

Within the International Collaboration CHAIN: a Summary of Events Observed with Flare Monitoring Telescope (FMT) in Peru

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Abstract. In 2008 we inaugurated the new Solar Observatory in collaboration with Faculty of Sciences of San Luis Gonzaga de Ica National University, 300 km south of Lima. In March of 2010 a Flare Monitoring Telescope of Hida Observatory of Kyoto University arrived to Ica, part of CHAIN Project (Continuous H-alpha Imaging Network). In October of the same year we hosted the First FMT Workshop in Ica, then in July of 2011 the Second FMT Workshop was opened. Since that we are focused on two events registered by FMT in Peru to publish results. FMT is a good tool to introduce young people from universities into scientific knowledge; it is good also for education in Solar Physics and outreach. Details of this successful collaboration will be explained in this presentation.

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Keywords: CHAIN Project

Introduction

CHAIN Project (Continuous H-alpha Imaging Network) aims to observe The Sun 24 hours, spreading H-alpha telescopes around the world. A FMT (Flare Monitoring Telescope) is a telescope capable to observe the Sun in three different wavelengths centered on H-alpha that allows 3D analysis of solar events. Part of CHAIN Project is the Solar Magnetic Activity Research Telescope (SMART) that was installed at Hida Observatory in 2003. This telescope daily observes H-alpha multi-wavelength full-disk chromospheric images.

Observation and study of filament eruptions, shock waves as of Moreton waves (Moreton and Ramsey, 1960) with solar flares and variation of UV radiation on the full-disk of the Sun is of interest in order to understand and predict the change of space-weather environment from the Sun to the Earth.

Solar Physics in Peru

Astronomy Division of Geophysical Institute of Peru began sunspots observations with a 15 cm refractor telescope in 2002 at Ica National University, then in 2006, Ica University decided to construct a Solar Observatory at the university campus. Geophysical Institute of Peru advise Ica University and provided



Fig. 1. FMT in Ica, Peru

some instruments as a solar spectrograph. In the meantime that the Solar Observatory was in construction, Hida Observatory of Kyoto University contacted Geophysical Institute of Peru proposing to install FMT in Ica University. Solar Observatory was completed in 2008 and in 2010 FMT was installed provisionally, but data came out from April 2010. Meanwhile Ica University prepared budgets to

construct housing for FMT with a sliding roof. In 2012 sliding roof building for FMT was completed and FMT will be moved to the permanent place.



Fig. 2. New sliding roof for FMT in Ica, Peru.

Training and Academic Exchange

Once FMT was installed, undergraduate students and researchers of Ica University have to learn how to observe, how to reduce data and learn the way to analyze them. So Dr. Satoshi Morita stayed first for near one month in Ica University in June of 2010, then near two months also in 2010, between October and November. He also gave Solar Physics lectures in Ica University.

Subjects are:

Acquisition method of calibration data and calibration method.

Calculation of physical parameters from multi-wavelength solar images and scientific analysis.

Lectures of solar physics and space weather.

Scientific Reunions

To reinforce capacity building in Ica University, some scientific workshops were organized in cooperation with Ica National University, Geophysical Institute of Peru and Hida Observatory of Kyoto University. Important financial contributions made Iberoamerican States Organization and COSPAR.

First Scientific FMT Workshop was held in Ica University in November 2010 that was the first time that FMT data obtained in Ica were showed and discussed. Participants were mostly from Peru but participants from Algeria, Ecuador and Brazil were present as well.

The 2nd Japan and Peru Data Analysis Workshop was from 20th to 31st of July in 2011, 8 days at Hida Observatory and 4 days at NAOJ, Mitaka.

Objectives for the Workshop were:

Report of progress of data-analysis during this one year

Lectures of solar physics and solar active phenomena in more detail.

Introduction of recent studies by using the data obtained with CHAIN-network, by Japanese researchers.

How to analyze solar observational data taken with FMT and space mission such as Hinode

How to write scientific paper on solar physics research

Basics of solar observations on ground

Scientific Results

At the beginning of the Workshop, all data available from Ica Solar Observatory were analyzed and picked up only two important events to be deeply analyzed in order to finally publish as a scientific research. Two groups focused on each event as follows:

Group 1: February 16th of 2011, M1.6 Flare

Group 2: March 08th of 2011, M4.4 Flare

During 2012 using Skype young researchers from Ica University and Geophysical Institute of Peru, discussed and coordinated with people of Hida Observatory about two events. At the time figures, tables and all the material needed to be published is almost ready. Details for publications will be discussed on the Third FMT Workshop to be held in March of 2013, in Japan. Both papers are in preparations.

Group 1: Winking Filament in the Vicinity of "Dandelion" Eruption Associated with February 16th 2011 Solar Flare (P.I.: Cabezas, D.)

Group 2: A 3-Dimensional View of the Filament Eruption and Coronal Mass Ejection Associated with March 8th 2011 Solar Flare (P.I.: Gutierrez V.)

Observations with FMT

FMT was operating quasi-regularly by the Solar Observatory members (volunteers) at Ica University in Peru.

Observations started from around 9 am until sunset.

Mainly weekday base but sometimes also on Saturday.

Total five young members. Two of them are staff members (lecturer) of the university. The other three are Geophysical Institute of Peru members.

Sometime undergraduate students of Faculty of Sciences made observations and learn how to reduce data.

Data Analyze Center

A Data Analyze Center was implemented from October 2010 and is equipped with the entire necessary environment for general solar physics data analysis.

5 computers (Linux OS, NIS, NFS)

RAM size: 8GB, 3GBx2, 1.5 GB x2

6.4TB RAID (FMT data storage, and some other solar instruments data.)

IDL (1 license)

Solar Software (full version)

Internet connection (uplink: downlink = 50kB/s: 150kB/s)

Currently, some young researchers are working there, and started solar data analysis trainings.



