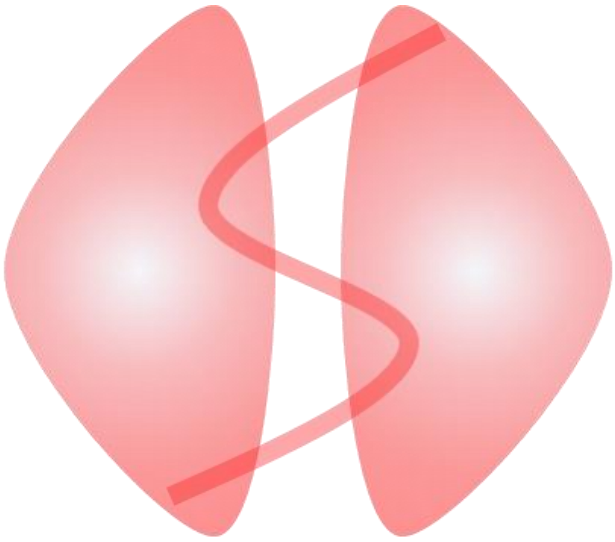

ISTW 2022

The 21st International Spherical Torus Workshop

Manual

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Introduction

ISTW 2022 will be virtually held by Tsinghua University, Beijing, China, Oct. 31- Nov. 4 2022. The local host representative is Professor GAO Zhe.
Previous ISTWs were held in Oak Ridge (1994), Princeton (1995), Culham (1996), St. Petersburg (1997), Tokyo (1998), Seattle (1999), Sao Jose dos Campos (2001), Princeton (2002), Culham (2003), Kyoto (2004), St. Petersburg (2005), Chengdu (2006), Fukuoka (2007), Frascati (2008), Madison (2009), Toki (2011), York (2013), Princeton (2015), Seoul(2017), Frascati(2019). If interested, please visit the web archive of previous ISTWs.

Objectives

The objectives of this workshop are to contribute to advancing the understanding of spherical tori (ST) and, when appropriate, compact toroid (CT) configurations and to enhance their potential for fusion power applications, and to provide a forum for discussion and collaboration enhancement. The scope of the meeting covers the full range of research activities on ST, extended to their interface with other CT fusion concepts; namely, spheromaks and field reversed configurations.

Topics

Topical areas of interest include:

- A. Plasma science (experiment and/or theory-computation)
- B. Engineering, technology and diagnostic development
- C. Future concepts (device upgrades, CTF, DEMO, power plants)

Guide for All Participants

Prerequisites

The workshop will be held online with Microsoft Teams platform. However, Teams app is not necessary to join in the meeting. Web explorers such as Chrome or Edge are OK for both presenters and attendees. After your registration, you will be invited to the "ISTW2022" team in the SUNIST Laboratory at the Teams platform, and get the access to all online meeting rooms in the 21st ISTW.

An email will be sent to the email address which you used for registration to confirm your invitation. And this email address will be your account to join in the meeting. If you already have a Teams account with your registration email, just sign in and join in the meetings. If you do not have a Teams account with your registration email, you can sign in with your registration email and the "one-time-entrance-code" sent to your email, and then you can join in the meetings.

Attendee's Guide

For attendees who are not giving an oral presentation or a poster, every presentation can be accessed by the Agenda Table in the "**Workshop Agenda and Attendees' Access**" section in this Manual. Or you can access the meeting room with the official website. Click the Access link and you will be guided to the meeting webpage. (If you are a presenter, please check the guide after this section.) Please enter your name and affiliation in "Alice_Bob-Affiliation" format when you join in the meeting room. People who do not show their names will be removed from the meeting room.

Presenter's Guide

For invited talkers who will give an **oral presentation**, please check your email. A presenter **invitation email** will be sent one day before your presentation. You can confirm to give a talk by clicking the accept button in the **invitation email**. If you encounter any problem with your presentation, please contact the LOC assistant.

