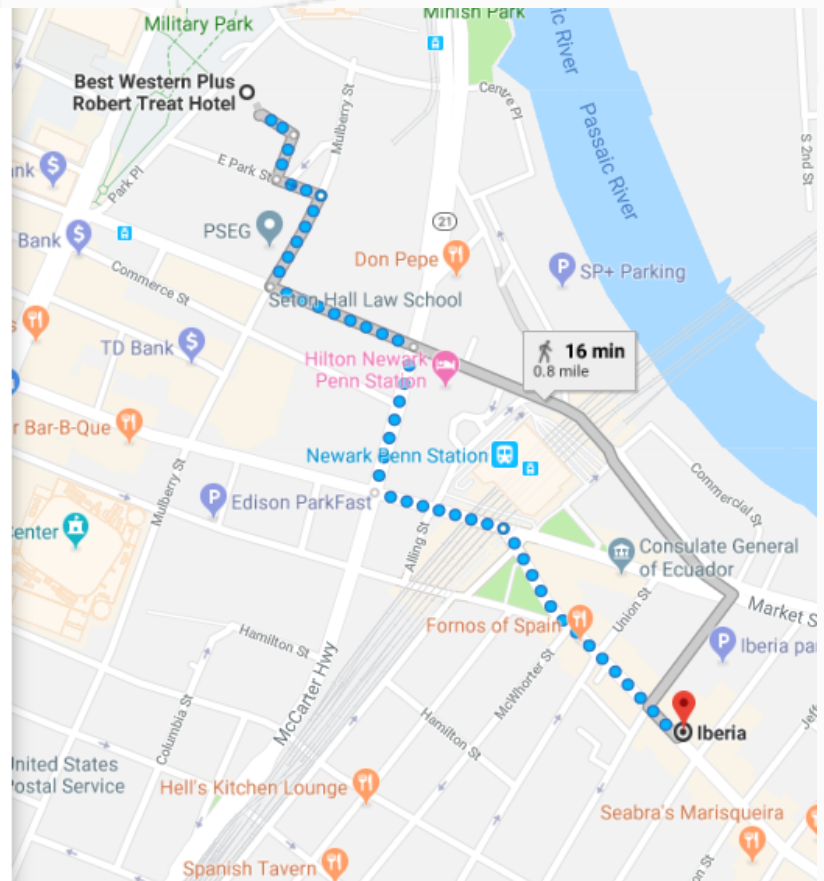
➤ Slight right onto Ferry St

📍 Destination will be on the left

0.2 mi

Iberia

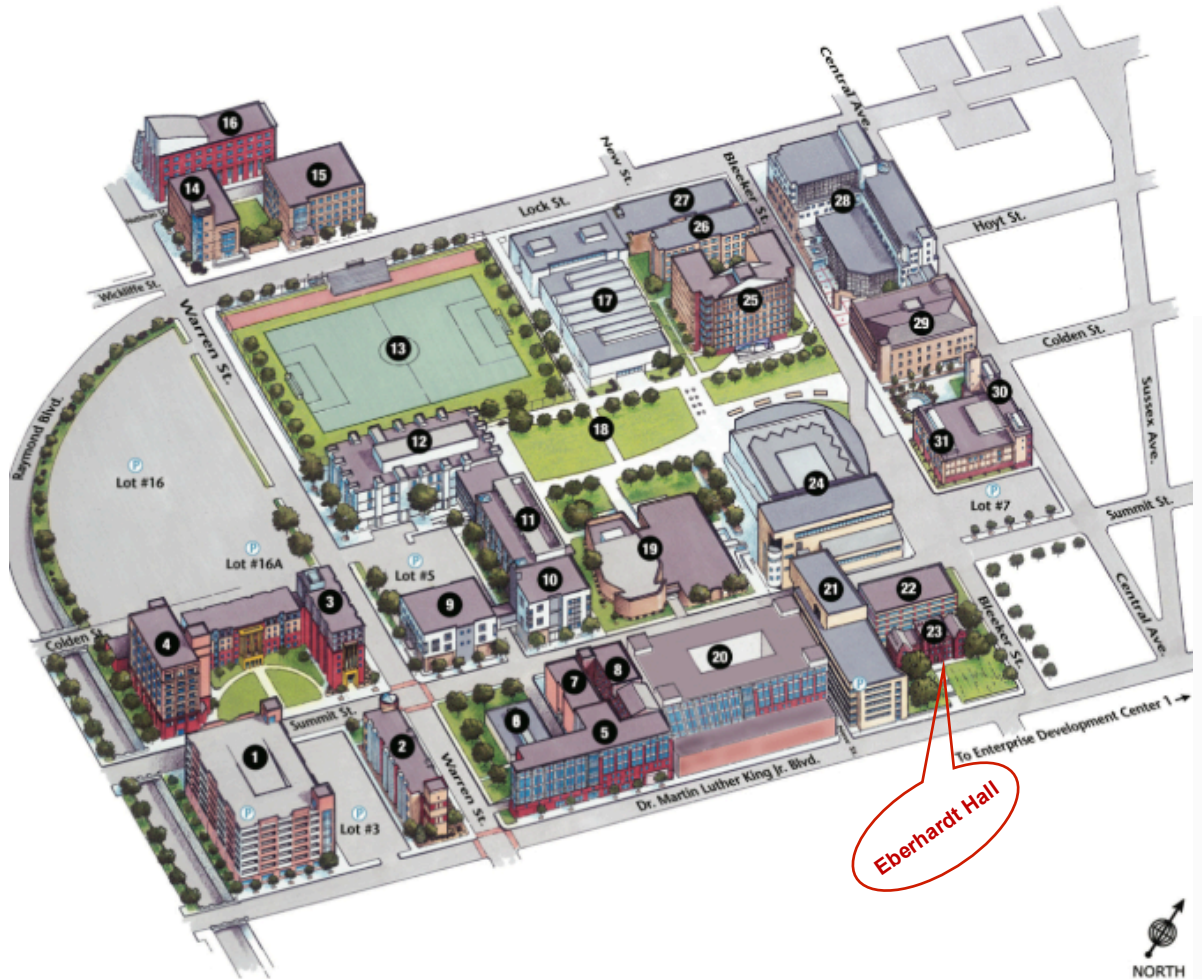
80-84 Ferry St, Newark, NJ 07105



Building Names

- 1) Student Mall/ Parking Deck
- 2) York Center for Env. Engineering & Science
- 3) Laurel Residence Hall
- 4) Oak Residence Hall
- 5) College of Arch & Design
- 6) Specht Building
- 7) Colton Hall
- 8) Campbell Hall/ Student Services
- 9) ECE Building
- 10) Microelectronics Center
- 11) Faculty Memorial Hall
- 12) Tiernan Hall
- 13) Lubetkin Field
- 14) CHEN Building
- 15) EDC 2
- 16) EDC 3
- 17) Estelle & Zoom Fleisher Athletic Center
- 18) The Green
- 19) Kupfrian Hall
- 20) Central King Building
- 21) Fenster Hall/ Admissions
- 22) Cullimore Hall
- 23) Eberhardt Hall/ Alumni Center
- 24) Campus Center
- 25) Cypress Res Hall
- 26) Redwood Res Hall
- 27) Naimoli Family Athletic & Rec Facility
- 28) Guttenberg Info Tech Center
- 29) Mech Eng Center
- 30) Central Ave Bldg
- 31) Van Houten Library
- 32) Warren Street Village

NJIT's Campus



Emergencies on Campus

Emergencies on Campus Dial (973) 596-3111

For all non-emergencies, please dial 973-596-3116 or 973-596-3120