Fig. 3. Data Analyze Center

Solar Events

Flare events registered by FMT in Ica University are presented in list as in Tables 1, 2, and 3 that corresponds to each year, from 2010 to 2012, respectively. A summary of them in relation to GOES classification is as follows:

Flare List 2010 at Ica University					
GOES-CLASS					
2010	B	C	M	X	Total
Jan	NR	NR	NR	NR	0
Feb	NR	NR	NR	NR	0
Mar	0	0	0	0	0
Apr	0	0	0	0	0
May	0	1	0	0	1
Jun	0	0	0	0	0
Jul	1	1	0	0	2
Aug	1	0	0	0	1
Sep	0	2	0	0	2
Oct	2	3	0	0	5
Nov	13	2	1	0	16
Dec	1	0	0	0	1
TOTAL	18	9	1	0	28

NR: Not Registered

Flare List 2011 at Ica University					
GOES-CLASS					
2011	B	C	M	X	Total
Jan	2	0	0	0	2
Feb	14	16	1	0	31
Mar	12	37	7	0	56
Apr	13	11	1	0	25
May	13	3	0	0	16
Jun	NR	NR	NR	NR	0
Jul	NR	NR	NR	NR	0
Aug	7	4	0	0	11
Sep	5	41	8	2	56
Oct	4	16	0	0	20
Nov	4	27	0	0	31
Dec	7	10	0	0	17
TOTAL	81	165	17	2	265

NR: Not Registered

Flare List 2012 at Ica University					
GOES-CLASS					
2012	B	C	M	X	Total
Jan	1	5		0	6
Feb					
Mar	7	8	1	0	16
Apr	3	13	1	0	17
May	4	13	0	0	17
Jun	0	2	0	0	2
Jul	0	2	0	0	2
Aug	17	13	2		32
Sep	8	14	1		23
Oct	1				1
Nov	1	5			6
Dec	5	2			7
TOTAL	47	77	5	0	129

NR: Not Registered

Conclusions

Since IHY recommended TRIPOD, consisting of an instrument array, data taking and analysis, and teaching space science (Kitamura et al., 2007), we emphasize on capacity building once installed the FMT in a local university in Ica in Peru, in collaboration of Geophysical Institute of Peru and we can say that it is an a successful case, two papers are in preparation.

On the other hand FMT is a non-expensive instrument that have some interesting issues that have to be exploit. It is easy to use so that anyone can make observations, that make people (students for instance) get interested in observations with FMT. Once observation begun, five images of the sun are visible on the PC monitor, in real time. That makes observer fascinating if some solar phenomenon is in course. Having data, students have to learn some IDL and Solar Software, quite complicate for someone that is a Windows user, have to learn some commands of Linux System, but it is a good way to get involved people to speak the same language (Linux commands) of other scientist in the world. After suffering a little they can have a movie of a particular event, and it is a motivator experience. And so on, each step to finally analyze and have useful information from mere images is a good way to learn about scientific method.

At Ica university it is common having students from school visiting the Solar Observatory, students are really impressed watching PC's monitors with H-alpha images. It is a good mean for outreach.

References

Moreton, G.E. and Ramsey, H.E., 1960, Recent Observations of Dynamical Phenomena Associated to Solar Flares, Publications of the Astronomical Society of the Pacific, Vol. 72, No. 428, p.357.

Kitamura, M., Wentzel, D., Henden, Ar., Bennett, J., Al-Naimiy, H. M. K., Mathai, A. M., Gopalswamy, N., Davila, J., Thompson, B., Webb, D. and Haubold, H., 2007, IAU Special Session #5, Astronomy for the Developing World. 26th meeting of the IAU, held 21-22 August, 2006 in Prague, Czech Republic. Edited by J.B. Hearnshaw and P. Martinez. Cambridge: Cambridge University Press, 2007, pp.277-284.

Tables

Table 1. FMT observations during 2010.

