



RAPPORTO TECNICO - TECHNICAL REPORT

METIS INSTRUMENT PROPOSAL

for the Solar Orbiter Mission

Part 5: Management Plan

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for the
Solar Orbiter Mission

Part V
MANAGEMENT PLAN

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1 General Introduction

Scope of this document is to describe the management scheme and plan proposed for the METIS investigation.

In this documents are included the personnel roles, contributions and activities, and the list of the affiliate institutes and agencies.

2 Instrument Organization and Responsibilities

The METIS investigation is proposed by an International Consortium under the responsibility of the Principal Investigator, Ester Antonucci, INAF-Osservatorio Astronomico di Torino. Experiment Manager of the METIS project is Giampiero Naletto, University of Padua and the METIS Investigation Scientist is Silvano Fineschi, INAF-Osservatorio Astronomico di Torino. The METIS elements are in turn under the leadership of the following Co-PIs: Marco Romoli, University of Florence (COR), Daniele Spadaro, INAF- Osservatorio Astrofisico di Catania (EUS) and Dan Moses, Naval Research Laboratory, US (SOCS).

The METIS proposal is endorsed by the Italian Space Agency (ASI) as Leading Funding Agency.

The project top level organization is represented in Figure 1. Since the instrument is a suite of three different elements, for the instrument suite and for element of the suite the same organizational structure has been adopted. The structure consists of:

- Pi, Investigation Scientist and Instrument Scientist at instrument suite level;
- and Co-Pi, Investigation scientist and Instrument Scientist at element level.

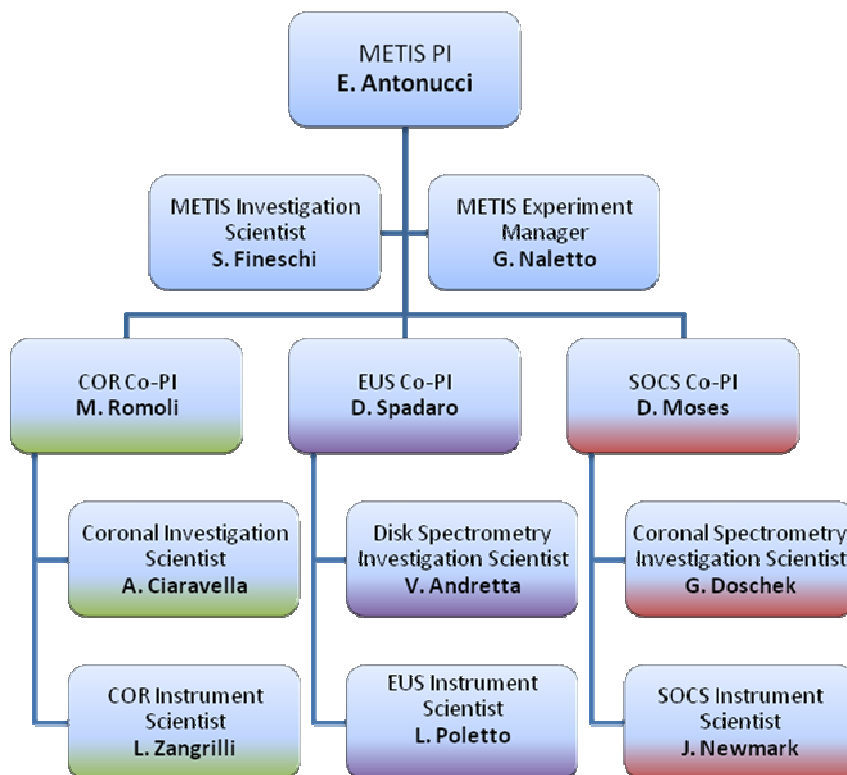


Figure 1: METIS top level organizational chart

METIS PI duties are in line with the requirements listed in [AD-1] and specifically she shall be responsible for:

- Sole managerial and decision making authority interfacing with the ESA Solar Orbiter Project Office.
- Appointing an instrument development manager to manage the day to day activities of the instrument development team.

- c) Providing financial control in order to assure necessary resources to achieve the agreed delivery dates of all deliverables including technical data and instrument models.
- d) Providing instrument support to system level anomaly investigations, tests, reviews, operations and scientific activities arranged by ESA.
- e) Creating and maintaining a EID Part B which details the instrument design and interfaces answering requirements stated in the EID part A.
- f) Ensuring compliance with all ITAR regulations in a timely manner. Surveillance requirements arising from ITAR regulations shall be reported to ESA and any costs associated with such requirements shall be borne by the PI.
- g) Support and attendance to Science Working Team meetings as called by the ESA Project Scientist. As far as scientific requirements are concerned the PIs are committed to the Science Working Team to whom the Science Performance Reports submitted on regular basis (at every project review).

METIS Investigation Scientist shall support the PI in the coordination, at the level of the overall METIS investigation,

- the definition of the instrument suite parameters and performances, and ensure
- the compatibility of instrument performances and scientific requirements, as derived from the scientific objectives,
- the scientific operations and data handling are compliant with the scientific objectives identified for the METIS investigation

METIS Experiment Manager shall

- establish in coordination with the PI an efficient management scheme
- manage the day to day activities of the instrument development team
- support the PI in creating and maintaining a EID Part B which details the instrument design and interfaces answering requirements stated in the EID part A.

Each Elements Co-PI's shall ensure

- the coordination of the activities of development of the instrument element
- the coordination of the operations of the instrument element
- the interface with the other elements of the METIS suite
- to ensure the timely delivery of elements/element components for the integration of the instrument suite.
- *SOCS Co-PI shall deliver the SOCS element accordingly to the Master Instrument Schedule. The precise framework for this delivery will be defined in the NASA LOA for Solar Orbiter. An ASI – NASA LOA will be also established. The SOCS Co-PI will ensure the SOCS sensor meets the interface specification, the sensor performance specification, and instrument development flow defined in the SOCS-METIS Interface Control Document (ICD). A draft of the SOCS-METIS ICD (NRL document 7907-SICM-001) and draft language for the SOCS section of the NASA Solar Orbiter LOA have been collaboratively developed by the SOCS Co-PI and the METIS PI & EM. These are NRL documents during the proposal phase and will be submitted as a part of the NRL SOCS proposal to NASA. The SOCS-METIS ICD will be finalized during Phase A in accordance with the relevant LOA sections and will be under maintained under the METIS configuration control system*

Each Element Investigation Scientist shall ensure that

- the instrument element performances allow the implementation of the scientific requirements, as derived from the scientific objectives
- the scientific operations and data handling are compliant with the scientific objectives identified for the element investigation

Each Element Instrument Scientist shall coordinate

- the definition of the instrument element parameters and performances
- the development of the instrument element, at the component and system level (when applicable)
- integration and test activities at element level
- in flight commissioning and engineering and calibration operations

2.1 METIS Consortium

The consortium is formed the following Italian institutions: Istituto Nazionale di Astrofisica (INAF), the Universities of Florence, Padua, Pavia, Catania, the Consiglio Nazionale delle Ricerche – Istituto di Fisica della Materia (CNR-INFM), the Politecnico of Torino, and the following foreign institutions: Naval Research Laboratory (NRL), US, Max-Planck-Institut für Sonnensystemforschung (MPS), Lindau, Germany, Laboratoire d’Astrophysique de Marseille (LAM), France, the Institute d’Astrophysique Spatiale (IAS), France, University of Athens, Greece, Royal Observatory of Belgium, Bruxelles, Belgium and Mullard Space Science Laboratory, UK. In terms of hardware contributions, NRL intends to provide the SOCS optical bench and sensors MCP, and is submitting to NASA a proposal in response to the NASA Focused Opportunity for Solar Orbiter, FOSO (deadline 31 January 2008), MPS intends to provide the two detectors of the COR element, LAM intends to provide the mirrors and mountings for COR.

INAF is the leading scientific institute and ASI is the leading founding national space agency of METIS investigation consortium.

METIS consortium is detailed in Table 1 with their proposed contribution to the investigation in terms of activities and hardware.

For reference, in Figure 2 and Figure 3 and are shown the METIS HW tree and a preliminary WBS respectively.

Institute	Country	Activities	Contribution
Artep	USA	CHIANTI software	
CNR-INFM	I	Instrument Design, Instrument Development, Instrument AIV, Data reduction and scientific analysis	Instrument ML coatings
CNRS-IAS	F	Scientific Objectives Definition, Data reduction and scientific analysis, Scientific Operations	

Institute	Country	Activities	Contribution
INAF-IASF	I	Instrument (Detectors) Instrument AIV	Development
INAF-IFSI	I	Data reduction and scientific analysis	
INAF-OACN	I	EUS Scientific Investigation, Data reduction and scientific analysis Observing modes definition and planning Scientific Operations	
INAF-OACT	I	Co-PIship (EUS) Data reduction and scientific analysis Observing modes definition and planning Scientific Operations	
INAF-OAPa	I	COR investigation scientist, Data reduction and scientific analysis Scientific Operations	
INAF-OATo	I	PI-ship, METIS Scientific Investigation, COR Instr. Scientist, Observing modes definition and planning, Data Analysis SW, Data reduction and scientific analysis, Scientific Operations, Outreach	
INAF-OATs	I	Data Archival and Scientific Analysis	
LAM	F	Support to COR instrument development and design, Data reduction and scientific analysis, Instrument AIV	Optical components blanks and mounts
MPS	D	Instrument development, Instrument AIV, Observing modes definition and planning, Scientific Operations, Data reduction and scientific analysis	COR Detectors

Institute	Country	Activities	Contribution
MSSL	UK	Observing modes definition and planning, Scientific Operations, Data reduction and scientific analysis	
NRL	USA	Co-PIship (SOCS), SOCS Instr. Scientist, SOCS Scientific Investigation Instrument AIV, Theoretical modelling Scientific Operations	SOCS optical bench, UV detectors MPC
Politecnico of Torino	I	On board and Data analysis Software and compression	
Royal Observatory of Belgium	B	Observing modes definition and planning, Scientific Operations, Data reduction and scientific analysis	
University of Athene	GR	On board SW, Data reduction and scientific analysis	
University of Catania	I	Observing modes definition and planning, Data reduction and scientific analysis, Outreach	
University of Firenze	I	Co-PIship (COR), Instrument Development, Instrument Design, Scientific Requirements, Instrument AIV, Data reduction and scientific analysis Scientific Operations	
University of Padova	I	METIS Instrument Manager, Instrument Development, Instrument AIV Operations	COR Multi layers filters
University of Pavia	I	Instrument Development, Instrument AIV	

