29th IAU General Assembly
10 August 2015

Daniel K. Inouye Solar Telescope (DKIST) Critical Science Plan

DKIST Critical Science Plan Activities

Call for Community Participation

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Operations begin September 2019

DKIST Critical Science Plan (CSP):

Aim: to be ready, as a community, by science first light to execute a set of observations that take advantage of the DKIST capabilities to address critical compelling science

- understand forthcoming capabilities
- define science goals
- compile Science Use Cases
- coordinate to form a complementary set of PI lead teams
- convert Science Use Cases into PI led Observing Proposals
- perform Service Mode observations
- scientific analysis
- PI led publication of first light results

Notes:

1. This process will likely be iterative – initial CSP structure is intended as a helpful but non-rigid framework and the science will evolve
2. The CSP process is not exclusive (all welcome) nor unique (direct submission of observing proposals to the DKIST project under a standard submission and review process will also be possible)
3. The development of the CSP in advance of first light helps the project beyond science definition – it helps in the development of essential operations and data management tools

http://dkist.nso.edu/CSP

mark.rast@colorado.edu for password and other help

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Process:

Research Topic definition

Science Use Case formulation

Coordination

PI led observing proposals

First light observations

PI led publication

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DANIEL K. INOUYE SOLAR TELESCOPE

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DKIST Critical Science Plan

- Research Areas
  - Magnetohydrodynamics and Dynamo Processes
  - Flares and Eruptive Activity
  - Magnetic Connectivity, Mass and Energy Flows in the Solar Atmosphere
  - Long-Term Studies of the Sun
  - Special Topics
- Service Mode

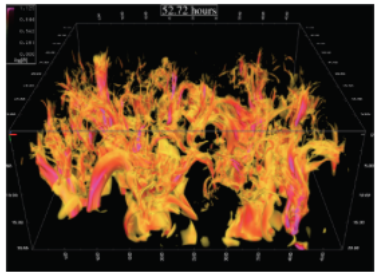
Research Areas

The DKIST will be the largest solar ground-based resource for high-resolution studies of the Sun's magnetic activity leading to sunspots, flares, coronal mass ejections (CME's), the solar wind and solar variability. Polarimetric accuracy and sensitivity at high-spatial resolution on the disk, and far into the solar atmosphere (corona) is a high priority. The flexible and versatile first-light instrument suite in conjunction with the active optics and a high-order adaptive optics system will allow to obtain observations that can address a variety of scientific questions of which many will fall into the following Research Areas:

- Magnetohydrodynamics and Dynamo Processes.
- Flares and Eruptive Activity.
- Magnetic Connectivity, Mass and Energy Flow in the Solar Atmosphere.
- Long-Term Studies of the Sun.
- Special Topics.

Each of those Research Areas is further divided into individual Research Topics. Please select one of the above areas and then a topic underneath that is most applicable to the Science Use Case you have in mind and submit your Science Use Case under that topic once it is prepared.

Magnetohydrodynamics and Dynamo Processes



Magnetic fields pervade the solar atmosphere, both giving rise to large scale phenomena like active regions and sunspots, as well as modifying solar convection on the smallest spatial scales. These fields are most likely not only advected from the deepest layers of the solar convection zone, after being generated by the global dynamo, but are also generated locally by a surface dynamo, although it is not clear to what relative degree. To distinguish between the two scenarios and determine their relative contributions will require the detailed comparison between physical parameters derived from high-resolution spectro-polarimetry, and (radiative-)MHD simulations of equal resolution. To measure the weakest, more horizontal, intranetwork fields will require interpretation of polarimetric data via the subtle Hanle effect, in addition to the traditional Zeeman effect, which is more suitable for stronger, vertical fields. Observations with high temporal cadence are required to determine the energy of waves that, guided by the magnetic field, transfer energy form the convectively dominated photosphere to the magnetically dominated chromosphere, where radiative losses balance the energy that is