FMT-ICA			FLARE-EVENT LIST		
'Date'	'Start Obs.'	'Stop Obs.'	'Start time'	'End time'	'Goes-class'
'17-Mar-2010'	'13:52:19'	'23:15:19'			
'18-Mar-2010'	'16:43:20'	'20:32:40'			
'19-Mar-2010'	'13:32:39'	'18:33:39'			
'20-Mar-2010'	'15:22:20'	'20:04:19'			
'21-Mar-2010'	'15:13:19'	'17:34:39'			
'Date'	'Start Obs.'	'Stop Obs.'	'Start time'	'End time'	'Goes-class'
'23-Apr-2010'	'14:08:19'	'23:53:40'			
'24-Apr-2010'	'14:42:20'	'17:41:59'			
'26-Apr-2010'	'19:42:00'	'22:04:59'			
'27-Apr-2010'	'15:33:00'	'17:29:39'			
'28-Apr-2010'	'15:41:19'	'17:22:59'			
'29-Apr-2010'	'15:37:59'	'17:52:39'			
'30-Apr-2010'	'14:12:19'	'16:56:40'			
'Date'	'Start Obs.'	'Stop Obs.'	'Start time'	'End time'	'Goes-class'
'01-May-2010'	'15:07:40'	'17:43:20'			
'03-May-2010'	'17:47:19'	'22:35:59'			
'04-May-2010'	'15:27:40'	'18:06:19'	'16:24'	'16:46'	'C3.6'
'05-May-2010'	'15:23:39'	'22:03:59'			
'07-May-2010'	'15:50:39'	'18:00:00'			
'08-May-2010'	'15:32:40'	'18:00:39'			
'10-May-2010'	'20:08:40'	'22:29:20'			
'11-May-2010'	'13:39:19'	'15:07:39'			
'13-May-2010'	'15:22:59'	'19:51:00'			
'14-May-2010'	'16:28:00'	'23:01:59'			
'17-May-2010'	'15:53:20'	'18:38:40'			
'19-May-2010'	'16:20:00'	'22:15:40'			
'20-May-2010'	'17:02:20'	'22:14:00'			
'21-May-2010'	'14:50:00'	'22:12:20'			
'25-May-2010'	'16:58:19'	'18:49:20'			
'29-May-2010'	'13:03:59'	'18:02:19'			
'Date'	'Start Obs.'	'Stop Obs.'	'Start time'	'End time'	'Goes-class'
'01-Jun-2010'	'20:36:20'	'22:14:39'			
'02-Jun-2010'	'19:43:39'	'22:13:39'			
'03-Jun-2010'	'16:55:20'	'22:14:19'			
'04-Jun-2010'	'14:51:39'	'21:59:00'			
'05-Jun-2010'	'14:36:59'	'22:13:40'			
'07-Jun-2010'	'14:52:19'	'22:15:40'			
'08-Jun-2010'	'16:38:19'	'22:15:39'			
'15-Jun-2010'	'21:10:59'	'22:21:20'			
'16-Jun-2010'	'17:24:20'	'22:18:20'			
'17-Jun-2010'	'15:53:19'	'22:19:00'			
'21-Jun-2010'	'17:20:39'	'22:24:59'			
'22-Jun-2010'	'16:59:00'	'19:22:39'			
'26-Jun-2010'	'15:40:39'	'22:16:40'			
'30-Jun-2010'	'15:13:20'	'16:44:20'			
'Date'	'Start Obs.'	'Stop Obs.'	'Start time'	'End time'	'Goes-class'
'06-Jul-2010'	'17:44:39'	'22:20:19'			
'07-Jul-2010'	'17:24:39'	'22:19:20'			
'08-Jul-2010'	'15:06:39'	'18:06:00'			
'09-Jul-2010'	'15:51:59'	'18:24:59'			
'10-Jul-2010'	'14:41:59'	'17:31:59'			
'13-Jul-2010'	'17:00:00'	'18:33:39'			
'14-Jul-2010'	'14:54:40'	'19:00:40'			
'16-Jul-2010'	'20:07:20'	'22:22:19'			
'17-Jul-2010'	'15:16:40'	'17:36:39'	'17:27'	'18:20'	'C2.4'
'20-Jul-2010'	'17:13:19'	'18:05:40'			
'22-Jul-2010'	'21:19:59'	'22:23:00'	'21:30'	'21:45'	'B9.8'

'26-Jul-2010'	'16:46:19'	'17:50:19'			
'27-Jul-2010'	'15:15:40'	'17:55:40'			
'30-Jul-2010'	'16:42:20'	'19:08:40'			
'31-Jul-2010'	'14:57:20'	'16:47:19'			
'Date'	'Start Obs.'	'Stop Obs.'	'Start time'	'End time'	'Goes-class'
'02-Aug-2010'	'16:00:39'	'22:22:20'			
'03-Aug-2010'	'15:51:20'	'18:54:40'			
'04-Aug-2010'	'17:29:39'	'18:19:20'			
'05-Aug-2010'	'17:01:20'	'18:47:40'			
'10-Aug-2010'	'16:52:59'	'17:29:00'	'16:41'	'17:12'	'B8.1'
'17-Aug-2010'	'18:07:39'	'19:50:39'			
'23-Aug-2010'	'21:03:20'	'22:46:20'			
'24-Aug-2010'	'19:55:59'	'20:07:59'			
'27-Aug-2010'	'15:35:00'	'19:44:39'			
'Date'	'Start Obs.'	'Stop Obs.'	'Start time'	'End time'	'Goes-class'
'07-Sep-2010'	'14:27:40'	'19:50:39'			
'10-Sep-2010'	'13:50:19'	'21:58:59'			
'14-Sep-2010'	'17:10:19'	'19:46:20'			
'16-Sep-2010'	'21:29:59'	'23:34:39'			
'17-Sep-2010'	'14:45:40'	'19:22:19'			
'20-Sep-2010'	'15:56:19'	'21:40:00'	'19:34'	'19:43'	'C2.1'
			'20:59'	'21:05'	'C1.2'
'22-Sep-2010'	'18:06:39'	'21:12:00'			
'24-Sep-2010'	'15:41:19'	'21:50:20'			
'29-Sep-2010'	'15:02:22'	'21:31:00'			
'30-Sep-2010'	'14:20:19'	'17:00:19'			
'Date'	'Start Obs.'	'Stop Obs.'	'Start time'	'End time'	'Goes-class'
'01-Oct-2010'	'14:36:59'	'16:37:00'			
'04-Oct-2010'	'15:14:19'	'17:50:40'	'16:34'	'16:38'	'C2.3'
'05-Oct-2010'	'16:25:59'	'22:05:00'			
'07-Oct-2010'	'14:41:39'	'22:09:19'			
'11-Oct-2010'	'14:13:20'	'21:01:00'			
'13-Oct-2010'	'15:25:19'	'19:46:20'			
'16-Oct-2010'	'15:40:19'	'18:29:00'	'16:53'	'17:06'	'B7.2'
'18-Oct-2010'	'14:28:40'	'22:01:39'			
'19-Oct-2010'	'16:09:19'	'18:51:19'			
'20-Oct-2010'	'15:47:40'	'17:39:59'			
'21-Oct-2010'	'20:52:40'	'22:03:20'			
'22-Oct-2010'	'21:12:19'	'22:56:39'			
'23-Oct-2010'	'15:49:19'	'22:23:40'			
'24-Oct-2010'	'16:06:00'	'22:19:40'			
'25-Oct-2010'	'15:15:19'	'22:29:00'	'21:46'	'22:00'	'B6.9'
			'22:06'	'22:18'	'C1.1'
'26-Oct-2010'	'14:26:39'	'22:09:00'			
'27-Oct-2010'	'15:13:19'	'22:36:20'	'17:03'	'17:08'	'C1.2'
'28-Oct-2010'	'20:06:00'	'22:38:19'			
'29-Oct-2010'	'16:25:40'	'22:49:39'			
'30-Oct-2010'	'15:15:39'	'22:30:59'			
'Date'	'Start Obs.'	'Stop Obs.'	'Start time'	'End time'	'Goes-class'
'01-Nov-2010'	'15:31:00'	'20:11:39'			
'02-Nov-2010'	'16:07:19'	'22:49:19'			
'03-Nov-2010'	'16:11:19'	'22:48:00'	'20:41'	'22:21'	'B6.5'
'04-Nov-2010'	'14:43:59'	'22:36:00'	'15:56'	'16:09'	'B6.5'
			'20:55'	'21:29'	'B5.5'
			'21:58'	'22:15'	'B5.8'
'05-Nov-2010'	'14:50:40'	'22:47:40'	'20:12'	'20:16'	'B6.2'
'06-Nov-2010'	'15:12:40'	'20:46:19'	'15:32'	'17:11'	'M5.4'
'08-Nov-2010'	'14:20:04'	'21:28:00'			
'09-Nov-2010'	'14:30:59'	'22:47:00'			
'10-Nov-2010'	'15:10:20'	'22:54:40'	'16:38'	'16:45'	'B9.0'
			'22:51'	'22:54'	'B6.0'
'11-Nov-2010'	'14:58:29'	'22:21:40'	'16:10'	'16:51'	'C4.3'