Table 1: METIS consortium composition

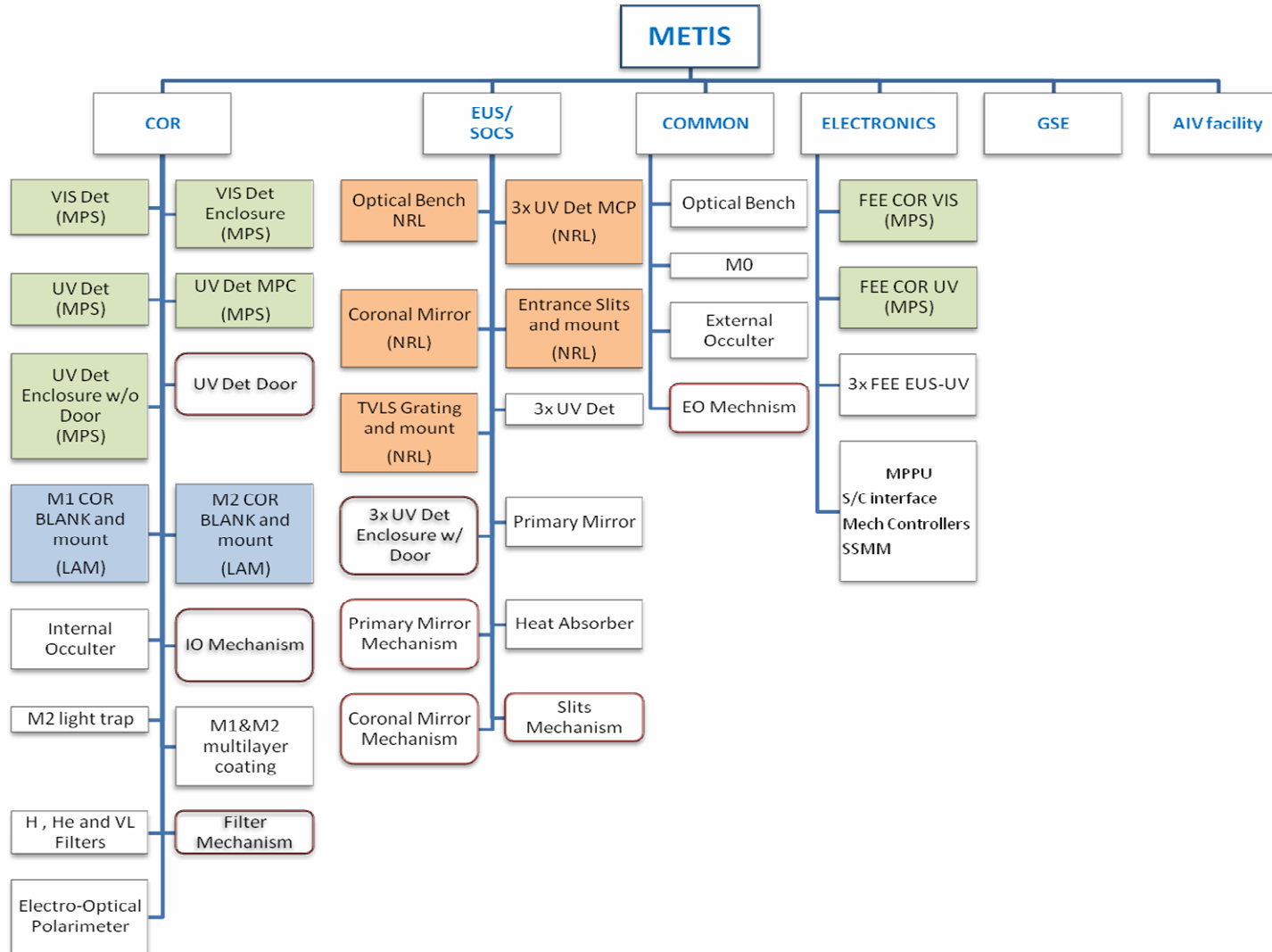


Figure 2: METIS HW Tree

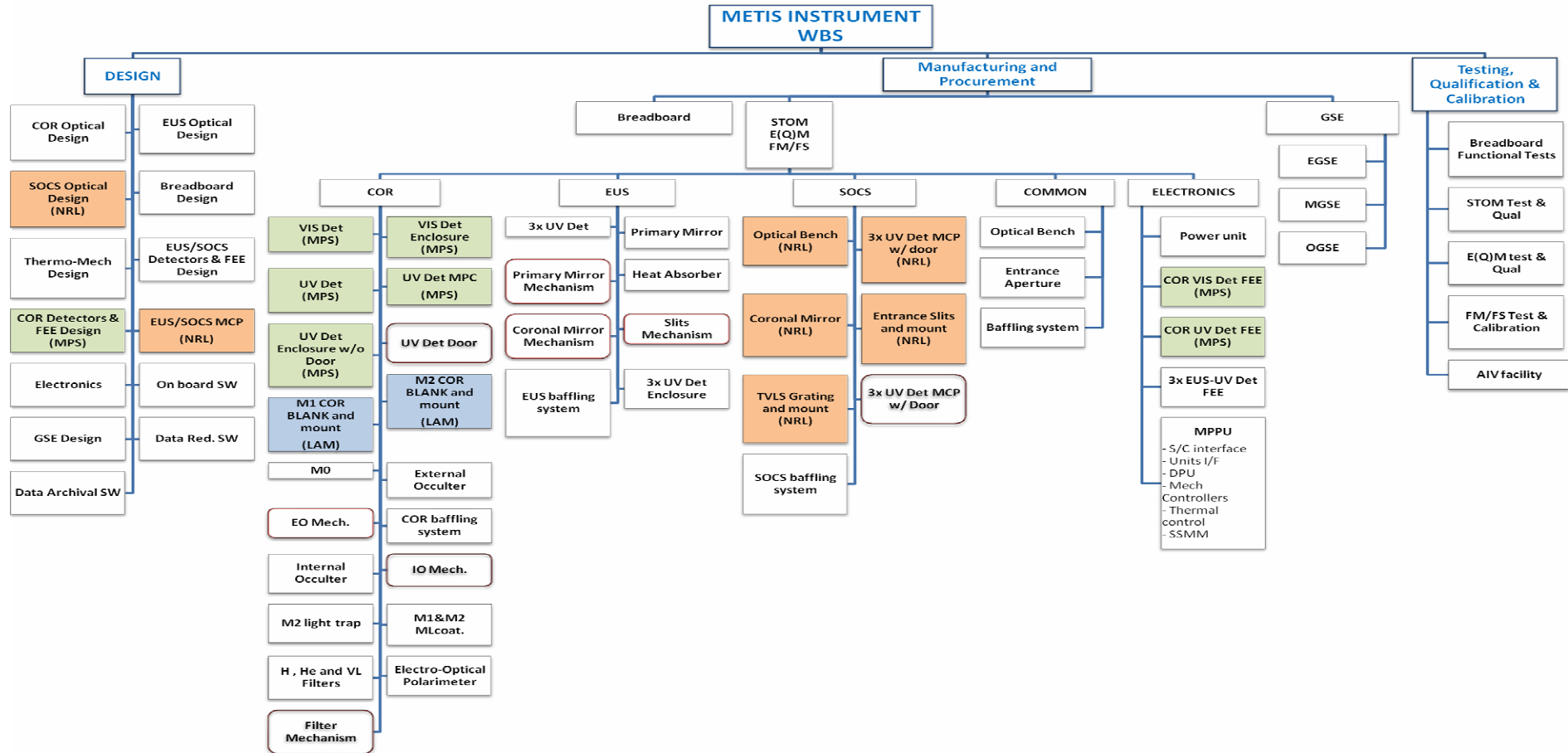


Figure 3: METIS WBS

2.2 METIS Detailed Organizational Structure

In the tables hereafter, the detailed METIS organizational structure is illustrated according to the following subdivision:

- Top level structure
- Co-I's,
- key persons and
- associate scientists

Co-I's are scientific personnel responsible for providing a deliverable linked to their specific activity (as listed in the following tables) based on their individual areas of expertise (as described in their CVs). For example, Co-Is listed with science analysis as their METIS activity would analyze the data returned from METIS related to their individual area of expertise and deliver a yearly METIS Technical Report (TR) containing a copy of published papers in refereed journals and presentations at both consortium and open science meetings.

Key persons are scientific and technical personnel involved in the development, testing of the instrument, scientific operations, data reduction and archiving.

Associate scientists are scientists that will support the investigation team in the scientific analysis of the METIS data and in the joint science with other Solar Orbiter instruments.

The tables report for each individual the institute affiliation and activities in the program.

Experience of Top level persons and Co-I are detailed in “**ANNEX 1: Curricula of the METIS investigators**” where the curriculum vitae are collected.

Name	Role	Affiliation and Address	Contact informations
Ester Antonucci	PI	INAF Osservatorio Astronomico di Torino Via dell'Osservatorio, 20 10025 Pino Torinese TO, Italy	+39 011 8101913 Office +39 011 8101930 Fax antonucci@oato.inaf.it
Silvano Fineschi	METIS Investigation Scientist	INAF Osservatorio Astronomico di Torino Via dell'Osservatorio, 20 10025 Pino Torinese TO, Italy	+39 011 8101919 Office +39 011 8101930 Fax fineschi@oato.inaf.it
Giampiero Naletto	METIS Experiment Manager	University of Padova Department of Information Engineering Via Gradenigo, 6/B 35131 Padova PD, Italy	+39 049 8277646 Office +39 049 8277699 Fax naletto@dei.unipd.it
Marco Romoli	Co-PI (COR)	University of Florence Department of Astronomy and Space Science Largo Enrico Fermi, 2 50125 Firenze FI, Italy	+39 055 2307767 Office +39 055 224193 Fax romoli@arcetri.astro.it
Angela Ciaravella	Investigation Scientist (COR – Coronal Imaging)	INAF Osservatorio Astronomico di Palermo Piazza del Parlamento, 1 90134 Palermo PA, Italy	+39 091 233454 Office +39 091 233-444 Fax ciarave@astropa.unipa.it
Luca Zangrilli	Instrument Scientist (COR)	INAF Osservatorio Astronomico di Torino Via dell'Osservatorio, 20 10025 Pino Torinese TO, Italy	+39 011 8101913 Office +39 011 8101930 Fax zangrilli@oato.inaf.it
Daniele Spadaro	Co-PI (EUS)	INAF Osservatorio Astronomico di Catania Via S. Sofia, 78 95123 Catania CT, Italy	+39 095 7332234 Office +39 095 7330592 Fax dspadaro@oact.inaf.it

Name	Role	Affiliation and Address	Contact informations
Vincenzo Andretta	Investigation Scientist (EUS – Disk Spectroscopy)	INAF Osservatorio Astronomico di Capodimonte Salita Moiriello, 16 8013 Napoli NA, Italy	+39 081 5575524 Office +39 081 5575433 Fax andretta@oacn.inaf.it
Luca Poletto	Instrument Scientist (EUS)	CNR-INFM-LUXOR c/o Department of Information Engineering Via Gradenigo 6/B, 35131 Padova PD, Italy	+39 049 8277680 Office +39 049 8277699 Fax poletto@dei.unipd.it
Daniel Moses	Co-PI (SOCS)	US Naval Research Laboratory Code 7661 4555 Overlook Avenue, SE Washington, DC 20375 – 0001, USA	+1 202 404 8108 Office +1 202 767 5636 Fax dan.moses@nrl.navy.mil
George Doschek	Investigation Scientist (SOCS – Coronal Spectroscopy)	US Naval Research Laboratory Code 7650 4555 Overlook Avenue, SE Washington, DC 20375 – 0001, USA	+1 202 7673527 Office +1 202 4047997 Fax george.doschek@nrl.navy.mil
Jeffrey Newmark	Instrument Scientist (SOCS)	US Naval Research Laboratory Code 7661 4555 Overlook Avenue, SE Washington, DC 20375 – 0001, USA	+1 202 767 0244 Office +1 202 767 5636 Fax newmark@nrl.navy.mil

Table 2: METIS top level characters

Name	Role	Activity	Affiliation
Frederic Auchere	Co-I	Data reduction and scientific analysis	CNRS-IAS
Roberto Bruno	Co-I	Data Reduction and Scientific Analysis	INAF/IFSI
Luigi Ciminiera	Co-I	On board and Data analysis Software and compression	PoliTo
Vania Da Deppo	Co-I	Instrument Development Instrument Design Instrument test and calibration	CNR-INFM
Giulio Del Zanna	Co-I	Observing modes definition planning Scientific operations Data reduction and scientific analysis	MSSL
Silvio Giordano	Co-I	Observing modes definition planning Data Analysis SW Data reduction and scientific analysis	INAF-OATo
Clarence Korendyke	Co-I	Calibration, Integration and Test	NRL
John Laming	Co-I	Theoretical Modeling	NRL
Philippe Lamy	Co-I	Support to COR instrument design Data Analysis Instrument test and calibration	LAM
Enrico Landi	Co-I	CHIANTI software	Artep
Massimo Landini	Co-I	EUS Science definition Spectroscopy Codes	UniFi
Alessandro Lanzafame	Co-I	Observing modes definition planning Scientific operations Data reduction and scientific analysis	INAF-OACT
Marco Malvezzi	Co-I	COR Instrument Development (Filters) Instrument test and calibration	UniPv
Salvatore Mancuso	Co-I	Observing modes definition planning Scientific operations Data reduction and scientific analysis	INAF-OATo
Mauro Messerotti	Co-I	Data Archival and Scientific Analysis	INAF-OATs
Piergiorgio Nicolosi	Co-I	Instrument development COR Multilayers filters Instrument test and calibration	UniPd
Giancarlo Noci	Co-I	Science requirements Definition	UniFi
Susanna Parenti	Co-I	Observing modes definition planning Scientific operations Data reduction and scientific analysis	Royal Observatory of Belgium
Maria Guglielmina Pellizzo	Co-I	Instrument development COR Multilayers filters Instrument test and calibration	CNR-INFM
Sami Solanki	Co-I	Instrument Development (COR Detectors) Instrument test and calibration	MPS