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Structure:

Critical Science Plan

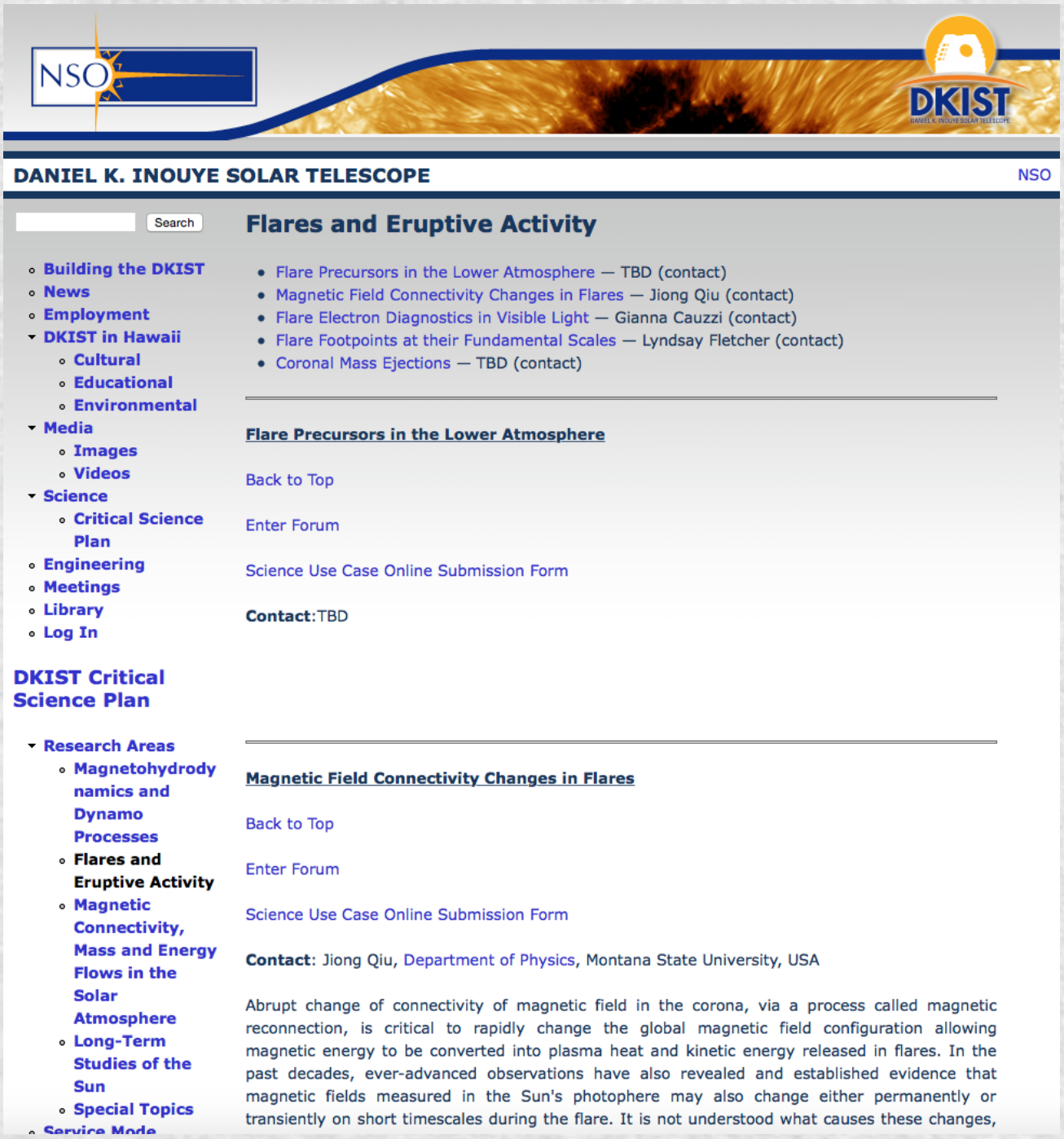
Research Areas

Research Topics