			'18:59'	'19:08'	'B9.4'
			'19:27'	'19:37'	'C1.1'
			'20:51'	'20:55'	'B9.0'
'12-Nov-2010'	'14:46:59'	'22:28:05'			
'13-Nov-2010'	'13:40:05'	'22:55:19'	'17:10'	'17:19'	'B5.7'
'15-Nov-2010'	'14:31:00'	'22:56:00'	'14:36'	'14:48'	'B7.6'
			'22:25'	'22:34'	'B8.3'
'16-Nov-2010'	'14:05:39'	'23:08:00'			
'17-Nov-2010'	'14:03:20'	'23:06:00'			
'18-Nov-2010'	'14:00:29'	'23:12:20'			
'19-Nov-2010'	'13:59:50'	'22:53:19'			
'20-Nov-2010'	'15:23:59'	'22:58:20'			
'21-Nov-2010'	'15:08:09'	'22:52:40'			
'22-Nov-2010'	'20:31:20'	'22:45:20'			
'23-Nov-2010'	'21:56:59'	'22:56:20'			
'25-Nov-2010'	'15:06:05'	'23:03:19'			
'26-Nov-2010'	'17:27:40'	'20:28:19'			
'27-Nov-2010'	'16:07:04'	'23:01:40'			
'28-Nov-2010'	'20:36:05'	'23:03:19'			
'29-Nov-2010'	'14:13:34'	'23:07:39'			
'30-Nov-2010'	'14:03:35'	'23:04:19'	'20:36'	'20:55'	'B8.1'
'Date'	'Start Obs.'	'Stop Obs.'	'Start time'	'End time'	'Goes-class'
'01-Dec-2010'	'14:18:04'	'23:04:00'	'18:36'	'18:51'	'B6.1'
'02-Dec-2010'	'14:05:05'	'22:04:19'			

Table 2. FMT observations during 2011.

