Many unanswered questions about the Sun require us to grapple with fundamental physics processes like turbulence and magnetic reconnection.

Given that much of the “action” takes place on tiny scales, we rely on the highest-resolution data to validate theories.

How will DKIST fill in the gaps in our understanding?
Session 17: Observational Signatures of Turbulence and Reconnection: New Frontiers with DKIST

2:15-3:30  • Scene-setting talk 1: Mark Rast
            “Turbulence and reconnection in the photosphere & low chromosphere: Unanswered questions and DKIST prospects”
            • Posters: Sam Van Kooten, Momchil Molnar

3:30-3:45  • Coffee Break

3:45-5:00  • Scene-setting talk 2: Lucas Tarr
            “Turbulence and reconnection in the upper chromosphere & low corona: Unanswered questions and DKIST prospects”
            • Posters: Ryan French, Chris Gilbert, Neeraj Kulkarni
One major goal of this session was to inform the SHINE community about DKIST first-light instrument capabilities . . . and limitations.

Example: diffraction-limited resolution (0.03” ~ 20 km) and fancy spectropolarimetry don’t play well together.

Some things (i.e., finite-depth formation regions for many spectral diagnostics) just can’t be tackled with bigger telescopes.
Turbulence in the photosphere: *Is granulation actually turbulent?*

Probably not on the scale of the 1000 km granules, but there are probably all kinds of turbulent instabilities in the tiny (50-100 km) intergranular downflow plumes.

*Sunrise/IMAX* showed that there are even more compact, intermittent, fast upflow sites in the granulation. Just the tip of the iceberg? Ideal for DKIST!

Lots of discussion of how photospheric motions affect the corona higher up. DKIST will destroy old conceptions of “bright points” and reveal their (likely) complex, vertical, & discontinuity-filled structure...

Turbulence in the chromosphere? IBIS and ALMA are showing some interesting hints of high-frequency waves, but DKIST is needed to show what is really going on.
Session 17: Observational Signatures of Turbulence and Reconnection: New Frontiers with DKIST

- **Magnetic reconnection:** what can we hope to see with DKIST?

- Expected DKIST resolution regimes in spatial scale & Lundquist number span several interesting theoretical “flavors” of reconnection.

- We may never be able to resolve kinetic-scale dissipation regions, but turbulent/viscous (?) regions around them seem to be resolvable.

- Simulations like MURAM have been useful as idealized pre-DKIST proxies.

- *CoMP* paved the way to resolving magnetic nulls, flux-rope twist, & other indirect signatures of reconnection.

- DKIST will be orders of magnitude more sensitive, and also provide V Stokes parameters.
Observational Signatures of Turbulence and Reconnection: New Frontiers with DKIST

Takeaways

• First light will be here within a year.

• We’ve only just begun exploring what types of plasma/MHD processes will be revealed at unprecedented resolution.

• We talked about many “tip of the iceberg” hints from existing telescopes (e.g., inter-granular turbulent flows, chromospheric waves, coronal current sheets) and what aspects of them will be measurable by DKIST.

• Please get involved in the Critical Science Plan process...

www.nso.edu/telescopes/dki-solar-telescope/csp/