SOLARNET

Integrating High Resolution Solar Physics

Coordination of development of software tools for solar physics

SOLARNET 2nd Forum on Telescopes and Databases

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USFD + Colleagues from SU, UiO, QUB, ASU, Aperio

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Objectives

**etermine the needs, availability, and future desired directions of computational,
sualisation & analysis tools**

ompose an inventory of existing tools relevant in particular for WP5 with the focus
wards supporting the development and realisation of EST

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Tasks

oordination of development of software tools for solar physics

lake inventory of needs, availability, and future desired directions of computational,
sualisation & analysis tools

ogether with ongoing **discussions directed these activities**

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Needs

omplex Sun (highly inhomogeneous, stratified magnetic field, partially ionized, variety f exotic plasma dynamics, highly subtle processes that change field topology, wave ansport processes, wide range of spatio-temporal and spectral scales

olar facilities (e.g., observatories, data centers, etc.) on ground (BBSO, DOT, DST, regor, GVTT, SST, Themis, DKIST) and in space (SOHO, TRACE, Hinode, RHESSI, TEREO, SDO, IRIS, SPP, Solar Orbiter …)

ll provide **already** a **huge amount of data well into Tb**

oming: EST, NLST or CGST will deliver **data ~ Pb daily**

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Availibility

1) In terms of ***solar data analysis and visualization***

- *SolarSoft*
- *SunPy*
- specific tools (Verwichte et al. 2018)

2) In terms *of* ***solar modelling and computing***

- AWESOM, Bifrost, ENLIL, Euphoria, Lare3d, MPI-AMRVAC, MURAM, Pencil, SAC, SMAUG, WSA-ENLIL

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Future Directions

ongly depends on

how major ground-based facilities, e.g. DKIST or EST will **develop** (SUCs or EST SRD
chlichenmaier et al 2019).

how computing facilities and the underlying technology will develop.

ay not be seen practical or even feasible to move around Pb data for processing,
ualising and analysis:

Data Centre???

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Future Directions

ge reconstruction

IOMFBDM

peckle

Vavefront aberration

??

dware

L, CNN to cater fast image reconstruction, 3D inversion of the Stokes parameters,
oise reduction in observational data, classification and tracking of solar features, etc.

PU/**GPU**/… platforms

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Future Directions

tware

Python has become one of the most popular languages in our field

Range of consolidated and robust solar community programs in the **proprietary**
nguage IDL

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Inventory

contribution

bservational data (SSTRED, redux, CRISPEX)

tmospheric inversion codes (STiC, MINE)

eep learning:

- Solar image denoising with Convolutional Neural Networks
- Stokes Inversion based on Convolutional Neural Networks
- Quick image restoration based on Deep Learning

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Inventory

contribution

ulti, RADYN, Bifrost, Helita

tmospheric inversion codes (STiC, MINE)

B contribution

o-alignment and visualisation tool

J contribution

APPA software package, FLARIX

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Inventory

erio contribution

full solar image calibration pipeline for VFT

FD contribution

tmospheric codes

- Mapping Of Non-potentiAl Magnetic fIeld (MONAMI)
- Automated Swirl Detection Algorithm v2 (ASDA v2)

ore Development Tools

- Python converting output of MONAMI into NDCube
- Improved NDCube package

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Thank you!