FMT-ICA			FLARE-EVENT LIST		
'Date'	'Start Obs.'	'Stop Obs.'	'Start time'	'End time'	'Goes-class'
'25-Jan-2011'	'14:54:20'	'23:06:59'			
'28-Jan-2011'	'14:16:35'	'19:58:00'	'16:11'	'16:17'	'B2.4'
			'17:54'	'18:04'	'B6.2'
'31-Jan-2011'	'16:08:19'	'17:42:00'			
'Date'	'Start Obs.'	'Stop Obs.'	'Start time'	'End time'	'Goes-class'
'01-Feb-2011'	'13:43:35'	'20:01:20'			
'02-Feb-2011'	'14:16:05'	'20:59:40'			
'03-Feb-2011'	'14:14:19'	'21:10:39'	'17:28'	'17:41'	'B2.0'
'04-Feb-2011'	'14:01:04'	'21:33:19'	'17:30'	'17:40'	'B1.3'
			'19:30'	'19:48'	'B6.9'
'05-Feb-2011'	'14:35:04'	'16:41:59'			
'07-Feb-2011'	'14:20:04'	'17:58:20'			
'08-Feb-2011'	'14:33:04'	'18:10:20'	'14:44'	'14:52'	'B5.0'
'09-Feb-2011'	'15:01:05'	'18:12:20'	'16:19'	'16:34'	'B8.6'
'10-Feb-2011'	'14:10:04'	'17:08:39'	'14:38'	'14:47'	'B6.7'
'11-Feb-2011'	'13:10:04'	'19:10:20'			
'12-Feb-2011'	'14:20:24'	'18:27:40'	'14:30'	'15:21'	'C2.6'
			'16:17'	'16:22'	'B1.2'
			'17:26'	'17:41'	'B5.6'
'15-Feb-2011'	'14:25:04'	'21:30:00'	'14:32'	'14:51'	'C4.8'
			'18:07'	'18:57'	'C1.7'
			'19:30'	'20:53'	'C6.6'
'16-Feb-2011'	'13:41:05'	'19:15:39'	'14:19'	'14:29'	'M1.6'
			'15:27'	'15:37'	'C7.7'
'17-Feb-2011'	'14:49:04'	'16:17:00'	'15:49'	'16:04'	'C1.3'
'19-Feb-2011'	'14:15:04'	'21:33:00'	'14:50'	'14:55'	'C1.0'
			'15:24'	'15:41'	'C1.5'
			'16:26'	'16:32'	'C1.9'
			'16:39'	'16:45'	'C6.1'
			'21:07'	'21:17'	'C1.9'
'21-Feb-2011'	'14:12:39'	'22:38:59'	'15:39'	'15:55'	'C1.5'
			'18:25'	'18:47'	'C1.4'
'22-Feb-2011'	'16:33:05'	'21:40:20'	'14:34'	'14:42'	'B2.7'
'25-Feb-2011'	'14:54:04'	'22:12:40'	'17:18'	'17:37'	'C1.1'
			'18:57'	'19:04'	'B4.5'
'26-Feb-2011'	'14:44:05'	'23:09:40'	'14:34'	'16:42'	'B8.3'
			'19:20'	'19:26'	'B3.9'
			'20:46'	'20:52'	'B4.3'
'28-Feb-2011'	'14:27:04'	'22:16:00'	'15:44'	'15:59'	'C1.0'
			'20:11'	'20:19'	'B7.3'
			'21:15'	'21:46'	'C1.7'
'Date'	'Start Obs.'	'Stop Obs.'	'Start time'	'End time'	'Goes-class'
'01-Mar-2011'	'12:53:04'	'23:15:00'	'14:35'	'14:40'	'C1.1'
			'16:25'	'16:59'	'C1.0'
			'17:42'	'17:54'	'C1.3'
			'18:06'	'18:26'	'C1.0'
			'18:51'	'18:58'	'B9.8'
			'19:34'	'20:17'	'C1.6'
'02-Mar-2011'	'13:08:39'	'23:59:00'	'13:11'	'13:21'	'C1.4'
'03-Mar-2011'	'14:19:05'	'22:52:00'	'14:12'	'14:31'	'C5.4'
			'19:24'	'19:44'	'C1.2'
			'20:27'	'21:02'	'C2.7'
'04-Mar-2011'	'14:42:15'	'17:01:04'	'17:15'	'17:23'	'C1.0'
'05-Mar-2011'	'14:26:05'	'21:55:40'	'14:22'	'14:30'	'C1.0'
			'20:05'	'20:16'	'C1.4'
			'20:51'	'21:53'	'C2.9'
'07-Mar-2011'	'13:37:04'	'21:59:59'	'13:45'	'14:56'	'M1.9'
			'16:05'	'16:12'	'C5.1'

			'18:18'	'18:41'	'C7.6'
			'19:43'	'20:58'	'M3.7'
			'21:45'	'21:55'	'M1.5'
'08-Mar-2011'	'13:51:05'	'22:36:59'	'18:08'	'18:41'	'M4.4'
			'19:46'	'21:19'	'M1.4'
'09-Mar-2011'	'13:39:05'	'23:07:20'	'13:17'	'14:13'	'M1.7'
			'15:42'	'15:53'	'C2.6'
			'16:42'	'16:53'	'C2.7'
			'20:56'	'21:25'	'C5.0'
			'21:35'	'21:45'	'C2.9'
			'22:03'	'22:14'	'C9.4'
'10-Mar-2011'	'13:13:05'	'22:42:40'	'13:19'	'13:34'	'C4.2'
			'13:42'	'13:50'	'C4.7'
			'14:21'	'14:28'	'C2.0'
			'19:00'	'19:17'	'C4.0'
'12-Mar-2011'	'16:39:05'	'19:06:40'	'16:26'	'16:45'	'C1.6'
			'17:32'	'17:44'	'C1.2'
			'17:58'	'18:04'	'C1.0'
'14-Mar-2011'	'16:32:04'	'22:52:00'	'18:42'	'18:55'	'B7.6'
			'19:14'	'19:23'	'B6.6'
			'19:30'	'19:54'	'M4.2'
'15-Mar-2011'	'13:35:35'	'21:29:59'	'17:28'	'17:39'	'C2.9'
			'18:58'	'19:04'	'B5.6'
'16-Mar-2011'	'13:59:05'	'19:55:40'	'17:12'	'18:40'	'C3.7'
'22-Mar-2011'	'13:33:34'	'16:05:40'	'15:42'	'16:02'	'C2.5'
'24-Mar-2011'	'15:50:35'	'19:55:40'	'16:55'	'17:00'	'B6.6'
			'17:01'	'17:10'	'C9.1'
			'17:15'	'17:21'	'B9.6'
			'18:23'	'18:29'	'B8.4'
			'18:51'	'19:14'	'C1.3'
'25-Mar-2011'	'13:56:05'	'22:00:20'	'16:47'	'17:22'	'C1.0'
'26-Mar-2011'	'14:10:34'	'20:43:59'	'14:42'	'14:47'	'B6.6'
'27-Mar-2011'	'15:29:30'	'19:10:20'	'15:54'	'15:59'	'B7.4'
			'16:58'	'17:05'	'C1.1'
			'18:09'	'18:18'	'B7.1'
'28-Mar-2011'	'13:20:04'	'20:19:59'	'18:52'	'19:02'	'B9.0'
'29-Mar-2011'	'14:40:05'	'21:08:19'	'21:21'	'21:59'	'C1.2'
'30-Mar-2011'	'14:26:34'	'21:52:59'	'19:42'	'20:13'	'C1.9'
'31-Mar-2011'	'14:13:34'	'22:28:39'	'15:26'	'15:46'	'C2.6'
			'21:35'	'21:47'	'B7.0'
'Date'	'Start Obs.'	'Stop Obs.'	'Start time'	'End time'	'Goes-class'
'01-Apr-2011'	'13:41:09'	'16:55:00'			
'08-Apr-2011'	'14:54:04'	'20:08:40'	'18:16'	'18:32'	'B7.4'
'09-Apr-2011'	'14:13:04'	'19:32:39'	'14:48'	'15:58'	'C1.3'
'11-Apr-2011'	'15:30:09'	'20:17:59'	'15:53'	'16:19'	'C1.2'
			'16:52'	'17:11'	'B4.6'
'12-Apr-2011'	'14:26:04'	'17:37:00'	'17:52'	'18:02'	'B9.7'
'14-Apr-2011'	'16:07:09'	'22:36:00'	'17:07'	'17:13'	'C1.1'
			'18:37'	'18:43'	'B9.8'
			'18:56'	'19:01'	'B8.2'
			'19:57'	'20:12'	'C1.7'
			'20:17'	'20:22'	'B9.3'
			'21:11'	'21:27'	'C1.1'
'15-Apr-2011'	'13:51:05'	'21:19:39'	'14:42'	'14:57'	'C2.0'
			'16:08'	'16:19'	'C1.6'
			'17:02'	'17:28'	'M1.3'
'16-Apr-2011'	'14:03:54'	'18:11:39'	'16:11'	'16:17'	'B6.8'
			'16:34'	'17:08'	'C3.7'
'20-Apr-2011'	'14:25:09'	'22:03:19'	'17:38'	'19:06'	'C1.5'
			'19:30'	'19:49'	'C4.0'
'25-Apr-2011'	'14:34:04'	'22:15:40'	'16:01'	'16:08'	'B8.1'
			'22:12'	'22:27'	'B9.3'

