Installation of the Flare Monitoring Telescope in Saudi Arabia as a New Member of CHAIN Project (Continuous H-alpha Imaging Network Project)

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Abstract

In 2011 we invited Prof. Kazunari Shibata (Kyoto University; Japan) and have discussed the possibility for our institute to become a member of the CHAIN project leaded by him and his group. We launched, later, a project to install the Flare Monitoring Telescope (FMT) in our department and hence establish a new solar research group (consisting of 6 faculty members). During 2012 our University agreed to provide the needed financial support. In the autumn of 2014, our FMT will be installed (replacing an already existed night telescope). Joining the world wide FMT network with Japan and Peru by our new telescope will surely enable us to implement the continuous H-alpha full-sun observation. Our FMT has a unique feature as it can obtain two red-shift solar images at H-alpha + 0.8 Å and H-alpha + 1.6 Å and two blue-shift images at H-alpha -0.8 Å and H-alpha - 1.6 Å. On one hand, we can estimate the velocity of very fast ejections of solar plasma by mainly using blue-shift images, on the other hand, we can observe falling plasma down to the photosphere using red-shift images. Our new solar research group at KSU will promote studies on sudden disturbances and long-term variations of the space weather environment through cooperative solar observations with Japan and Peru.

1. What is the "CHAIN" ?

The space-weather environment around the earth depends on 3-D structures and velocities of the Coronal Mass Ejection (CME), Shockwave and solar-wind disturbance around the magnetosphere.

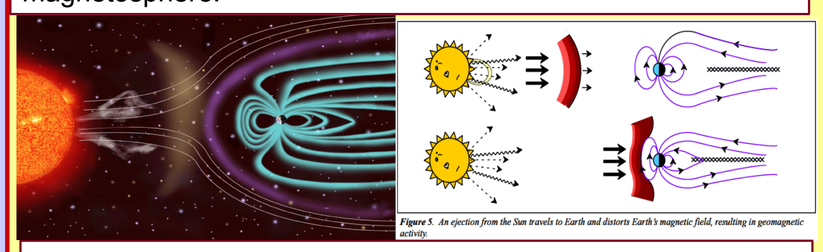


Figure 5. An ejection from the Sun travels to Earth and distorts Earth's magnetic field, resulting in geomagnetic activity.

It is highly important that we could accurately observe filament eruptions and structures of shock waves on the Sun, in order to accurately grasp and predict the structures, velocities and evolution of the CMEs and shock waves in the solar-terrestrial space

However, it is still difficult to predict whether solar active phenomena would have large geoeffectiveness or not, just when the solar phenomena occur on the solar surface

Observations of filament eruptions and shock waves with the mutli-wavelength full-disk solar telescope play a crucial role for the space weather research.

Observational & Scientific Themes of CHAIN Project

(Continuous H-alpha Imaging Network Project)

(1) 3D velocity field measurement of eruptive phenomena on the solar surface

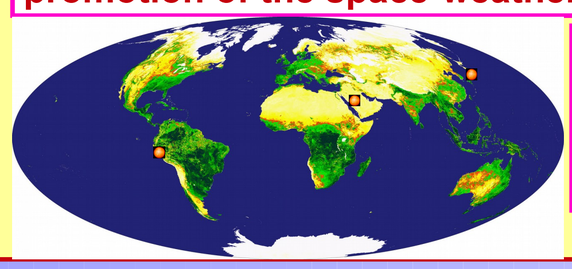
(2) Detection of shock waves (Moreton wave) generated by solar explosive phenomena

(3) Estimation of solar UV radiation and comparison with ionospheric variation

Purposes of CHAIN Project (Continuous H-alpha Imaging Network Project)

Reinforcement of multi-wavelength H-alpha observations of the full-disk Sun by formation of an international network of ground-based solar station

Capacity building:
International spread, academic exchange and promotion of the space-weather research



By FMT of KSU, continues multi-wavelength H-alpha observations of the full-disk Sun is completed

King Saud Univ. Flare Monitoring Telescope (FMT) Specifications

The Flare Monitoring Telescope (FMT) observes daily the solar activities and their long-term variation. This telescope have 6 tubes: 1) imaging telescope at H-alpha line-center, 2) imaging telescope at H-alpha +0.8 A, 3) imaging telescope at H-alpha – 0.8 A, 4) imaging telescope at H-alpha + 1.6 A, 5) imaging telescope at H-alpha – 1.6 A and 6) auto-guiding telescope. These five imaging telescopes simultaneously observe the full-disk solar chromosphere at multi-wavelengths, and the auto-guiding telescope enables the FMT to accurately track the sun all day long.

Filters

H-alpha line-center	wavelength = 656.281 nm
H-alpha + 0.8 A	wavelength = 656.281 + 0.08 nm
H-alpha – 0.8 A	wavelength = 656.281 – 0.08 nm
H-alpha + 1.6 A	wavelength = 656.281 + 0.16 nm
H-alpha – 1.6 A	wavelength = 656.281 – 0.16 nm

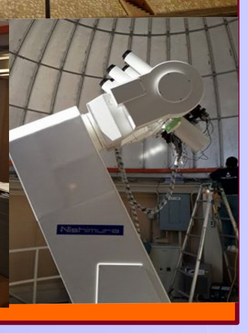
Composition

1. Optical part of the FMT
2. Equatorial-type mount
3. Controlling system
4. Imaging camera system

1-Diameter of the objective lens 68 mm
Field of View ~ 2920 x 2190 arcsec
2-Repeat ability of pointing & tracking < 1 arcsec
3- Clock: maintained by GPS
4- Auto-guiding telescope:-
Optical filter: ND-filter
Automatic adjustment of the solar position by using CCD sensor

Imaging camera system

CCD pixel number:	2616 x 1960 pixels
CCD pixel size:	3.40 um/pixel
Interface:	Gbit Ethernet
Quantum efficiency:	> 70 % at 656.3 nm



Conclusion

New Benefits Of King Saud Univ--FMT

1-Place: (FMT) at King Saud University, covers the solar monitoring during the period between the temporal Kyoto University Observatory and the University Observatory AKA . Thus, enables the complete follow-up monitoring of the Sun 24 hours a day.

2-In terms of wavelength: The KSU-FMT has an important issue increasing its performance and use, namely at the level of the observing wavelengths. Indeed, it covers a red-shift H-alpha +1.6 nm filter which allows measurements of very strong eruptive phenomena on the solar surface. In addition, a blue-shift H-alpha – 1.6 nm filter is also added, which gives the possibility to monitor high speed falling solar material

3- seeing condition and cloudy day: Our preliminary study of seeing conditions shows that the radius of air perturbation is around 6-7cm, with very rare cloudy days (more than 300 clear days).

Our Data and Future plane

Our data

Our FMT will begin working on the first April, 2015

Multi-wavelengths H-alpha data will be available on line.

Future plane

We plane to continue updating our Solar Station: Starting with FMT We plane in the future to install

1-Coelostat & Solar spectroscope

2-Geomagnetometer for MAGDAS:

3-IGP antennas: Antennas for measuring the ionosphere were also installed by IGP.