Name	Role	Activity	Affiliation
Thomas Straus	Co-I	Observing modes definition planning Scientific operations Data reduction and scientific analysis	INAF-OACN
Luca Teriaca	Co-I	Science requirements Definition Observing modes definition planning Scientific operations Data reduction and scientific analysis	MPS
Giuseppe Tondello	Co-I	Instrument Development	UniPd
Kanaris Tsinganos	Co-I	(on board) Software Data reduction and scientific analysis	Uni Athene
Michela Uslenghi	Co-I	Instrument Development (Detectors) Instrument test and calibration	INAF-IASF
Marco Velli	Co-I	Scientific analysis	UniFi
Rita Ventura	Co-I	Observing modes definition planning Scientific operations Data reduction and scientific analysis	INAF-OACT
Jean-Claude Vial	Co-I	Data reduction and scientific analysis, Science requirements Definition	CNRS-IAS

Table 3: METIS Co-I's

Name	Role	Activity	Affiliation
Lucia Abbo	Key Person	Observing modes planning Data reduction and scientific analysis Outreach	INAF-OATo
Alessandro Bemporad	Key Person	Observing modes planning, Data reduction and scientific analysis	INAF-OATo
Carlo Benna	Key Person	Data analysis Software Data Reduction and archiving Instrument test and calibration	INAF-OATo
Francesco Berrilli	Ass. Scientist	Data reduction and scientific analysis	UniRm/TorVer
Maurizio Busso	Ass. Scientist	Data reduction and scientific analysis	UniPg
Vincenzo Carbone	Ass. Scientist	Data reduction and scientific analysis	UniCal
Gianna Cauzzi	Ass. Scientist	Data reduction and scientific analysis	INAF-OAA
Alberto Cora	Key Person	Data reduction and archival	INAF-OATo
Ilaria Ermolli	Ass. Scientist	Data reduction and scientific analysis	INAF-OAR
Fabio Frassetto	Key Person	Instrument Development and Design Instrument test and calibration	CNR-INFM
Alessandro Gherardi	Key Person	Instrument Development and Design	UniFi
Catia Grimani	Ass. Scientist	Data reduction and scientific analysis	UniUrbino
Egidio Landi degli Innocenti	Ass. Scientist	Scientific requirements and Scientific analysis	UniFi
Federico Landini	Key Person	Instrument Development and Design Instrument test and calibration	UniFi
Joël Lemerrer	Key Person	Instrument Development and Design Instrument test and calibration	LAM
Patrick Levacher	Key Person	Instrument Development and Design Instrument test and calibration	LAM
Valentin Martinez	Ass. Scientist	Data reduction and scientific analysis	IAC
Anna Maria Massone		Data reduction and scientific analysis	INFM Ge

Name	Role	Activity	Affiliation
Giuseppe Massone	Key Person	Instrument Development and Design Instrument test and calibration	INAF-OATo
Titos Matsakos	Ass. Scientist	Software Data reduction and scientific analysis	UniTo
Gianalfredo Nicolini	Key Person	Project Management, Planning and Control	INAF-OATo (*)
Emanuele Pace	Key Person	Instrument Development Instrument test and calibration	UniFI
Maurizio Pancrazzi	Key Person	Instrument Development and Design	UniFI
Ermanno Pietropaolo	Ass. Scientist	Data reduction and scientific analysis	UniAQ
Giannina Poletto	Ass. Scientist	Data reduction and scientific analysis	INAF-OAA
Fabio Reale	Ass. Scientist	Data reduction and scientific analysis	UniPa
Guglielmo Rossi	Key Person	Instrument Development and Design	UniFI
Giuseppe Severino	Ass. Scientist	Data reduction and scientific analysis	INAF-OACN
Daniele Telloni	Ass. Scientist	Data reduction and scientific analysis	UniTo
Petros Tzeferacos	Ass. Scientist	Software Data reduction and scientific analysis	UniTo
Melanie Venet	Ass. Scientist	Software Data reduction and scientific analysis Instrument test and calibration	LAM
Sebastien Vives	Key Person	Instrument Development and Design Instrument test and calibration	LAM
Gaetano Zimbardo	Ass. Scientist	Data reduction and scientific analysis	UniCal
Francesca Zuccarello	Ass. Scientist	Data reduction and scientific analysis Outreach	INAF-OACt
(*) INAF-OATo sub-contractor			

Table 4: METIS associate scientists and key persons

3 Communications within the programme

Accordingly to the EID-A requirements all formal communication concerning technical and programmatic aspects will be made between the Principal Investigator and the ESA Project Manager.

The Principal Investigator will provide an interface to allow electronic transfer of data (documentation, progress reports including schedule information, changes, technical data, etc.) to be accessed by the ESA selected Prime and the ESA Project Office. The interfaces will be compatible with the Agency's scientific project infrastructure

4 Project phasing and planning

After the investigation approval, the PI will set up, establish and submit to the ESA Project Office and its selected Prime a Baseline Master Schedule in line with the Solar Orbiter Project Schedule covering all the instrument programme activities identified in the Work Breakdown Structure.

This schedule will cover:

- Overall instrument programme
- Individual instrument models
- Instrument model integration and testing
- Detailed bar chart of critical activities

4.1 METIS resources allocation

In Table 6 and Table 7 are listed the resource allocations of all team members, over the four nominal project phases. This allocations are consistent with the cost estimation present in the Financial Plan of this proposal.

4.1.1 Instrument Development Phase

This phase will last 7 years inclusive of launch (mid 2015) starting mid/end 2008

4.1.2 Instrument Science Operation Phase

Nominal scientific mission phase is about 3.5 years after Earth GAM-2. Anyhow METIS will require commissioning and calibration operations after launch and it is capable - and scientifically desirable - to produce science even before Earth GAM-2 providing the availability of the scientific telemetry.

As a consequence the manpower estimation has been quantified in order to cover an overall period of 6 (TBD) years.

4.1.3 Data reduction and scientific analysis

Data reduction and scientific analysis will be performed in parallel with calibration or scientific operations. Therefore, about the phase duration, the same considerations of par. 4.1.2 apply to this phase

4.1.4 Data Archival Phase

This phase will last approx 6 years from launch until the end of the nominal mission (mid 2021)

4.1.5 Overview of the human resources distribution

In Table 5 is summarized the manpower contribution to the METIS project grouped by the four mission phases and by geography.

Name	FTE [man-year] over the project phases				Totals
	Ph1	Ph2	Ph3	Ph4	
ITALY	113.0	54.5	72.5	8.5	248.5
EUROPE (*)	21.7	7.8	11.3	1.0	41.7
USA (1)	9.5	0.3	5.0	1.0	15.8
Totals	134.7	62.3	83.8	9.5	290.2

(*) excluding Italy

Table 5: Overview of the HR distribution

¹ USA labour accounting includes only NRL Civil Servant manpower (with the sole exception of Dr. E. Landini). Technical support, Visiting Scientists, and Post Doctorial Scientists are mostly subcontractor personnel. NRL will not host a remote mission operation centre nor provide staff for the Italian MOC. Thus, the USA Phase 2 manpower is primarily that associated with communicating inputs on operations related science planning and inputs on instrumental operational constraints. These inputs are obtained from the science analysis and in-flight SOCS performance evaluation activities accounted in the Phase 3 manpower. Additional Phase 3 science analysis manpower is anticipated under the usual NASA funded research and analysis programs (including a Guest Investigator type program as mentioned in the NASA FOSO announcement).

4.1.6 Detailed human resources distribution

Name	Institute	Role	FTE [man-year] over the project phases			
			Ph1	Ph2	Ph3	Ph4
Ester Antonucci	INAF/OATo	PI	3	2	1	0.5
Silvano Fineschi	INAF/OATo	METIS Investigation Scientist	4.5	2.5	2	0.5
Giampiero Naletto	UniPd	Experiment Manager	4	1	0.5	0
Marco Romoli	UniFi	COR - Co-PI	4	2.5	1.5	0.5
Angela Ciaravella	INAF-OAPa	COR Coronal Investigation Scientist	2	2	2.5	0.5
Luca Zangrilli	INAF/OATo	COR, Instr.Sci	4.5	1	1	
Daniele Spadaro	INAF/OACT†	EUS - Co-PI	4	2	2.5	0.5

Name	Institute	Role	FTE [man-year] over the project phases			
			Ph1	Ph2	Ph3	Ph4
Vincenzo Andretta	INAF/OACN	Spectroscopy Investigation Scientist	2	2	2.5	0.5
Luca Poletto	CNR-INFN	EUS, Instr. Sci	4.5	2	2	
Daniel Moses	NRL	SOCS - Co-PI	3	0.1	1.5	0.25
George Doschek	NRL	SOCS, Coronal Spetroscopy Inv.Sci	0.5	0	0.5	0.13
Jeffrey Newmark	NRL	SOCS, Instr.Sci	3	0.2	1.5	0.25

Table 6: METIS principal characters resource allocation

Name	Institute	Role	Task	FTE [man-year] over the project phases			
				Ph1	Ph2	Ph3	Ph4
Frederic Auchere	CNRS-IAS	Co-I	Data reduction and scientific analysis				
Roberto Bruno	INAF/IFSI	CO-I –	Data Reduction and Scientific Analysis -	1	1.5	1.5	0
Luigi Ciminiera	PoliTo	CO-I –	On board and Data analysis Software and compression	2	1	0	0.5
Vania Da Deppo	CNR-INFM	CO-I –	Instrument Development Instrument Design Instrument test and calibration	4.5	2	0	0
Giulio Delzanna	MSSL	Co-I	Observing modes definition planning Scientific operations Data reduction and scientific analysis	0.7	0.3	0.3	0
Silvio Giordano	INAF/OATo	Co-I	Observing modes definition planning Data Analysis SW Data reduction and scientific analysis	3.5	2.5	2	0.5
Clarence Korendyke	NRL	Co-I	Calibration, Integration and Test	2	0	0.5	0.13
John Laming	NRL	Co-I	Theoretical Modeling	0.5	0	0.5	0.25
Philippe Lamy	LAM	Co-I	Support to COR instrument design Data Analysis Instrument test and calibration	3	1	1	0.5
Enrico Landi	Artep	Co-I	CHIANTI software	0.5	0	0.5	0.13
Massimo Landini	UniFi	Co-I	EUS Science definition Spectroscopy Codes	1	0	0	0
Alessandro Lanzafame	INAF/OACt	Co-I	Observing modes definition planning Scientific operations Data reduction and scientific analysis	1.5	1.5	2	0
Marco Malvezzi	UniPv	Co-I	COR Instrument Development (Filters) Instrument test and calibration	1.5	1	0	0