For presenters who will put up a **poster**, each of you will post in a separated meeting room, and you will be assigned as the co-organizer of your meeting room. An **invitation email** will be sent one day before your post. You can confirm to show a poster by clicking the accept button in the **invitation email**. You can access your meeting room any time before your presentation through the invitation email. If you encounter any problem in your presentation room, please contact the LOC assistant.

Workshop Agenda and Attendees' Access

Day 1, Monday, Oct. 31

USA West	USA East	UK	Spain/Italy	Moscow	Beijing	Japan/Korea	Day 1 Main Session **Access** for Attendees
4:00-4:10	7:00-7:10	11:00-11:10	12:00-12:10	14:00-14:10	19:00-19:10	20:00-20:10	Gao Zhe - Introduction
4:10-4:40	7:10-7:40	11:10-11:40	12:10-12:40	14:10-14:40	19:10-19:40	20:10-20:40	Tan Yi – "Twenty years of research on the SUNIST spherical tokamak" & "Progress of the SUNIST-2 spherical tokamak"
4:40-5:05	7:40-8:05	11:40-12:05	12:40-13:05	14:40-15:05	19:40-20:05	20:40-21:05	Hitoshi Tanaka - "Overview of Low Aspect ratio Torus Experiment (LATE): Recent Results and Plans"
5:05-5:30	8:05-8:30	12:05-12:30	13:05-13:30	15:05-15:30	20:05-20:30	21:05-21:30	Hiroshi Idei- "Electron cyclotron plasma ramp-up through effective acceleration of energetic electrons and bulk electron heating in QUEST"
5:30-5:55	8:30-8:55	12:30-12:55	13:30-13:55	15:30-15:55	20:30-20:55	21:30-21:55	Yong-Seok Hwang - "Research in Versatile Experiment Spherical Torus (VEST) for the Development of Compact Fusion Reactor"
5:55-6:20	8:55-9:20	12:55-13:20	13:55-14:20	15:55-16:20	20:55-21:20	21:55-22:20	Break
6:20-6:45	9:20-9:45	13:20-13:45	14:20-14:45	16:20-16:45	21:20-21:45	22:20-22:45	James Harrison - "Overview of Physics Results from the First Campaign of Experiments on MAST Upgrade"
6:45-7:10	9:45-10:10	13:45-14:10	14:45-15:10	16:45-17:10	21:45-22:10	22:45-23:10	Otto Asunta - "High temperature plasmas in ST40"
7:10-7:35	10:10-10:35	14:10-14:35	15:10-15:35	17:10-17:35	22:10-22:35	23:10-23:35	Paolo Micozzi - "Status of the PROTO-SPHERA experiment: evidences of plasma tori production and sustainment and progress towards Phase-2"
7:35-8:00	10:35-11:00	14:35-15:00	15:35-16:00	17:35-18:00	22:35-23:00	23:35-0:00	Stephanie Diem - "The New PEGASUS-III Experiment"

