Summary of the
Solar/Astron Session

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Charm of Chengdu

Once being here, you would rather **live** here, not to **leave** here.
Solar/Astron guys love instabilities!
Dynamo, Helicity & Filaments
\[ \alpha = \frac{\tau_c}{3} \left( -\omega \cdot u + \frac{j \cdot b}{\rho} \right) \]
P. F. Chen

$H_c = J \cdot B$

91.6% follow the rule

helicity

+ helicity

91.6% follow the rule
P. F. Chen

Flux rope

Sheared arcade

89%

11%
Magnetic Rayleigh-Taylor instability
Mass supply cycle:

Black hole $\rightarrow$ Corona $\rightarrow$ Cool filaments
Coronal Heating
J. Okamoto

Alfvén waves
Ling Chen

Kinetic Alfven waves via Landau damping

L. Xiang

Ion beams are more effective than electron beams in exciting Alfven cyclotron waves.
Most loops are not in a hydrostatic state.

T is nearly uniform along the loops.
Solar chromospheric jets

T. Yokoyama

3D MHD
Solar Wind
A power-law spectrum, $J \sim E^{-\beta}$, with $\beta \sim 2.4$.

Nearly isotropic angular distributions.

No clear correlation with solar flares or CMEs.

Different origins
Whistler waves can be generated by electrons.
Relativistic MHD
Relativistic reconnection in Poynting-dominated plasma

Only 1% of B energy is sufficient to drive turbulent reconnection

M. Takamoto
Radiative relativistic reconnection

Radiation can increase reconnection rate.
Radiation can accelerate high-speed jets

Radiative MHD with GR

Black hole

Neutron star

H. Takahashi
Strong electromagnetic wave emissions are generated at the upstream of relativistic shocks.
Clumps help accelerate particles
Non-uniform upstream can extend the lifetime of the enhanced B in the downstream.
Y. Matsumoto

The 1st 3D PIC simulations of high-$M_A$ shock

Electron shock surfing & drift accelerations under turbulence generate relativistic particles
R. Yamazaki

PIC simulations +

**Advantage:** simultaneous measurements of density and $T$ across the shock, $Ma > 3$
J. Shimoda

Komolgorov-law only at the outer shell

B → shock → particle → radio emission
Star Formation
K. Tomida

Sun and planets are formed together
A simple MHD model to explain it

A Key Parameter: Rossby number

11-year solar cycle
Accretion Disk
R. Matsumoto

A higher order MHD code CANS+

MRI + buoyant escape \rightarrow cycle
Instruments
R. Kano

CLAPS
Mingantu Spectral Radioheliograph—MUSER
100 antenna, max. baseline: 3 km, array with 3 spiral arms
H. Li

Ly-alpha
Solar Telescope (LST)
Lab Experiments
1 PW laser $\rightarrow$ reconnection
J. Y. Zhong

Mimic solar flare

Low $\beta$ & high $\beta$
Challenging the orthodox
Aly-Sturrock Theorem

\[ E_{\text{force-free}} > E_{\text{open}} \]
D. Melrose

Electromotive force (EMF) is missing, which is important.

Y. Bi

Standard reconnection model
Welcome back to China!

P. F. Chen