Name	Institute	Role	Task	FTE [man-year] over the project phases			
				Ph1	Ph2	Ph3	Ph4
Salvatore Mancuso	INAF/OATo	Co-I	Observing modes definition planning Scientific operations Data reduction and scientific analysis	1	2	2	0
Mauro Messerotti	INAF/OATs	Co-I	Data Archival and Scientific Analysis	1	0	2	1.5
Piergiorgio Nicolosi	UniPd	Co-I	Instrument development COR Multilayers filters Instrument test and calibration	2.5	1	0	0
Giancarlo Noci	UniFi	Co-I	Science requirements Definition	1	0	0	0
Susanna Parenti	Royal Observatory of Belgium	Co-I	Observing modes definition planning Scientific operations Data reduction and scientific analysis	1	1	2	0
Maria Guglielmina Pellizzo	CNR-INFM	Co-I	Instrument development COR Multilayers filters Instrument test and calibration	2.5	1	0	0
Sami Solanki	MPS	Co-I	Instrument Development (COR Detectors) Instrument test and calibration	1	0	0.5	0
Thomas Straus	INAF/OACN	Co-I	Observing modes definition planning Scientific operations Data reduction and scientific analysis	1.5	1	2	0
Luca Teriaca	MPS	Co-I	Science requirements Definition Observing modes definition planning Scientific operations Data reduction and scientific analysis	2	2	2	0.5
Giuseppe Tondello	UniPd	Co-I	Instrument Development	1	0	0	0

Name	Institute	Role	Task	FTE [man-year] over the project phases			
				Ph1	Ph2	Ph3	Ph4
Kanaris Tsinganos	Uni Athene	Co-I	(on board) Software Data reduction and scientific analysis	1	0	2	0
Michela Uslenghi	INAF/IASF	Co-I	Instrument Development (Detectors) Instrument test and calibration	3	1	0	0
Marco Velli	UniFi	Co-I	Scientific analysis	1	0	2	0
Rita Ventura	INAF/OACt	Co-I	Observing modes definition planning Scientific operations Data reduction and scientific analysis	1.5	1	3.5	0
Jean-Claude Vial	CNRS-IAS	Co-I	Data reduction and scientific analysis, Science requirements Definition				
Lucia Abbo	INAF/OATo	Key Person	Observing modes planning and data reduction Outreach Scientific Analysis	1.5	2.5	2	0
Alessandro Bemporad	INAF/OATo	Key Person	Observing modes planning and data reduction Scientific Analysis	1.5	2.5	2	0
Carlo Benna	INAF/OATo	Key Person	Data analysis Software Data Reduction and archiving Instrument test and calibration	4.5	4	0.5	1
Francesco Berrilli	UniRm/TorVer	Ass. Scientist	Data reduction and scientific analysis	1	0	2	0
Maurizio Busso	UniPg	Ass. Scientist	Data reduction and scientific analysis	1	0	1	0
Vincenzo Carbone	UniCal	Ass. Scientist	Data reduction and scientific analysis	1.5	0	2	0
Gianna Cauzzi	INAF-OAA	Ass. Scientist	Data reduction and scientific analysis	1	0	2	0
Alberto Cora	INAF/OATo	Key Person	Data reduction and archival	1	2	2	1.5

Name	Institute	Role	Task	FTE [man-year] over the project phases			
				Ph1	Ph2	Ph3	Ph4
Ilaria Ermolli	INAF/MPorzio	Ass. Scientist	Data reduction and scientific analysis	1	0	2	0
Fabio Frassetto	CNR-INFM	Key Person	Instrument Development and Design Instrument test and calibration	4.5	1	0	0
Alessandro Gherardi	UniFi	Key Person	Instrument Development and Design	1	0	0	0
Catia Grimani	UniUrbino	Ass. Scientist	Data reduction and scientific analysis	1	0	2	0
Egidio Landi degli Innocenti	UniFi	Ass. Scientist	Scientific requirements and Scientific analysis	1	0	1	0
Federico Landini	UniFi	Key Person	Instrument Development and Design Instrument test and calibration	4.5	1.5	1.5	0
Joël Lemerrer	LAM	Key Person	Instrument Development and Design Instrument test and calibration	2	0	0	0
Patrick Levacher	LAM	Key Person	Instrument Development and Design Instrument test and calibration	3	1	1	0
Valentin Martinez	IAC	Ass. Scientist	Data reduction and scientific analysis	0	0	1	0
Anna Maria Massone	INFM Ge	Ass. Scientist	Data reduction and scientific analysis	1	0	2	0
Giuseppe Massone	INAF/OATo	Key Person	Instrument Development and Design Instrument test and calibration	4.5	1	0	0
Titos Matsakos	Uni To	Ass. Scientist	Software Data reduction and scientific analysis	1.5	1	1.5	0
Gianalfredo Nicolini	INAF-OATo (*)	Key Person	Project Management, Planning and Control	3.5	0.5	0	0

Name	Institute	Role	Task	FTE [man-year] over the project phases			
				Ph1	Ph2	Ph3	Ph4
Emanuele Pace	UniFI	Key Person	Instrument Development Instrument test and calibration	2.5	1	0	0
Ermanno Pietropaolo	UniAQ	Ass. Scientist	Data reduction and scientific analysis	1	0	2	0
Giannina Poletto	INAF-OAA	Ass. Scientist	Data reduction and scientific analysis	1	0	0	0
Fabio Reale	UniPa	Ass. Scientist	Data reduction and scientific analysis	1	0	2	0
Giuseppe Severino	INAF/OACN	Ass. Scientist	Data reduction and scientific analysis	1	0	2	0.5
Daniele Telloni	UniTo	Ass. Scientist	Data reduction and scientific analysis	1.5	2	2.5	0
Petros Tzeferacos	Uni Athene	Ass. Scientist	Software Data reduction and scientific analysis	1.5	1	1.5	0
Melanie Venet	LAM	Ass. Scientist	Software Data reduction and scientific analysis Instrument test and calibration	3	1	1	0
Sebastien Vives	LAM	Key Person	Instrument Development and Design Instrument test and calibration	3	1	1	0
Gaetano Zimbardo	UniCal	Ass. Scientist	Data reduction and scientific analysis	1	0	2	0
Francesca Zuccarello	INAF/OAC†	Ass. Scientist	Data reduction and scientific analysis Outreach	1	0	3.5	0
(*) INAF-OATo sub-contractor							

Table 7: METIS Co-I's, Associate Scientists and Key Persons resource allocation

4.2 HW procurement

For reference in Figure 2 and Figure 3 are shown the METIS HW tree and a preliminary WBS respectively.

According to METIS HW-tree and WBS, the main part of METIS hardware (white boxes) is provided by the Italian Space Agency and mainly developed by the Italian industry (Thales Alenia Space and Galileo Avionica).

The project foresees the procurements of remaining HW parts from the following foreign partners¹:

- NRL (orange boxes) will submit at end of January their proposal to NASA in order to contribute to METIS with the SOCS sensor. (see par. 2).
- MPS (green boxes) will provide the COR detectors.
- LAM (blue boxes) will provide COR mirrors blank and mounts.

There is a purely European backup of the EUS channel for the case that the SOCS sensor provided by NRL is not approved. In this case the EUS detector electronics are considerably simpler, since a photon counting mode is not required.

Furthermore, a two channel EUS can be considered as reported in the Scientific and Technical Plan, Part I of this proposal.

¹ Possible further hardware contributions (e.g. from the Greece Space Office) have not yet been finalized

5 Meetings and reviews

The PI will organize regular and ad-hoc (to address critical subjects at the time) progress meetings with the Solar Orbiter Project Office including instrument members as required.

The PI will provide the resources to prepare review data packages to support the review processes at instrument, ground segment and mission level as defined in the EID-A.

In detail:

- a) Instrument Level
 - i. Instrument Science Requirements Review
 - ii. Instrument Preliminary Design Review
 - iii. Instrument Qualification Review
 - iv. Instrument Critical Design Review
 - v. Instrument Delivery Review Board
 - vi. Other TBD Reviews as required
- b) Ground Segment Level
 - i. Ground Segment Requirements Review
 - ii. Ground Segment Design Review
 - iii. Ground Segment Implementation Review
 - iv. Ground Segment Readiness Review
- c) Mission Level
 - i. System Requirements Review
 - ii. Preliminary Design Review
 - iii. Critical Design Review
 - iv. Qualification Review
 - v. Flight Acceptance Review
 - vi. Flight Readiness Review
 - vii. Mission Commissioning Results Review

5.1 Instrument Progress Meetings

These meetings will be conducted between the ESA Project Office / the selected Prime and the PI with the objective of ensuring that the interface technical design integrity of the experiment, its compatibility with the spacecraft system, and instrument programmatics are proceeding in a manner which will not jeopardize the overall programme.

These meeting will be held periodically on the premises of the PI or the instrument Prime, during the design, development and verification programme of the instrument. Detailed technical problems occurring on either side of the interface will be addressed at these meetings and corrective actions, including their schedule impact, agreed and implemented.

The PI will maintain and publish minutes of meetings to all participants and stake holders in the instrument.

5.2 Mission Reviews

The objective of the Mission Reviews is to ascertain the satisfactory status of advancement and to verify the compliance of the technical and programmatic progresses with the overall programme requirements. Mission Reviews shall consist in the global assessment of Spacecraft, Instruments

Ground Segment and Launcher. The Principal Investigator will attend to these Mission Reviews if relevant for the METIS investigation or if requested by ESA Project Office.

5.3 Instrument Reviews

Instrument Reviews will be conducted by the ESA Project Office for each instrument selected for the Solar Orbiter Programme. The objectives will be to ensure that the instrument design will achieve the anticipated science objectives and that it complies with the technical interface requirements of the EID. Programmatic aspects like scheduled delivery dates and their compatibility with system level requirements will also be screened.

The PI and his scientific and technical team will support the review and its panel and board sessions with appropriate manpower, expertise and the documentation requested/defined by ESA Project Office.

6 Configuration management

The PI will ensure that all HW, SW and documentation will be fully traceable with history and exact definition of date or hardware at all times accordingly to the Solar Orbiter Project documentation coding system.

The PI will setup set up the necessary organization and means for satisfying the objectives and requirements of configuration management and will impose the same configuration management requirements on contractors and suppliers.

6.1 Configuration and change control

The PI will set up a configuration and change control procedure such that the status of all aspects of her experiment like the design and manufacturing of hardware and development of software can be unambiguously defined at any time, allowing at the same time ESA Project Office to conduct a configuration audit at any point in the programme in order to obtain the up-to-date status of the instrument.

After finalization and approval of EID-B and EID-A, changes to former of these documents shall be handled using an Engineering Change Request (ECR) and deviations or not fulfilments from the requirements defined in EID A, B will be handled using the Request for Waiver (RFW) form defined by the Solar Orbiter programme.

7 Deliverable items

Accordingly to the programme requirements (ref [AD-1]), METIS project deliverable items are listed below.

7.1 Deliverables to the spacecraft

- All relevant interface documentation (EID-B) throughout the project lifetime.
- The Structural Mathematical Model (SMM) of the instrument, as defined in the latest applicable version of Solar Orbiter EID-A
- The Thermal Mathematical Model (TMM) of the instrument, as defined in the latest applicable version of Solar Orbiter EID-A
- The Structural and Thermal Optical Model (STOM)
- The Electrical (Qualification) Model (E(Q)M),
- The (calibrated) Flight Model (FM),
- The (calibrated) Flight Spares (FS).

Each unit delivery will include, as appropriate, not only the instrument hardware, but also the on-board software, the required mechanical and electrical ground support equipments, its End Item Data Package (content TBD) and any hardware, software or document needed to correctly operate, integrate or calibrate the instrument.

The METIS project will support the system level integration and test activities as well as the launch preparation by supplying the appropriate manpower and expertise.

8 Schedules

METIS investigation is compatible with the predefined Solar Orbiter programme schedule to meet the launch in mid 2015.

The planning of the project will be compliant to the requirement of delivering to the programme the foreseen models with the predefined timeline:

- STOM: 4 yrs prior to launch (TBC)
- E(Q)M: 3 yrs prior to launch (TBC)
- FM: 2 yrs prior to launch (TBC)

After selection, the PI will define a preliminary Instrument Master Schedule in the form of Gantt diagram to organize the project activities in a conformant manner with the overall Solar Orbiter Master Schedule.