Day 2, Tuesday, Nov. 1

USA West	USA East	UK	Spain/Italy	Moscow	Beijing	Japan/Korea	Day 2 Main Session **Access** for Attendees
4:00-4:25	7:00-7:25	11:00-11:25	12:00-12:25	14:00-14:25	19:00-19:25	20:00-20:25	Michiaki Inomoto - "Overview of UTST/TS-6 ST merging startup experiments"
4:25-4:50	7:25-7:50	11:25-11:50	12:25-12:50	14:25-14:50	19:25-19:50	20:25-20:50	Naoto Tsujii - "Studies of fast electron dynamics in rf start-up plasmas on the TST-2 spherical tokamak"
4:50-5:15	7:50-8:15	11:50-12:15	12:50-13:15	14:50-15:15	19:50-20:15	20:50-21:15	Yuejiang Shi - "Overview of EXL-50 Research Progress and Future Plan"
5:15-5:35	8:15-8:35	12:15-12:35	13:15-13:35	15:15-15:35	20:15-20:35	21:15-21:35	Hua-sheng Xie - "ENN Roadmap for Proton-Boron Fusion Energy Based on Spherical Torus"
5:35-6:00	8:35-9:00	12:35-13:00	13:35-14:00	15:35-16:00	20:35-21:00	21:35-22:00	Vladimir Minaev - "Overview of plasma research at the Globus-M2 spherical tokamak"
6:00-6:25	9:00-9:25	13:00-13:25	14:00-14:25	16:00-16:25	21:00-21:25	22:00-22:25	Break
6:25-6:50	9:25-9:50	13:25-13:50	14:25-14:50	16:25-16:50	21:25-21:50	22:25-22:50	Manuel Garcia-Munoz - "Overview of the SMall Aspect Ratio Tokamak - SMART"
6:50-7:15	9:50-10:15	13:50-14:15	14:50-15:15	16:50-17:15	21:50-22:15	22:50-23:15	Ken McClements - "Plasma Scenario Development in the Spherical Tokamak for Energy Production (STEP)"
7:15-7:35	10:15-10:35	14:15-14:35	15:15-15:35	17:15-17:35	22:15-22:35	23:15-23:35	Michele Romanelli - "ST40: Advancing the Physics Basis of Spherical Tokamak Reactors"
7:35-7:55	10:35-10:55	14:35-14:55	15:35-15:55	17:35-17:55	22:35-22:55	23:35-23:55	Mikhail Gryaznevich - "ST Reactor – new considerations"

Day 3, Wednesday, Nov. 2

USA West	USA East	UK	Spain Italy	Moscow	Beijing	Japan Korea	Poster session (Click the titles below to access)
4:00-6:00	7:00-9:00	11:00-13:00	12:00-14:00	14:00-16:00	19:00-21:00	20:00-22:00	Alessio Mancini – "Mechanical and electromagnetic design of the vacuum vessel of the SMART tokamak"
							Alexandre Fil – "Disruption runaway electrons generation and mitigation attempts in STEP preferred concept"
							Amil Sharma – "Global gyrokinetic study of shaping effects on electromagnetic modes at NSTX aspect ratio"
							Anna Kudriavtseva – "Verification of toroidal field coil stress analysis based on the measurements in experiments on tokamak GLOBUS-M2"
							Ekaterina Tkachenko – "Analysis of Globus-M2 tokamak plasma heating experiments using diamagnetic measurements"
							James Yang – "Framework for predictive modeling of neoclassical tearing mode activity in NSTX-U"
							Jorge Segado-Fernandez – "The SMART Central Stack Design"
							Jung-Hwa Kim – "Systemic error analysis of Thomson scattering system on VEST with rotational Raman calibration"
							Kotaro Iwasaki – "Properties of anomalous ion heating in lower hybrid wave sustained plasmas"
							Mingyuan Wang – "Observation of whistler wave instability driven by temperature anisotropy of energetic electrons in plasmas of EXL-50 spherical tours"
							Oak Nelson – "Initial Simulations of Negative Triangularity Plasmas on MAST-U"
							Pengjuan Su – "Disruption processes and their characteristics on the SUNIST spherical tokamak"
							Sam Bakes – "Free Boundary Equilibrium Modelling of Disruption Scenarios for STEP"