Science Use Case

↓

Observing Proposal



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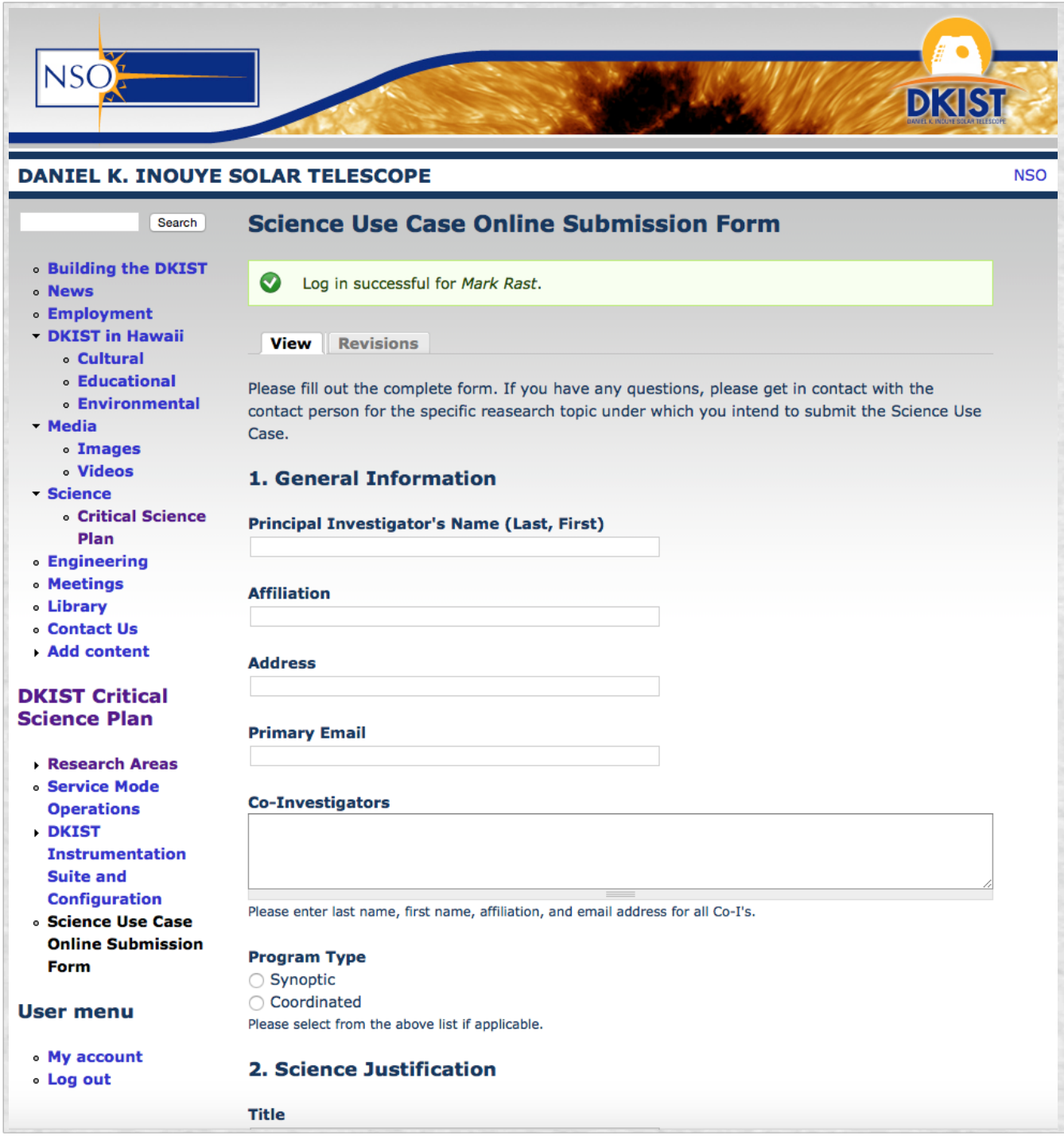
Coordination:

PI level activities are at Science Use Case/ Observing Proposal level

Some coordination (self organization) of Science Use Cases under a given Research Topic is anticipated and will be facilitated by “contacts”



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Science Use Case Submission:

Password protected
mark.rast@colorado.edu

General Information

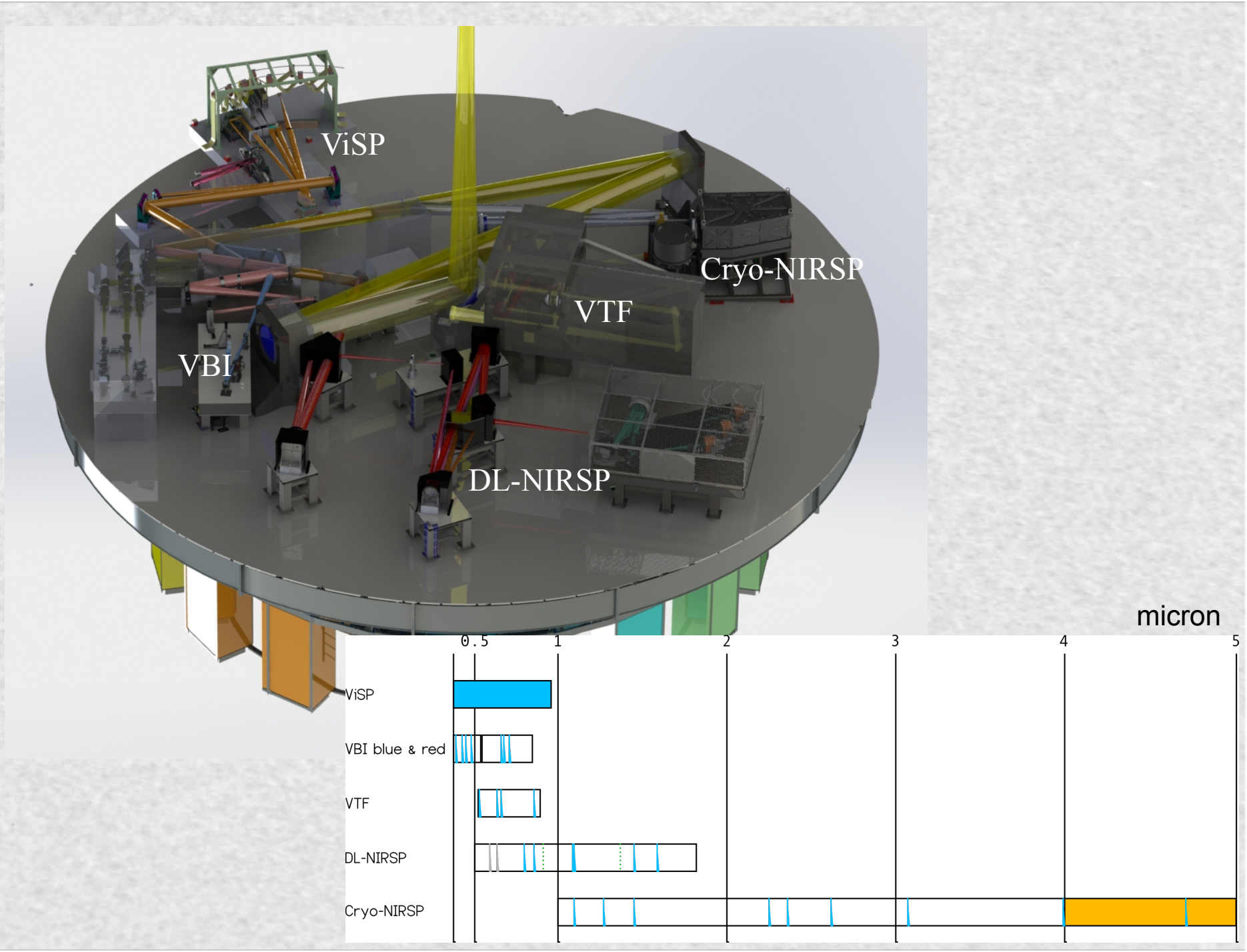
Science Justification
- includes some info about expected data, data products, data analysis