9 Document References

9.1 Applicable Documents

- AD-1** Solar Orbiter EID-A
- AD-2** Solar Orbiter AO
- AD-3** HELEX Scientific Requirements

9.2 Reference Documents and Publications

10 Acronyms

ADC	Analog to Digital Converter
AFT	Abbreviated Functional Test
AIT	Assembly, Integration and Test
AOCS	Attitude and Orbit Control System
APS	Active Pixel Sensor
BB	Breadboard
BBM	Bread-Board Model
CCD	Charge Couple Device
CFRP	Carbon Fiber Reinforced Plastic
CME	Coronal Mass Ejections
CNR	Consiglio Nazionale delle Ricerche
CNRS	Centre National de la Recherche Scientifique
CoI	Co-Investigator
CoM	Center of Mass
CoPI	Co-Principal Investigator
COR	METIS Visible and EUV Coronagraphic imager
CTE	Coefficient of Thermal Expansion
DMS	Data Management System
ECSS	European Cooperation for Space Standardization
EEO	Extended External Occulter
EEOM	EEO Mechanism
EM	Electrical Model
EM	Experiment Manager
EO	External occulter
EOM	External occulter Mechanism
EQM	Electrical Qualification Model
ESA	European Space Agency
EUI	EUV Imager
EUS	METIS EUV disk Spectrometer
EUV	Extreme UltraViolet
EUVC	EUV Channel
FEE	Front End Electronics
FEM	Filter Exchange Mechanism
FFT	Full Functional Test
FM	Flight Model
FOV	Field Of View
FS	Flight Spare
FWHM	Full Width at Half Maximum
GSE	Ground Support Equipment
H/W	Hardware
HeF	Aluminum low-pass filter of the coronagraph
HELEX	Heliophysical Explorers
HERSCHEL	Helium Resonance Scattering in the Corona and Heliosphere
HF	Narrow-band multilayer filter of the coronagraph
HGA	High Gain Antenna



HVPS	High Voltage Power Supply
HWRP	Half Wave Retarder Plate
IAC	Instituto de Astrofísica de Canarias
IAPS	Intensified APS
IAS	Institut d'Astrophysique Spatiale
IASF	Istituto di Astrofisica Spaziale e Fisica cosmica
IDP	Instrument Development Plan
IFE	Instrument Front End
IFSI	Istituto di Fisica dello Spazio Interplanetario
ILS	Instrument Line of Sight
INAF	Istituto Nazionale di AstroFisica
INFM	Istituto Nazionale Fisica della Materia
IO	Internal Occulter
IOM	Internal Occulter Mechanism
IR	Infrared
LAM	Laboratoire d'Astrophysique de Marseille
LCL	Latching Current Limiters
LCVR	Liquid Crystal Variable Retarder
M0	Sun-disk rejection mirror of the coronagraph
M1	Primary mirror of the coronagraph
M2	Secondary mirror of the coronagraph
MCP	Micro Channel Plate
METIS	Multi Element Telescope for Imaging and Spectroscopy
MGSE	Mechanical Ground Support Equipment
ML	Multilayer
MOC	Mission Operation Center
MoI	Moment of Inertia
MPPU	METIS Processing & Power Unit
MPS	Max-Planck-Institut fuer Sonnensystemforschung
MSSL	Mullard Space Science Laboratory
N/A	Not Applicable
NASA	National Aeronautics and Space Administration
NOM	Nominal Observing Mode
NRL	Naval Research Laboratory
OAA	Osservatorio Astronomico di Arcetri
OACN	Osservatorio Astronomico di Capodimonte Napoli
OACt	Osservatorio Astronomico di Catania
OAPa	Osservatorio Astronomico di Palermo
OAR	Osservatorio Astronomico di Roma
OATo	Osservatorio Astronomico di Torino
OATs	Osservatorio Astronomico di Trieste
OGSE	Optical Ground Support Equipment
OP	Off Pointing
PA	Product Assurance
PI	Principal Investigator
PoliTo	Politecnico di Torino
QE	Quantum Efficiency
RD-n	Reference Document n



S/C	Spacecraft
S/W	Software
SC	Sun Center
SCORE	Sounding-rocket Coronagraphic Experiment
SEP	Solar Energetic Particles
SMM	Structural Mathematical Model
SO	Solar Orbiter
SOCS	METIS Solar Orbiter Coronal Spectrometer
SOHO	Solar and Heliospheric Observatory
STOM	Structural Thermal Optical Model
TBC	To Be Confirmed
TBD	To Be Defined
TBW	To Be Written
TEC	Thermo Electric Cooler
TM	Telemetry
TSOM	Time Share Observing Mode
TVLS	Toroidal Variable Line Space
UFOV	Unobstructed Field Of View
UniAq	Università di Aquila
UniCal	Università della Calabria
UniFi	Università di Firenze
UniPD	Università di Padova
UniPd	Università di Padova
UniPg	Università di Perugia
UniPv	Università di Pavia
UniRm	Università di Roma
UORF	Unit Optical Reference Frame
URF	Unit Reference Frame
UV	Ultraviolet
UVC	UV channel
UVD	Ultraviolet Detector
VD	Visible Detector
VIM	Visible Imager & Magnetograph
VLC	Visible Light Channel
VUV	Vacuum ultraviolet

ANNEX 1: Curricula of the METIS Investigators

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METIS INSTRUMENT PROPOSAL
for the
Solar Orbiter Mission

Management Plan

ANNEX 1
Curricula of the METIS investigators

Ester Antonucci – METIS PI

Ester Antonucci, born on March 10, 1945 in Boves (Cuneo), Italy.

Curriculum Vitae:

- Laurea Degree in Physics in 1967 and Diploma di Specializzazione in Cosmic Physics in 1972, at the University of Turin.
- Since 1995 Senior Astronomer at the Astronomical Observatory of Turin
- Since 2005 Director of the Astronomical Observatory of Turin
- Professore Incaricato/Associato at the University of Turin, 1975-1995
- ESRO/ELDO fellowship at the Stanford University, 1972-1974
- ESA fellowship at the Rutherford Appleton Laboratory, UK, and Goddard Space Flight Center, MD, US, 1980-1982

Professional:

- Research in space solar physics has been the primary activity since 1979: working in soft X-ray spectrometry of solar flares with the Soft-X-Ray Polychromator (XRP) during the Solar Maximum Mission and the outer corona UV spectrometry with the Ultraviolet Coronagraph Spectrometer (UVCS) during the SOHO mission.
- Deputy Principal Investigator of the Soft X-Ray Polychromator (XRP) in the first operation phase of the Solar Maximum Mission (NASA), 1980-1981; XRP Co-Investigator, 1984-1989 (second operation phase, after the in-flight S/C repair)
- Co-Investigator of the Ultraviolet Coronagraph Spectrometer (UVCS) of the SOHO mission (ESA/NASA), since 1988
- Deputy Principal Investigator of the project 'Helium Resonance Scattering in the Corona and Heliosphere, HERSCHEL', LWS-NASA sub-orbital flight program, since 2003
- Coordinator of one of the 3 European SOHO archives, since 1995
- ESA SOHO Phase A Study, 1984-1985
- Solar Orbiter Proposal Co-Author, 1999
- ESA Assessment Study Team of the Solar Orbiter, 2000
- ESA Solar System Working Group 1986-1988.

- ESA Space Science Advisory Committee, 2004-2006
- Scientific Committee, International Space Science Institute, ISSI, Bern, 2004-2008
- Recipient: Solar Maximum Mission Group Achievement Award, NASA, 1980; SMM-XRP Productivity Improvement Award, Lockheed Missiles and Space Co., 1991; European Space Agency Award, Solar Heliospheric Observatory (SOHO), 1996
- Vice-Chairman Commission E (Astrophysics), COSPAR, 1998-2006
- Author of more than 200 papers.

Relevant Publications:

- *J.L. Kohl, L.W. Hartmann, A. Van Ballegooijen, G.L. Withbroe, J.C. Raymond, H. Weiser, G. Noci, E. Antonucci, J. Geiss, G. Gloeckler, 'UVCS - An Ultraviolet Coronagraph Spectrometer for SOHO', ESA SP-1104, 49-54, 1988*
- *E. Antonucci, 'EUV complementary instrumentation for SIMURIS', invited, Proc. 'Solar Physics and Astrophysics at Interferometric Resolution', ESA SP-344, 215-220, 1992*
- *E. Antonucci, 'The X-ray Ultraviolet Imager for the Orbiting Solar Laboratory', invited, AIP Conf. Proc. 267, 126-135, 1992*
- *E. Antonucci, et al., 'Ultraviolet and visible-light coronagraph for the Solar Orbiter mission', Proc. SPIE Vol. 4139, p. 378-389, 2000*
- *B. Fleck, E. Marsch, E. Antonucci et al., 'Solar Orbiter: a high-resolution mission to the sun and inner heliosphere', Proc. SPIE Vol. 4498, p. 1-15, 2001*
- *M. Romoli, E. Antonucci et al., 'The Ultraviolet and Visible-light Coronagraph of HERSCHEL', AIP Conf. Proceedings, Volume 679, pp. 846-849, 2003*
- *E. Antonucci, 'The scientific possibilities for coronagraphy from the Solar Orbiter', invited, Adv. in Space Res. 36, 1367-1374, 2005*
- *E. Antonucci, 'Wind in the Solar Corona: Dynamics and Composition', invited, Space Sci. Rev. 124, 35-50, 2006*

Silvano Fineschi – METIS Investigation Scientist

Silvano Fineschi,
born the 19th of July, 1958 in Terni, Italy

Curriculum Vitae:

- 1994 Ph.D. in Astronomy, Universita' di Firenze, Firenze, Italy
- 1988 Doctor in Physics ("Laurea in Fisica") Univ. di Firenze, Firenze, Italy
- 1999 – present - Staff Astronomer, Nat. Inst. of Astrophysics. (INAF) - Turin Astronomical Obs., Torino, Italy
- 1995-1999 - Astrophysicist, Smithsonian Astrophysical Observatory, Cambridge, MA, USA
- 1991-95 - Visiting Scientist, Harvard-Smithsonian Center for Astrophysics, Cambridge, MA, USA
- 1989-91 - Research Associate, NRC/NASA Marshall Space Flight Center, Huntsville, AL,

Professional:

- 2002 - Co-PI, NASA, UV & Visible-light Coronagraphic Imager (UVCI) for the HERSCHEL sounding-rocket
- 2005 – Co-responsible, INAF/Turin Astron. Obs., Optical Payload System Facility.
- 1996-2000 - Co-Investigator, Lead Science Operations Scientist, NASA/ASI (Italian Space Agency), Ultraviolet Coronagraph and Spectrometer (UVCS/SOHO)
- 1992-2000 - Associate Scientist, NASA, Ultraviolet Coronal Spectrometer for the Space Shuttle Sub-satellite SPARTAN

Relevant Publications:

- □ *F. Landini, M. Romoli, S. Fineschi, E. Antonucci, Applied Optics 45, 26, "Stray-light analysis for the SCORE coronagraphs of HERSCHEL", 6697 (2006)*
- *G. Naletto, S. Fineschi, et al. Applied Optics 44, 24, "Optical design of a high-spatial-resolution extreme-ultraviolet spectro-heliograph for the transition region", 5046 (2005)*
- *S. Fineschi, J.D. Moses, and R.J. Thomas, Proc. SPIE 5901, "Spectro-imaging of the extreme-UV solar corona", 289 (2005)*
- *S. Fineschi, et al, Proc. SPIE 5487, "Solar ultraviolet spectro-coronagraph with toroidal varied line-space (TVLS) grating", 1165 (2004)*
- *S. Fineschi, et al. Proc. SPIE 4853, "Ultraviolet and Visible-light Corona-graphic Imager (UVCI)", 162 (2003)*
- *K. Yuan-Ko, [et al.], S Fineschi, et al., Ap. J. 578, 2, , "SOHO/UVCS and Yohkoh Soft X-Ray Telescope Observations of the High-Temperature Corona above an Active Region Complex", 979, (2002)*
- *A. Ciaravella, [et al.], S. Fineschi, Ap. J. 575, 2, "Elemental Abundances and Post-Coronal Mass Ejection Current Sheet in a Very Hot Active Region", 1116, (2002)*
- *E. Antonucci, S. Fineschi, et al., Proc. SPIE 4139, "Ultraviolet and visible-light coronagraph for the Solar Orbiter mission", 378 (2000)*