'26-Apr-2011'	'13:56:30'	'22:27:59'	'22:10'	'22:22'	'B4.4'
'27-Apr-2011'	'13:57:05'	'22:31:00'			
'28-Apr-2011'	'13:45:05'	'22:37:40'	'21:06'	'21:18'	'B8.2'
'29-Apr-2011'	'13:49:04'	'22:26:40'	'20:40'	'20:58'	'C1.8'
'30-Apr-2011'	'13:27:04'	'22:13:59'	'21:54'	'22:00'	'B6.4'
			'22:09'	'22:15'	'B6.6'
'Date'	'Start Obs.'	'Stop Obs.'	'Start time'	'End time'	'Goes-class'
'03-May-2011'	'16:13:10'	'19:00:00'	'18:44'	'18:57'	'B4.1'
'04-May-2011'	'14:13:35'	'22:28:39'	'16:55'	'18:25'	'B6.8'
'05-May-2011'	'13:41:04'	'22:20:40'	'17:42'	'17:50'	'B2.9'
			'20:37'	'20:51'	'B4.2'
'06-May-2011'	'14:27:10'	'22:17:00'			
'07-May-2011'	'14:45:05'	'22:35:19'	'15:30'	'15:49'	'B3.3'
'09-May-2011'	'14:07:05'	'22:31:59'	'17:29'	'17:54'	'C1.5'
			'20:42'	'21:19'	'C5.4'
'10-May-2011'	'13:13:35'	'14:31:00'			
'11-MAY-2011'	'13:42:05'	'22:38:20'	'20:28'	'20:54'	'B3.2'
'12-May-2011'	'17:43:04'	'21:40:59'			
'13-May-2011'	'15:15:40'	'22:39:20'	'21:35'	'21:50'	'B2.2'
'14-May-2011'	'14:24:34'	'22:39:20'			
'16-May-2011'	'15:19:15'	'22:30:40'	'22:11'	'22:27'	'B3.5'
			'23:19'	'23:27'	'B3.0'
'17-May-2011'	'13:07:20'	'22:29:20'	'20:15'	'20:38'	'B5.3'
'18-May-2011'	'13:52:05'	'22:24:59'	'16:33'	'16:41'	'B2.0'
			'18:02'	'19:50'	'C2.0'
'19-May-2011'	'14:12:35'	'22:21:40'			
'20-May-2011'	'14:06:35'	'22:38:39'			
'21-May-2011'	'15:12:14'	'22:28:40'	'16:06'	'16:30'	'B1.1'
			'19:25'	'19:33'	'B2.7'
'Date'	'Start Obs.'	'Stop Obs.'	'Start time'	'End time'	'Goes-class'
13-Jul-2011'	'22:02:20'	'22:25:00'			
'Date'	'Start Obs.'	'Stop Obs.'	'Start time'	'End time'	'Goes-class'
'04-Ago-2011'	'21:53:39'	'22:37:40'			
'09-Ago-2011'	'15:49:05'	'22:18:40'	'15:43'	'16:04'	'C2.4'
			'16:58'	'17:05'	'B8.6'
			'18:04'	'18:42'	'C2.0'
'10-Ago-2011'	'17:51:40'	'22:29:59'	'20:35'	'20:41'	'C1.1'
'16-Ago-2011'	'14:20:49'	'22:15:19'	'15:39'	'15:48'	'B4.2'
			'17:24'	'17:34'	'B3.8'
'18-Ago-2011'	'18:42:04'	'22:43:40'			
'19-Ago-2011'	'17:05:04'	'22:42:20'			
'20-Ago-2011'	'14:06:59'	'22:19:00'			
'22-Ago-2011'	'15:21:35'	'22:29:59'			
'23-Ago-2011'	'16:27:04'	'22:30:59'			
'24-Ago-2011'	'14:55:04'	'22:34:59'	'16:29'	'16:40'	'C1.1'
			'16:44'	'16:55'	'B5.0'
			'17:32'	'17:38'	'B5.5'
			'18:17'	'18:22'	'B4.5'
			'20:12'	'20:18'	'B4.3'
'31-Ago-2011'	'14:59:53'	'22:35:00'			
'Date'	'Start Obs.'	'Stop Obs.'	'Start time'	'End time'	'Goes-class'
'01-Sep-2011'	'15:44:04'	'22:48:00'	'18:13'	'18:30'	'C2.2'
'02-Sep-2011'	'14:34:30'	'22:30:00'			
'03-Sep-2011'	'15:37:04'	'22:31:30'	'17:32'	'17:39'	'C2.5'
			'18:42'	'18:49'	'C1.2'
			'20:04'	'20:14'	'C1.2'
			'22:08'	'22:14'	'C1.6'
'05-Sep-2011'	'15:18:04'	'22:39:00'			
'06-Sep-2011'	'14:54:35'	'22:46:20'	'22:12'	'22:24'	'X2.1'
'07-Sep-2011'	'14:08:34'	'22:57:40'	'14:45'	'14:51'	'B7.9'
			'18:24'	'18:33'	'B9.1'
			'19:55'	'20:19'	'C3.0'