Observation Specifics

Target Specifics

Instrument Specifics
- includes Coude configuration

References


ViSP
Cryo-NIRSP
VTF
VBI
DL-NIRSP
micron
0.5
1
2
3
4
5
ViSP
VBI blue & red
VTF
DL-NIRSP
Cryo-NIRSP

Search

DKIST Instrumentation Suite and Configuration

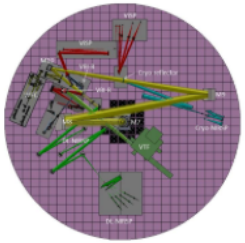
Instrumentation Suite Overview

The DKIST will offer a combination of state-of-the-art instruments with imaging and/or spectropolarimetric capabilities covering a broad wavelength range. This first-light instrumentation suite will include:

- Cryogenic Near-InfraRed Spectro-Polarimeter (Cryo-NIRSP) : a cryogenic slit-based spectropolarimeter for coronal magnetic field measurements and on-disk observations up to 4.7 microns.
- Diffraction-Limited Near-InfraRed Spectro-Polarimeter (DL-NIRSP) : a fiber-fed two-dimensional spectropolarimeter.
- Visible Broadband Imager (VBI) : a rapid broadband filtergraph for high-spatial and -temporal resolution imaging.
- Visible Spectro-Polarimeter (ViSP) : a slit-based dual-beam spectropolarimeter for sensitive and accurate multi-line spectropolarimetry.
- Visible Tunable Filter (VTF) : a double Fabry-Pérot based imaging instrument for high-spatial resolution spectroscopy and spectropolarimetry.

Combining Individual Instruments

The individual instruments can be combined and operated in parallel with the exception of the Cryo-NIRSP, which can only be operated as stand-alone during early operations. For early operations, the DKIST will be equipped with an intitial set of beam splitters allowing to feed specific wavelength ranges to the individual instruments.



In order to avoid any conflicts in the light distribution when combining individual instruments for your Science Use Case, please study the following information:

- Coudé Beamsplitter Configuration

and if necessary cross-check your Coudé configuration and combination of instruments by using the following tool (IDL procedure):

- Beamsplitter configuration tool (zip file containing the IDL tool and user instruction file).

Proposal Opportunities to support Science Readiness

Astronomy and Astrophysics Research Grants (AAG) Program:
https://www.nsf.gov/funding/pgm_summ.jsp?pims_id=13630

- NSF AST responds to proposal pressure from community (typically without issuing and AO)
- Review panel breakdown by research area reflects volume of proposals
  - A critical mass of 15-20ish proposals can result in a topical panel within AAG
  - NSF caveat: overall AAG proposal success rate is low ~15%
- Timing is critical:

Full Proposal Window: September 15, 2015 - November 16, 2015
September 15 - November 15, Annually Thereafter

Bottom Line: AST encourages continued conversations and proposals from the solar physics community for supporting the most important DKIST first-light science

Possible coordination contact:

mark.rast@colorado.edu if that would help.

DKIST Critical Science Plan workshops:

- A series of community workshops to examine and develop Science Use Cases and convert them to Observing Proposals by first light
- Possible support from NSF for student participation
- Broadly organized by Research Areas

Possible workshop dates:

- in conjunction with SPD 2016 in Boulder, CO
- in conjunction with SPD 2017 in Jackson Hole, WY
- series of workshops during summers 2018 and 2019

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