Giampiero Naletto – METIS Experiment Manager

Giampiero Naletto, born in Mirano VE (Italy) on 21 June 1962

Curriculum Vitae:

- Education: Optics Specialization at the National Institute of Optics at the Florence University (Italy)
- Since 2006. Associate Professor in General Physics at the Department of Information Engineering, University of Padova (Italy)
- 1994-2006. University Researcher in Matter Physics at the Department of Information Engineering, University of Padova (Italy)
- 1996-1997. Assistant Development Engineer at the Space Science Laboratory, University of California, Berkeley (CA, USA)

Professional:

- 2007-present. Responsible of *Sub-Task 02310 Studi di fattibilità e prototipi per osservare corona e vento solare*
- 2007-present. *Responsible of optical design* in the “Astronomy to the quantum limit” project (Fondazione Cariparo Excellence Projects 2006)
- 2003-present. *Co-Investigator (STC Technical manager)* of the STC/SIMBIOSYS stereo camera for the BepiColombo ESA mission to Mercury
- 2003-present. *Co-Investigator* of the UV spectrograph Phebus for the BepiColombo ESA mission to Mercury
- 1998-present. *Co-Investigator* of the OSIRIS instrument on board the ESA Rosetta mission for the observation of the 67 P/Churyumov-Gerasimenko comet
- 1996-1997. *Assistant Development Engineer* for the realization of the FUSE (NASA mission) detector
- 1988-1996. *Responsible of optical design* of the UVCS spectroscopic channels on board the SOHO ESA/NASA satellite.

Relevant Publications:

G. Naletto is co-author of more than 120 publications on international journals and proceedings. A selection follows.

- *E. Verroi, F. Frassetto, G. Naletto, “Analysis of diffraction from the occulter edges of a giant externally occulted solar coronagraph”, J.O.S.A. A 25(1), pp. 182-189 (2008)*
- *G. Naletto, S. Fineschi, E. Antonucci, V. Da Deppo, P. Nicolosi, L. Zangrilli, M. Romoli, M. Malvezzi, D. Moses, “Optical design of a high spatial resolution extreme ultraviolet spectroheliograph for the transition region”, Appl. Opt. 44(24), pp. 5046-5054 (2005).*
- *G. Naletto, V. Da Deppo, M.G. Pelizzo, R. Ragazzoni, E. Marchetti, “The optical design of the Wide Angle Camera for the Rosetta mission”, Appl. Opt. 41(7), pp. 1446-1453 (2002)*
- *S.R. Cranmer, J.L. Kohl, G. Noci, E. Antonucci, G. Tondello, M.C.E. Huber, L. Strachan, A.V. Panasyuk, L.D. Gardner, M. Romoli, S. Fineschi, D. Dobrzycka, J.C. Raymond, P. Nicolosi, O.H.W. Siegmund, D. Spadaro, C. Benna, A. Ciaravella, S. Giordano, S. Habbal, M. Karovska, X. Li, R. Martin, J.G. Michels, A. Modigliani, G. Naletto, R.H. O’Neal, C. Pernechele, G. Poletto, P.L. Smith, R.M. Suleiman, “An empirical model of a polar coronal hole at solar minimum”, ApJ 511, pp. 481-501 (1999)*
- *J.L. Kohl, G. Noci, E. Antonucci, G. Tondello, M.C.E. Huber, S. Fineschi, L.D. Gardner, G. Naletto, P. Nicolosi, J.C. Raymond, M. Romoli, D. Spadaro, B. Martin, J. Michels, C. Benna, A. Ciaravella, S. Giordano, A. Modigliani, A. Panasyuk, C. Pernechele, G. Poletto, O.H.W. Siegmund, P.L. Smith, S.R. Cranmer, L. Strachan, “First results from the SOHO Ultraviolet Coronagraph Spectrometer”, Solar Physics 175, pp. 613-644 (1997)*

Marco Romoli – METIS (COR) Co-PI

Marco Romoli, Firenze, 16/10/1961

Curriculum Vitae:

- Education:
- Degree in Physics, Univ. di Firenze, 1987
- PhD in Astronomy, Univ. di Firenze, 1992
- 1/98 – today, Researcher, Univ. di Firenze
- 7/95 – 7/97, Post-Doc Fellow, Univ. di Firenze
- 8/92 – 8/94, ESA Post-doc Fellow at SAO, Cambridge, MA, USA

Professional:

- Co-Investigator for sounding rocket experiment HERSCHEL (2002 – today), optical design, AIV, deputy-PI.
- Co-Investigator for SOHO/UVCS (1995 – today), mission operations, data analysis
- Ass. Scientist for SOHO/UVCS (1989 – 1995), WLC design, development and characterization; End-to-end calibrations.
- Co-Investigator for MIDEX/ASCE (1998 – 2003), design and development of EUV polarimeter, responsible for the Italian Team activity.

Relevant Publications:

- M. Romoli et al., "The HERSCHEL/SCORE Visible and UV Coronagraph", ESA SP-641 (2007)
- Landini F., Romoli M., Rossi G., "Space-Borne Solar Coronagraphs External Occulter Apodization", ESA SP-641 (2007)
- Matthaeus W. H., Breech B., Dmitruk P., Bemporad A., Poletto G., Velli M., Romoli M., "Density and Magnetic Field Signatures of Interplanetary 1/f Noise", ApJ, 657, L121 (2007)
- Bemporad A., Raymond J., Poletto G., Romoli M., "A Comprehensive Study of the Initiation and Early Evolution of a Coronal Mass Ejection from Ultraviolet and White-Light Data", ApJ, 655, 576 (2007)

- Gherardi A., Romoli M., Pace E., Pancrazzi M., Rossi G., Focardi M., Paganini D., "CCD cameras and Spacewire interfaces for HERSCHEL/SCORE suborbital mission.", MemSAIt, 78, 715 (2007)
- Romoli M., Giordano S., Benna C., "The Solar Cycle as Seen from the SOHO/UVCS White Light Channel". ESA SP-617, 107 (2006)
- Fineschi S., Zangrilli L., Rossi G., Gori L., Romoli M., Corti G., Capobianco G., Antonucci E., Pace E., "KPol: liquid crystal polarimeter for K-corona observations from the SCORE coronagraph", SPIE, 5901, 389-399 (2005).
- Landini F., Romoli M., Colaninno R. C., Thernisien A., "Comparison of different algorithms and programming languages in the diffraction calculation for a coronagraph stray light analysis", SPIE, 5901, 191-199 (2005).
- Ventura R., Spadaro D., Cimino G., Romoli M., "Streamers and adjacent regions observed by UVCS/SOHO: A comparison between different phases of solar activity", A&A, 430, 701 (2005)
- Spadaro D., Ventura R., Cimino G., Romoli M., "UVCS/SOHO investigation of the interface between streamers and coronal holes", A&A, 429, 353 (2005)
- Romoli M., Antonucci E., Fineschi S., Gardiol D., Zangrilli L., Malvezzi M. A., Pace E., Gori L., Landini F., Gherardi A., da Deppo V., Naletto G., Nicolosi P., Pelizzo M. G., Moses J. D., Newmark J., Howard R., Auchere F., Delaboudiniere J. P., "The Ultraviolet and Visible-light Coronagraph of the HERSCHEL experiment", AIP, 679, 846 (2003)
- Teriaca L., Poletto G., Romoli M., Biesecker D. A., "The Nascent Solar Wind: Origin and Acceleration", ApJ, 588, 566 (2003)
- Romoli M., Fineschi S., Uslenghi M., Corti G., Pace E., Ciaravella A., Tondello G., Noci G., Gardner L. D., Kohl J. L., "The ASCE EUV Polarimeter" MemSAIt, 74, 835 (2003)

Angela Ciaravella – METIS Scientist

Angela Ciaravella, 03-03-1960, Sambuca di Sicilia (AG), Italy

Curriculum Vitae:

- Degree in Physics (1988), PhD in Physics (1994)
- Since 2001 Dec 5 Ricercatore Astronomo, INAF-Osservatorio Astronomico di Palermo, Palermo, Italy
- August 1995 - Dec 31, 2001 Visiting Scientist, Harvard-Smithsonian Center for Astrophysics, Cambridge, USA
- March 1996 - February 1998 European Space Agency (ESA) Post-Doctoral Fellowship at the Harvard-Smithsonian Center for Astrophysics, Cambridge, USA
- March 1995 - February 1996 Fellowship with the Department of Astronomy and Space Science, University of Firenze. Firenze, Italy

Professional:

- Has been a key scientist in the study of the Ultraviolet spectra of Coronal Mass Ejections observed by UVCS/SoHO
- General interests in the solar physics are:
 - Analysis of the chromospheric Ly α line scattered by coronal free electrons.
 - UV and X-ray emission from solar corona.
 - Spectroscopic diagnostics of the solar corona in the EUV and X-ray.
- From Dec 95 to March 99 has been part to the Mission Operations team for UVCS/SoHO at NASA Goddard Space Flight Center Greenbelt, USA
- From Dec 95 to March 99 was involved in the data acquisition and on flight calibration of UVCS/SoHO spectrometer.
- Has worked to the UVCS/SOHO end-to-end Functional and optical tests and Calibrations of UVCS/SOHO at the Harvard-Smithsonian Center for Astrophysics Cambridge, USA

Relevant Publications:

- SOHO Observations of a Helical Coronal Mass Ejection, A. Ciaravella et al. 2000, ApJ 529, 575.
- SOHO and radio observations of a CME shock wave, J.C. Raymond et al. 2000, Geoph. Res. Let. 27, 1439.
- The Dec. 12, 1997 Helical Coronal Mass Ejection: Density, Energy Estimates and Hydrodynamics, A. Ciaravella et al. 2001, ApJ, 557, 351
- Current Sheet in a Very Hot Active Region, Elemental abundances and Post-CME A. Ciaravella et al. 2002, ApJ, 575, 1116
- SOHO/UVCS and Yohkoh/SXT Observation of a High Temperature Corona Above an Active Region Complex, Ko Y-K, Raymond J.C., J. Li, Ciaravella A. 2002, ApJ, 578, 979
- Ultraviolet Spectroscopy of the Narrow Coronal Mass Ejections, Dobrzycka, D., Raymond J.C., Biesscker, D. A., Li J., and Ciaravella A, 2003, ApJ, 588, 586
- Far Ultraviolet Spectra of Coronal Mass Ejections Associated with X-Class Flares, Raymond J.C., Ciaravella A., Dobrzycka, D., Strachan L., Ko Y-K and Uzzo M., 2003, ApJL, 597, 1106
- Physical Parameters of the 2000 February 11 Coronal Mass Ejection: Ultraviolet Spectra versus White Light Images, Ciaravella A., Raymond J.C., van Ballegoijen A., Strachan L., Vourlidas A., Li J., Chen J., Panasyuk A., 2003, ApJ, 597, 1118
- Detection and Diagnostics of a Coronal Shock Wave Driven by a Partial-Halo CME on 2000 June 28, Ciaravella A., Raymond J.C., Kahler, S.W., Vourlidas, A., Li, J., 2005, ApJ, 621, 1121
- UV Properties of Halo CMEs: Doppler Shifts, Angles, Shocks and Bulk Morphology, Ciaravella A., Raymond J.C., Kahler, S.W., 2006, ApJ, 652, 774
- Analysis of a multi-wavelength time-resolved observation of a coronal loop, Reale F., Ciaravella A., 2006, A&A, 449, 1177
- Transition Region Emission and Energy Input to Thermal Plasma During the Impulsive Phase of Solar Flares, Raymond J.C., Holman g., Ciaravella A., Panasyuk A., Ko Y-K., and Kohl J., 2007, ApJ, 659, 750.