			'22:13'	'22:26'	'C1.6'
			'22:15'	'23:48'	'X1.8'
'09-Sep-2011'	'15:01:04'	'22:35:40'	'14:42'	'15:24'	'C3.2'
			'20:04'	'20:10'	'B8.7'
'10-Sep-2011'	'14:48:00'	'22:15:39'	'17:16'	'17:21'	'B8.1'
			'17:16'	'17:31'	'C1.2'
'12-Sep-2011'	'13:54:05'	'22:36:59'	'20:30'	'21:51'	'C9.9'
'13-Sep-2011'	'15:32:19'	'23:33:19'	'17:27'	'18:21'	'C1.5'
'14-Sep-2011'	'13:50:19'	'22:00:00'	'15:00'	'15:07'	'B9.6'
			'15:57'	'16:14'	'C1.8'
			'16:16'	'16:48'	'C4.2'
			'20:42'	'20:54'	'C9.2'
'15-Sep-2011'	'14:55:24'	'22:15:59'	'16:18'	'16:41'	'C3.0'
			'18:27'	'18:38'	'C1.0'
			'20:32'	'20:43'	'C1.3'
			'21:09'	'21:19'	'C2.6'
'16-Sep-2011'	'16:41:40'	'22:29:00'	'17:09'	'17:27'	'C2.2'
			'17:30'	'18:27'	'C1.4'
			'18:40'	'18:47'	'C2.2'
			'19:26'	'19:33'	'C1.5'
			'22:09'	'22:45'	'C1.4'
'19-Sep-2011'	'14:21:40'	'22:30:00'	'15:35'	'15:47'	'C6.9'
			'18:34'	'18:54'	'C1.3'
'20-Sep-2011'	'14:47:39'	'22:26:59'	'15:45'	'16:57'	'C1.5'
			'17:35'	'17:50'	'C1.6'
			'19:23'	'20:14'	'C2.7'
			'21:38'	'21:46'	'C3.0'
'21-Sep-2011'	'14:12:00'	'22:35:00'	'14:37'	'14:54'	'C2.7'
			'15:21'	'15:30'	'C2.8'
			'16:13'	'16:20'	'C2.3'
			'16:47'	'16:51'	'C2.1'
			'20:31'	'20:40'	'C2.0'
'23-Sep-2011'	'14:35:40'	'17:41:59'	'15:01'	'15:08'	'C2.1'
'24-Sep-2011'	'15:16:39'	'22:35:00'	'16:36'	'17:15'	'M1.7'
			'17:19'	'17:31'	'M3.1'
			'17:59'	'18:24'	'M2.8'
			'19:09'	'19:41'	'M3.0'
			'20:29'	'20:42'	'M5.8'
			'21:03'	'21:45'	'M1.2'
'26-Sep-2011'	'13:55:19'	'22:25:00'	'14:31'	'15:36'	'M2.6'
			'16:43'	'17:06'	'C4.8'
			'20:04'	'20:09'	'C1.8'
'27-Sep-2011'	'14:15:59'	'21:59:59'	'18:05'	'18:22'	'C1.1'
			'20:44'	'21:11'	'C6.4'
'28-Sep-2011'	'13:51:59'	'22:00:00'			
'29-Sep-2011'					
'30-Sep-2011'	'14:29:59'	'23:17:40'	'18:42'	'18:53'	'C3.4'
			'18:52'	'19:35'	'M1.0'
			'20:37'	'20:48'	'C1.1'
'Date'	'Start Obs.'	'Stop Obs.'	'Start time'	'End time'	'Goes-class'
'01-Oct-2011'	'17:54:00'	'22:30:00'			
'03-Oct-2011'	'13:53:50'	'22:03:00'			
'04-Oct-2011'	'15:18:00'	'22:30:00'			
'05-Oct-2011'	'19:19:10'	'22:30:00'			
'06-Oct-2011'	'14:56:52'	'22:38:00'	'21:19'	'21:25'	'B8.5'
			'22:06'	'22:13'	'C1.2'
'07-Oct-2011'	'13:48:00'	'22:26:05'	'18:53'	'19:01'	'C2.6'
			'19:53'	'20:00'	'B6.7'
'10-Oct-2011'	'16:25:00'	'22:18:03'			
'11-Oct-2011'	'17:04:42'	'22:31:30'	'19:21'	'19:39'	'B6.1'
'15-Oct-2011'	'14:53:00'	'21:57:00'	'16:10'	'16:26'	'C2.3'
			'17:24'	'17:43'	'C1.3'