							Stan Kaye – "Transport Analysis of ST40 High Performance Discharges"
							TaeHee Eom – "Design of a new charge exchange spectroscopy system in VEST"
							Tao Xin – "Development of a washer gun for doublet startup on the SUNIST-2 spherical tokamak"
							Tingzhi Chang – "Development of a Projectile Probe"
							Yang Ren – "Linear Instabilities in a ST40 Hot Ion Plasma"
							Yi Peng – "Investigation on anisotropic temperature in Ohmic plasmas in TST-2"
							Yuankai Martin Peng – "Evolution of the D-T Spherical Torus (ST) toward the p-11B ST"
							Zhengbo Cheng – "Equilibrium design for the SUNIST-2 spherical tokamak"
							Zichong Song – "Development of hybrid multi-level inverters for the PF coils of the SUNIST-2 spherical tokamak"
							Žiga Štancar – "Modelling of the STEP ramp-down phase with JETTO"
6:00-6:20	9:00-9:20	13:00-13:20	14:00-14:20	16:00-16:20	21:00-21:20	22:00-22:20	Break Day 3 Main Session **Access** for Attendees
6:20-6:40	9:20-9:40	13:20-13:40	14:20-14:40	16:20-16:40	21:20-21:40	22:20-22:40	Stuart Henderson - "Physics drivers of the STEP divertor concept design"
6:40-7:00	9:40-10:00	13:40-14:00	14:40-15:00	16:40-17:00	21:40-22:00	22:40-23:00	Emmi Tholerus - "Analysing flat-top operational space of STEP reactor design"
7:00-7:20	10:00-10:20	14:00-14:20	15:00-15:20	17:00-17:20	22:00-22:20	23:00-23:20	Alexander Philip Prokopyszyn - "Steady-State Alpha-Particle Flux on the Walls of the Spherical Tokamak for Energy Production"
7:20-7:40	10:20-10:40	14:20-14:40	15:20-15:40	17:20-17:40	22:20-22:40	23:20-23:40	Kathreen Thome - "Development of holistic whole-device predict-first modeling of NSTX-U"
7:40-8:00	10:40-11:00	14:40-15:00	15:40-16:00	17:40-18:00	22:40-23:00	23:40-0:00	Rajesh Maingi - "Pre-conceptual Design of Liquid Li Plasma Facing Components in NSTX-U"

Day 4, Thursday, Nov. 3

USA West	USA East	UK	Spain/Italy	Moscow	Beijing	Japan/Korea	Day 4 Main Session **Access** for Attendees
4:00-4:20	7:00-7:20	11:00-11:20	12:00-12:20	14:00-14:20	19:00-19:20	20:00-20:20	Yasushi Ono - "High-Power Reconnection Heating for Formation of High-Beta Spherical Tokamak with Absolute Minimum-B in TS-3,4,6 ST merging experiments"
4:20-4:40	7:20-7:40	11:20-11:40	12:20-12:40	14:20-14:40	19:20-19:40	20:20-20:40	Kengoh Kuroda - "Improvements to the High-Field-Side Transient CHI System on QUEST"
4:40-5:00	7:40-8:00	11:40-12:00	12:40-13:00	14:40-15:00	19:40-20:00	20:40-21:00	Zhou Junyao - "Investigation of EBW current drive in open magnetic flux surface using flux loop with HFS injection in QUEST"
5:00-5:20	8:00-8:20	12:00-12:20	13:00-13:20	15:00-15:20	20:00-20:20	21:00-21:20	Shouzhi Wang - "Electron Bernstein waves heating experiments in SUNIST"
5:20-5:40	8:20-8:40	12:20-12:40	13:20-13:40	15:20-15:40	20:20-20:40	21:20-21:40	Erasmus du Toit - "Overview of ECRH and EBW modelling on ST40"
5:40-6:00	8:40-9:00	12:40-13:00	13:40-14:00	15:40-16:00	20:40-21:00	21:40-22:00	Masayuki Ono - "X-I mode for efficient solenoid-free ECCD plasma current start-up for fusion reactor"
6:00-6:20	9:00-9:20	13:00-13:20	14:00-14:20	16:00-16:20	21:00-21:20	22:00-22:20	Break
6:20-6:40	9:20-9:40	13:20-13:40	14:20-14:40	16:20-16:40	21:20-21:40	22:20-22:40	Nicola Bertelli - "High-fidelity 3D HHFW full wave simulations in NSTX-U"
6:40-7:00	9:40-10:00	13:40-14:00	14:40-15:00	16:40-17:00	21:40-22:00	22:40-23:00	Fatima Ebrahimi - "Magnetic reconnection: From compact fusion to plasma propulsion"
7:00-7:20	10:00-10:20	14:00-14:20	15:00-15:20	17:00-17:20	22:00-22:20	23:00-23:20	Euichan Jung - "Interaction between External Blobs and Internal MHD Modes During Internal Reconnection Event in VEST"
7:20-7:40	10:20-10:40	14:20-14:40	15:20-15:40	17:20-17:40	22:20-22:40	23:20-23:40	Samanta Macera - "Three-dimensional Magnetic Reconnections in PROTO-SPHERA"
7:40-8:00	10:40-11:00	14:40-15:00	15:40-16:00	17:40-18:00	22:40-23:00	23:40-0:00	Franco Alladio - "Morphology: PROTO-SPHERA experiment vs. the inner wind region of the Crab Nebula supernova remnant"