Luca Zangrilli – METIS COR Instrument Scientist

Luca Zangrilli, born in San Dona' di Piave (VE), on 6th September 1968

Curriculum Vitae:

- 1 Laurea degree in Astronomy, University of Padua, Italy, 1993.
- 2 Ph.D in Astronomy, University of Padua, Italy, 1998.
- 3 Since 2001, employed in INAF-OATo as Scientific Technician.

Professional:

- Responsible of the laboratory activities related to the integration and calibration of the visible light polarimeters for the EKPol eclipse telescope, and SCORE/UVCI sounding rocket coronagraph.
- Member of the alignment and integration team of the SCORE/UVCI sounding rocket coronagraph.
- Program manager of the SPECTRE instrument for the Solar Dynamic Observatory.

Relevant Publications:

- Fineschi S. *et al.*, *KPol: liquid crystal polarimeter for K-corona observations from the SCORE coronagraph*, SPIE, Volume 5901, pp. 389-399 (2005).
- Naletto G. *et al.*, *SPECTRE: a spectro-heliograph for the transition region*, ESA Publications Division, 2004, p. 251 - 256
- Gherardi A. *et al.*, *CCD camera for ground- and space-based solar corona observations*, SPIE, Volume 5171, pp. 247-257 (2004).
- Fineschi S., *et al.*, *Ultraviolet and Visible-light Coronagraphic Imager (UVCI)*, SPIE, Volume 4853, pp. 162-171 (2003).
- Zangrilli L. *et al.*, *Solar and Stellar Polarimetry with Liquid Crystal Retarders*, Memorie della Societa Astronomica Italiana, v.74, p.807 (2003).

Daniele Spadaro – METIS Co-PI

Daniele Spadaro, 30th October 1958
 Scicli (RG), Italy

Curriculum Vitae:

- Education:
 1983 - Laurea in Physics, Univ. of Catania, Italy
 1987 - Ph.D. in Astronomy, Univ. of Florence, Italy
- Since 2003 - Associate Astronomer at INAF-Astrophysical Observatory of Catania
- Since 1987 to 2002 - Researcher at Astrophysical Observatory of Catania
- 1986 - Researcher at Astronomical Observatory of Capodimonte, Naples
- Since 1984 to 1985 - Naval Officer in the Italian Navy

Professional:

- Co-Investigator of the UVCS/SOHO experiment:
 co-operation in the feasibility study, definition phase and development phase of the instrument;
 monitoring of the activities of the Italian factories responsible for the design and construction of some sections of the UVCS;
 co-operation in the integration, alignment and calibration activities of the UVCS;
 participation in the thermal-vacuum tests of SOHO;
 contribution to UVCS mission operations (Observing Leader), data reduction and analysis;
 Joint Science Operations Leader of SOHO (several times).
- Leader of ground-based observations of the Sun (WL & H α) at the Astrophysical Observatory of Catania (2001-2006)

Relevant Publications:

- *D. Spadaro, R. Susino, R. Ventura, A. Vourlidas, E. Landi, "Physical parameters of a mid-latitude streamer during the declining phase of the solar cycle", A&A 475, 707 (2007)*
- *J. Sanchez Almeida, L. Teriaca, P. Sutterlin, D. Spadaro, U. Schuele, R.J. Rutten, "Search for photospheric footpoints of quiet Sun transition region loops", A&A 475, 1101 (2007)*
- *D. Spadaro, A.F. Lanza, J.T. Karpen, S.K. Antiochos, "A transient heating model for the structure and dynamics of the solar transition region", ApJ 642, 579 (2006)*
- *R. Ventura, D. Spadaro, G. Cimino, M. Romoli, "Streamer and adjacent regions observed by UVCS/SOHO: a comparison between different phases of solar activity", A&A 430, 701 (2005)*
- *D. Spadaro, R. Ventura, G. Cimino, M. Romoli, "UVCS/SOHO investigation of the interface between streamers and coronal holes", A&A 429, 353 (2005)*
- *D. Spadaro, A.F. Lanza, A.C. Lanzafame, J.T. Karpen, S.K. Antiochos, J.A. Klimchuk, P.J. MacNeice, "A transient heating model for coronal structure and dynamics", ApJ 582, 486 (2003)*
- *R. Ventura, D. Spadaro, M. Uzzo, R. Suleiman, "UV line intensity and flow velocity distributions in two coronal mass ejections as deduced by UVCS-SOHO observations", A&A 383, 1032 (2002)*
- *A.F. Lanza, D. Spadaro, A.C. Lanzafame, S.K. Antiochos, P.J. MacNeice, D.S. Spicer, M.G. O'Mullane, "Extreme-ultraviolet transition region line emission during the dynamic formation of prominence condensations", ApJ 547, 1116 (2001)*
- *D. Spadaro, A.C. Lanzafame, L. Consoli, E. Marsch, D.H. Brooks, J. Lang, "Dynamical properties of an active region loop system observed on the solar disc with SUMER/SOHO", A&A 359, 716 (2000)*

Vincenzo Andretta – METIS Co-I (Investigation Scientist)

Vincenzo Andretta,

Place and date of birth: S. Maria a Vico (Italy, prov. Caserta) – 18 August 1966

Curriculum Vitae:

- 4 19/9/1994: Doctorate in Physics from University of Naples “Federico II” (Italy); thesis on *Helium in the spectrum of the Sun and of Solar-type stars*.
- 5 Since 13/5/1999: Research Astronomer at Istituto Nazionale di Astrofisica - Osservatorio Astronomico di Capodimonte (Naples, Italy).
- 6 1/2/1996 - 31/1/1999: National Research Council (NRC) Research Assistant at NASA's Goddard Space Flight Center (Greenbelt, Maryland, USA).
- 7 1/8/1994 – 15/1/1996: Post-Doctoral Research Assistant at Armagh Observatory (Armagh, N. Ireland, UK)

Professional:

- Co-chair of the ARENA (*Antarctic Research, a European Network for Astrophysics*) Solar Working Group, since November 2007.
- Co-I of the *Concordia/Italy* Project, from 2001 to 2006, a project to install a 40-cm class solar telescope at the Concordia Station, on Dome C, Antarctica.
- Coordinator or participant to several coordinated campaigns involving ground-based and space-born solar instruments; e.g.: SOHO Joint Observing Proposals (JOP) #16, #63, #139, #197 – the latter also in coordination with Hinode within HINODE Operation Plan (HOP) #44.
- Expertise in the analysis and interpretation of EUV solar spectra; e.g.: data obtained with the Coronal Diagnostics Spectrometer (CDS) aboard SOHO.
- Expertise in spectroscopic observations with optical telescopes, both solar (e.g.: NSO's McMath-Pierce Telescope – Kitt Peak, Arizona, USA) and stellar (e.g.: the Anglo-Australian Telescope, Siding Spring Observatory, Australia).

Relevant Publications:

- Busà, I., Aznar Cuadrado, R., Terranegra, L., Andretta, V., & Gomez, M. T., 2007, *The Ca II infrared triplet as a stellar activity diagnostic. II. Test and calibration with high resolution observations*, A&A **466**, 1089–1098.
- Landstreet, J. D., Bagnulo, S., Andretta, V., Fossati, L., Mason, E., Silaj, J., & Wade, G. A., 2007, *Searching for links between magnetic fields and stellar evolution. II. The evolution of magnetic fields as revealed by observations of Ap stars in open clusters and associations*, A&A **470**, 685–698.
- Bagnulo, S., Landstreet, J. D., Mason, E., Andretta, V., Silaj, J., & Wade, G. A., 2006, *Searching for links between magnetic fields and stellar evolution. I. A survey of magnetic fields in open cluster A- and B-type stars with FORS1*, A&A **450**, 777–791.
- Andretta, V., Busà, I., Gomez, M. T., & Terranegra, L., 2005, *The Ca II Infrared Triplet as a stellar activity diagnostics - I. Non-LTE photospheric profiles and definition of the R_{IRT} indicator*, A&A **430**, 669–677.
- Mauas, P. J. D., Andretta, V., Falchi, A., Falciani, R., Teriaca, L., & Cauzzi, G., 2005, *Helium Line Formation and Abundance in a Solar Active Region*, ApJ **619**, 604–612.
- Andretta, V., Del Zanna, G., & Jordan, S. D., 2003, *The EUV helium spectrum in the quiet Sun: a by-product of coronal emission?*, A&A **400**, 737–752.
- Andretta, V., Jordan, S. D., et al., 2000, *The Role of Velocity Redistribution in Enhancing the Intensity of the He II 304 Å Line in the Quiet-Sun Spectrum*, ApJ **535**, 438–453.
- Andretta, V., Doyle, J. G., & Byrne, P. B., 1997, *The Na I $\lambda\lambda 5890, 5896$ resonance doublet as chromospheric diagnostics in M dwarfs*, A&A **322**, 266–279.
- Andretta, V. & Jones, H. P., 1997, *On the Role of the Solar Corona and Transition Region in the Excitation of the Spectrum of Neutral Helium*, ApJ **489**, 375–394.

Luca Poletto – METIS Co-I (Instrument Scientist)

Luca Poletto, born in Vicenza (Italy), 22-8-1968

Curriculum Vitae:

- Laurea in Electronic Engineering cum laude, February 1993
- PhD in Electronic Engineering, December 1996
- Research Scientist of CNR-National Institute for the Physics of Matter, since January 1999

Professional:

- Research experience on: design and realization of instrumentation for EUV and soft X-Ray spectroscopy, characterization of EUV detectors, measurement of optical constants of materials, X-ray diagnostic techniques, characterization of ultrashort pulses in the EUV
- Responsible of the CNR-INFM activity on the design of the instrumentation for the photon beam characterization and handling of the EUV Free Electron Laser FERMI@ELETTRA (Elettra Synchrotron, Trieste, Italy)
- Responsible of the CNR-INFM activity for the realization of the spectrometer for the UV Free Electron Laser SPARC (ENEA, Frascati-Rome, Italy)
- Responsible of the CNR-INFM activity for the realization of the spectrometer for ultrashort EUV pulses for the Laser Division of the Rutherford Appleton Laboratory (UK)
- Responsible of the CNR-INFM activity for the realization of a stigmatic spectrometer for solar observation in the soft X-ray region (part of the Italian Space Agency contract on “Study for observation of the Solar System”)

Relevant Publications:

1. L. Poletto: **Off-axis pivot mounting for aberration-corrected concave gratings at normal incidence**, Appl. Opt. **39** 7, 1084 (2000)
2. L. Poletto and G. Tondello: **Grazing-incidence telescope-spectrograph for space solar imaging spectroscopy**, Appl. Opt. **40** 16, 2778 (2001)
3. L. Poletto, G. Tondello and P. Villoresi, **Optical design of a spectrometer-monochromator for the extreme-ultraviolet and soft-x-ray emission of high-order harmonics**, Appl. Opt. **42** 31, 6367 (2003)
4. L. Poletto and R.J. Thomas, **Stigmatic spectrometers for extended sources: design with toroidal varied-line-space (TVLS) gratings**, Appl. Opt. **43** 10, 2029 (2004)
5. L. Poletto, **Time-compensated grazing-incidence monochromator for extreme-ultraviolet and soft X-ray high-order harmonics**, Appl. Phys. B **78**, 1013 (2004)
6. L. Poletto, S. Bonora, M. Pascolini and P. Villoresi, **Time-frequency analysis of single-shot high-order harmonic spectra**, Rev. Sci. Instr. **75**, 4413 (2004)
7. M. Fernández-Perea, J.I. Larruquert, J.A. Aznárez, J.A. Méndez, L. Poletto, A.M. Malvezzi, A. Giglia and S. Nannarone, **Determination of optical constants of scandium films in the 20–1000 eV range**, J. Opt. Soc. Am. A, **23**, 2880 (2006)
8. L. Poletto and P. Villoresi, **Time-compensated monochromator in the off-plane mount for extreme-ultraviolet ultrashort pulses**, Appl. Opt. **45** 34, 8577 (2006)
9. L. Poletto and P. Villoresi, **Realization of a time-compensated monochromator exploiting conical diffraction for few-femtosecond XUV pulses**, Las. Part. Beams **25** 3, 391 (2007)

CURRICULUM VITAE Dr. J. Daniel Moses

Astrophysicist: Solar Physics Branch, Space Sciences Division, Naval Research Laboratory.