			'18:13'	'18:25'	'C1.5'
			'20:35'	'20:56'	'C3.9'
'17-Oct-2011'	'15:59:00'	'21:13:04'	'18:05'	'18:13'	'C1.9'
'19-Oct-2011'	'14:12:30'	'22:00:00'	'16:31'	'16:37'	'C2.4'
			'18:45'	'18:51'	'C3.4'
			'19:55'	'20:00'	'C1.7'
			'20:31'	'20:39'	'C3.5'
'20-Oct-2011'	'16:20:00'	'22:37:00'			
'21-Oct-2011'	'14:30:30'	'22:44:40'	'17:00'	'17:10'	'C2.7'
'22-Oct-2011'	'13:48:00'	'22:30:00'	'15:14'	'15:29'	'C4.1'
			'19:11'	'19:23'	'C2.2'
			'20:39'	'20:47'	'C1.7'
'25-Oct-2011'	'17:06:00'	'22:22:00'	'20:01'	'20:35'	'C1.7'
			'22:30'	'22:41'	'B7.3'
'Date'	'Start Obs.'	'Stop Obs.'	'Start time'	'End time'	'Goes-class'
'16-Nov-2011'	'16:27:00'	'20:53:00'	'18:49'	'19:00'	'C2.9'
			'19:47'	'19:57'	'C5.2'
			'21:37'	'21:49'	'C1.6'
'17-Nov-2011'	'14:03:00'	'21:05:20'	'15:53'	'16:16'	'C2.0'
'18-Nov-2011'	'17:24:00'	'22:15:00'	'17:07'	'17:56'	'C2.7'
			'19:04'	'19:12'	'C2.0'
'19-Nov-2011'	'14:16:00'	'22:03:00'	'19:48'	'20:03'	'C3.9'
			'20:47'	'20:56'	'C1.6'
			'22:19'	'22:35'	'C4.5'
'20-Nov-2011'	'15:19:00'	'20:55:00'	'15:21'	'15:34'	'C1.2'
			'16:11'	'16:19'	'C1.0'
			'16:35'	'17:07'	'C6.1'
			'17:54'	'18:00'	'C1.4'
'21-Nov-2011'	'15:19:00'	'22:31:19'	'15:56'	'16:07'	'B8.0'
			'18:19'	'18:36'	'C1.3'
'24-Nov-2011'	'14:16:00'	'22:39:40'	'18:53'	'19:00'	'B5.3'
			'20:12'	'20:39'	'C1.2'
			'21:14'	'21:21'	'C1.2'
'25-Nov-2011'	'15:33:00'	'22:39:44'	'17:14'	'17:25'	'C1.1'
			'21:49'	'22:08'	'C2.4'
'26-Nov-2011'	'15:21:00'	'22:12:45'	'15:00'	'15:31'	'C1.3'
			'16:14'	'16:17'	'C1.1'
			'17:12'	'17:34'	'C1.0'
'28-Nov-2011'	'14:21:00'	'22:22:12'	'14:56'	'15:07'	'C1.2'
			'18:22'	'18:39'	'C3.2'
			'21:41'	'21:53'	'C1.2'
'29-Nov-2011'	'14:24:00'	'22:26:00'	'15:42'	'15:48'	'B9.6'
			'21:57'	'22:03'	'B8.0'
			'22:22'	'22:29'	'C1.1'
'30-Nov-2011'	'13:40:00'	'22:13:00'	'20:20'	'20:39'	'C3.8'
			'21:53'	'22:48'	'C3.6'
'Date'	'Start Obs.'	'Stop Obs.'	'Start time'	'End time'	'Goes-class'
'01-Dec-2011'	'15:21:00'	'22:05:00'	'20:27'	'20:37'	'C1.1'
'02-Dec-2011'	'15:13:00'	'20:18:40'			
'03-Dec-2011'	'14:21:00'	'22:19:40'	'21:15'	'21:24'	'C1.3'
'04-Dec-2011'	'14:04:00'	'20:02:40'	'16:05'	'16:22'	'C4.8'
			'19:37'	'20:03'	'C1.3'
'05-Dec-2011'	'14:50:00'	'22:17:00'	'15:14'	'15:20'	'C4.7'
			'18:06'	'18:12'	'B9.6'
			'19:04'	'19:11'	'C2.5'
'06-Dec-2011'	'16:22:00'	'18:33:00'			
'07-Dec-2011'	'13:53:00'	'22:15:00'	'15:34'	'15:45'	'C1.3'
			'20:07'	'20:18'	'C2.7'
'09-Dec-2011'	'14:46:00'	'22:00:00'			
'10-Dec-2011'	'14:16:00'	'19:53:00'			
'12-Dec-2011'	'12:32:00'	'20:55:00'	'13:35'	'13:45'	'B8.0'
			'18:55'	'19:02'	'B9.3'

			'20:36'	'20:54'	'B8.6'
'13-Dec-2011'	'15:26:00'	'15:55:00'			
'15-Dec-2011'	'13:09:00'	'17:00:00'			
'16-Dec-2011'	'14:37:00'	'19:44:00'			
'17-Dec-2011'	'14:20:00'	'21:48:00'	'21:35'	'21:40'	'B4.3'
'19-Dec-2011'	'14:05:00'	'22:30:00'	'14:05'	'14:15'	'B8.1'
			'21:23'	'21:32'	'B6.2'
'20-Dec-2011'	'14:38:00'	'17:23:00'			
'21-Dec-2011'	'14:06:00'	'18:57:00'	'15:21'	'15:33'	'C2.5'
			'18:07'	'18:17'	'C1.9'

Table 3. FMT observations during 2012.

FMT-ICA			FLARE-EVENT LIST		
'Date'	'Start Obs.'	'Stop Obs.'	'Start time'	'End time'	'Goes-class'
'03-Jan-2012'	'14:48:15'	'18:49:00'			
'04-Jan-2012'	'14:12:35'	'19:09:40'			
'06-Jan-2012'	'15:07:59'	'17:34:00'	'17:03'	'17:09'	'B6.8'
			'17:16'	'17:22'	'C1.4'
'09-Jan-2012'	'15:15:39'	'19:29:40'	'17:15'	'17:21'	'C1.3'