Day 5, Friday, Nov. 4

USA West	USA East	UK	Spain/Italy	Moscow	Beijing	Japan/Korea	Day 5 Main Session **Access** for Attendees
4:00-4:20	7:00-7:20	11:00-11:20	12:00-12:20	14:00-14:20	19:00-19:20	20:00-20:20	Jeong Won Ik - "Improvement of vacuum and wall conditioning systems in Versatile Experiment Spherical Torus"
4:20-4:40	7:20-7:40	11:20-11:40	12:20-12:40	14:20-14:40	19:20-19:40	20:20-20:40	Taekyoung Kim - "Improvement of plasma diamagnetic flux measurement system in VEST"
4:40-5:00	7:40-8:00	11:40-12:00	12:40-13:00	14:40-15:00	19:40-20:00	20:40-21:00	Seongcheol Kim - "Development of full electromagnetic plasma start-up model for analysis and prediction of ohmic discharges in Versatile Experiment Spherical Torus"
5:00-5:20	8:00-8:20	12:00-12:20	13:00-13:20	15:00-15:20	20:00-20:20	21:00-21:20	Tara Ahmadi - "Will the MHD model coupled with the plasma diagnostics data be able to reconstruct out of reach core plasma parameters in Tokamak devices"
5:20-5:40	8:20-8:40	12:20-12:40	13:20-13:40	15:20-15:40	20:20-20:40	21:20-21:40	Nikita Zhiltsov - "Electron heating during neutral beam injection at Globus-M2"
5:40-6:00	8:40-9:00	12:40-13:00	13:40-14:00	15:40-16:00	20:40-21:00	21:40-22:00	Alexandra Dudkovskaia - "Plasma shaping effects on the neoclassical tearing mode threshold physics"
6:00-6:20	9:00-9:20	13:00-13:20	14:00-14:20	16:00-16:20	21:00-21:20	22:00-22:20	Break
6:20-6:40	9:20-9:40	13:20-13:40	14:20-14:40	16:20-16:40	21:20-21:40	22:20-22:40	Chang Liu - "Nonlinear simulation of pressure-driven MHD modes and beta-limit study in MTF"
6:40-7:00	9:40-10:00	13:40-14:00	14:40-15:00	16:40-17:00	21:40-22:00	22:40-23:00	Jack Berkery - "Equilibrium operational space and stability limits in early operation of MAST-U"
7:00-7:20	10:00-10:20	14:00-14:20	15:00-15:20	17:00-17:20	22:00-22:20	23:00-23:20	Sarah Elmore - "Overview of First Exhaust Physics Results from MAST-U"
7:20-7:45	10:20-10:45	14:20-14:45	15:20-15:45	17:20-17:45	22:20-22:45	23:20-23:45	Jon Menard - "PPPL Low-Aspect-Ratio Next-Step Facility Scoping Studies"
7:45-8:00	10:45-11:00	14:45-15:00	15:45-16:00	17:45-18:00	22:45-23:00	23:45-0:00	Workshop summary and discussion of next workshop