□ *Education:* B.S., Physics, Duke University, 1975; Ph.D., Physics, University of Chicago, 1985.

□ *Professional:* Dr. Moses's areas of interest include observational studies of the structure and dynamics of the solar atmosphere, observational studies of the interaction of the solar atmosphere and the interplanetary medium, and the development of instrumentation to achieve those observations. Among his contributions have been studies of the interrelation of structures of different temperatures and different temporal and spatial scales in the solar atmosphere, studies of plasma parameters and elemental abundances in evolving coronal structures, and studies of the relationship between X-ray properties of flares and interplanetary particle energy spectra. His contributions to instrumentation include development of CCD cameras for space-based solar observations in the first use of an X-ray CCD in astronomy, investigations of wide-band gap semiconductors for future UV detectors including the first development of a diamond UV photocapacitor, and the development of calibrations for space-based EUV instrumentation.

Dr. Moses has been a PI on four successful NASA suborbital program efforts. He has been a PI or Co-I on numerous NASA and Navy sponsored spaceflight hardware development, data analysis, and advanced instrument development research efforts. He is currently the PI on the NASA-sponsored EIT CalRoc suborbital calibration program, the PI on the Navy-sponsored program for the advanced development of CCDs, and a Co-I on the NASA-sponsored program for the development of wideband gap UV solid state detectors. He is an A-level Co-I on the NASA-sponsored EIT and LASCO programs, playing a major role in the development of both instruments, contributing to the operations (particularly for the EIT), and participating in the reduction, analysis and interpretation of the data. Dr. Moses is the author or co-author of more than 40 articles in the refereed literature and proceedings of scientific conferences. He is a member of the American Astronomical Society, the American Geophysical Union, and the American Physical Society.

□ *Selected Relevant Publications:*

Moses, J.D. et al., "EIT Observations of the Extreme Ultraviolet Sun," *Sol. Phys.*, 175, 571 (1997)

Moses, D., C.M. Korendyke, N. Moulton, J. Newmark, "The Plasma Environment of Prominences - SOHO Observations," *proc. of the IAU 167, Aussois*, in press (1998)

Berghmans, D., F. Clette, J.D. Moses, "Quiet Sun EUV Transient Brightenings and Turbulence," *Astron. and Astrophys.*, 336, 1039 (1998)

Dere, K.P. et al., "EIT and LASCO Observations of the Initiation of a Coronal Mass Ejection," *Sol. Phys.*, 175, 601 (1997)

Delaboudiniere, J.P. et al., "EIT: Extreme-Ultraviolet Imaging Telescope," *Sol. Phys.*, 162, 291 (1995)

Brueckner, G.E. et al., "The Large Angle Spectroscopic Coronagraph (LASCO)," *Sol. Phys.* 162, 357 (1995)

Moses, J.D. et al., "Solar Fine Scale Structures in the Corona, Transition Region, and Lower Atmosphere," *Astrophys. J.*, 430, 913 (1994)

Moses, J.D. et al., "A Next Generation EUV Imaging Spectrometer for Solar Flare Observations," *SPIE*, 2804, 260 (1996)

Moses, J.D. et al., "Performance of EIT Flight Quality Tektronix CCDs in the Extreme Ultraviolet," *SPIE*, 2006, 252 (1993)

Howard, R.A., B.D. Au, J.F. Hochedez, J.D. Moses, D. Wang, and M.M. Blouke, "Evaluation of Teletronix 1024 MPP Frontside and Backside CCDs," *SPIE* 1170, 112 (1992)

Marchywka, M., J.F. Hochedez, M.W. Geis, D.G.

Socket, and R.T. Goldberg, "The UV Photo-Response Characteristics of Diamond Diodes," *Applied Optics*, 30 (34), 5011 (1991)

Marchywka, M. and J.D. Moses, "Diamond MIS Photocapacitor Characteristics," *IEEE ED* (1994)

Binari, S.C., M. Marchywka, M. Koolbeck, and J.D. Moses, "Diamond M-S-M UV Photoconductors," in *Proceedings of the Third International Conference on New Diamond Science and Technology*, ed. Bachmann, P.T., Collins, A.T., and Seal, M. (1992)

Moses, J. D. and J. Davis, "Flight Test of a Grazing Incidence Relay Optics Telescope for Solar X-ray Astronomy," *SPIE*, 982 (1988)

CURRICULUM VITAE – DR. JEFFREY NEWMARK

Astrophysicist: Solar Physics Branch, Space Sciences Division, Naval Research Laboratory.

Ph.D. Astronomy, 1990, Pennsylvania State University, University Park, PA

B.S. Physics and Astronomy, 1985, University of Rochester, Rochester, NY

Dr. Newmark has worked as an astrophysicist at NRL since 2001. His primary fields of interest involve, instrument integration and test, calibration, software development for analysis of scientific satellite data and solar physics. He is currently a Co-Investigator on SOHO EIT and STEREO SECCHI instruments and is responsible for the absolute and time varying calibration of the CCD detector, software for retrieval, display, and analysis of EIT data, and scientific research. He is Project Scientist on two NASA Sounding Rocket Programs (EIT CalRoc and HERSHEL) as well as a laboratory detector development program (). Scientific research centers on three main research areas: 1) the development and application of differential emission measure analysis techniques to EUV observations of the solar transition region and corona, 2) development of a three-dimensional image reconstruction tool using brightness and polarization brightness and temporal information content of 2-D white light coronagraph images to study the extended solar atmosphere and heliosphere, and 3) development of analysis tools for the recognition and understanding of EUV image data.

Relevant Scientific Publication List:

- Newmark, J.S. (2007), et al., 'The Sun To The Earth, A Panoramic View From SECCHI: CME Observations Through The Inner Heliosphere', SPIE, Accepted.
- Auchere, F., Cook, J.W., Newmark, J.S., et al., (2005), 'The Heliospheric He II 30.4 nm Solar Flux During Cycle 23,' Ap.J. Vol. 625, Issue 2, pp. 1036-1044.
- Cook, J. W.; Newmark, J. S.; Altrock, R. C., (2005), 'Comparison of the Sacramento Peak Fe XIV Index with a Model Index Computed from Differential Emission Measure Maps,' Ap.J. Volume 633, p. 518C
- Clette, F., J.S. Newmark, et al. (2002), "The Radiometric Calibration of the Extreme Ultraviolet Imaging Telescope," ISSI Scientific Report SR-002, p. 121
- Newmark, J.S. Cook, J.W., Moses, J.D., et al. (2001), "Solar EUV Variability as Measured by SOHO/EIT," American Geophysical Meeting.
- Aschwanden, M.J., Newmark, J.S., et al. (2000), "3D-Stereoscopic Analysis of Solar Active Region loops: II SOHO/EIT Observations at Temperatures of 1.5-2.5 MK," Ap. J. Volume 531, Issue 2, pp. 1129-1149.
- Cook, J. W.; Newmark, J. S.; Moses, J. D. (1999), "Coronal Thermal Structure from a Differential Emission Measure Map of the Sun," B.A.A.S. 194, #100.03.
- Thompson, B. J., Newmark, J. S., et al. (1999), "SOHO/EIT Observations of the 1997 April 7 Coronal Transient: Possible Evidence of Coronal Moreton Waves," Ap. J. Volume 517, Issue 2, pp. L151-L154.
- Aschwanden, M.J., Newmark, J.S., et al. (1999), "3D-Stereoscopic Analysis of Solar Active Region loops: I SOHO/EIT 171 A Observations at Temperatures of 1.0-1.5 MK," Ap. J. Volume 515, Issue 2, pp. 842-867.
- Moses, J.D., Newmark, J.S., et al. (1997), "EIT Observations of the Extreme Ultraviolet Sun," Solar Physics, 175, p.571.
- Newmark, J.S., et al. (1997), "Coronal EUV Proxies Based Upon Observations by the SOHO Extreme ultraviolet Imaging Telescope," Eos Transactions, SH22A-08.

Dr. George A. Doschek, Branch Head, Solar Terrestrial Relationships Branch
Space Science Division
Naval Research Laboratory

Background:

George Doschek has been Branch Head of the Solar-Terrestrial Relationships Branch in the Space Science Division at the Naval Research Laboratory (NRL) since 1979. He is the Solar Physics Task Area Coordinator at NRL. Between 1970 and 1979 he was a Research Astrophysicist at NRL, and between 1968 and 1970 he was an E.O. Hulburt Fellow at NRL. He is a member of the American Astronomical Society and the Solar Physics Division of that society, as well as a member of several other societies. He is a Fellow of the Optical Society of America. He was the 1986-1988 Chairperson of the Solar Physics Division, and he is a recipient of NRL's highest award for scientific achievement, the E.O. Hulburt Award. He is an author so far on 278 research papers, most of which are in refereed journals. George Doschek's research areas are solar physics, atomic physics, and solar physics space instrumentation. He has analyzed data from many astrophysical space missions and has been a key player in the design and construction of new solar space experiments.

Education:

1963 - B.S. (Physics, Magna Cum Laude) University of Pittsburgh
1968 - Ph.D. (Physics) University of Pittsburgh

Awards, Honors:

Honorary Woodrow Wilson Fellow - 1963
Fellow, Optical Society of America
NRL Publications Awards - 1972, 1978, 1979, 1980, 1984, 1993
NRL E.O. Hulburt Science and Engineering Award - 1994

Professional Societies:

American Astronomical Society (Solar Physics Division)
Optical Society of America
American Geophysical Union
International Astronomical Union
Sigma Xi

Publications, Experiments:

301 papers in scientific journals, proceedings, 80 invited talks, 140 contributed (oral and poster) papers.
NRL PI, Bragg Crystal Spectrometer (BCS), *Yohkoh*; PI to NASA, Extreme-ultraviolet Imaging Spectrometer (EIS), *Hinode*(*Solar-B*)

Committees, Working Groups:

Chairperson, Solar physics Division of AAS (1986-1988)
Vice Chairperson, Solar Physics Division of AAS (1985-86, 1988-89)
Committee member, Solar Physics Division of AAS (1983-84, 1989-90)
Facility Scientist, Science Working Group for the NASA Orbiting Solar Laboratory (OSL)
Member, NAS Committee for Solar and Space Physics (June 1985-June 1987)
Member, NASA Management and Operations Working Group for Solar and Heliospheric Physics (1984-1986)
Member, MAX'91 Science Study Working Group (Feb. 1985-Feb. 1986)
Leader, Chromospheric Explosions Team, NASA Solar Maximum Mission Workshop (1983-1984)
Member, NRC Committee of line Spectra of the Elements - Atomic Spectroscopy (1978-1980)
Chairperson and Organizer of the *Eighth International Colloquium on Ultraviolet and X-ray Spectroscopy of Astrophysical and Laboratory Plasmas*, IAU Colloquium No. 86, 27-29 August, 1984, published by NRL.
Member, Solar Panel of the Astronomy and Astrophysics Survey Committee (1989-1991)
Member, UV/Optical from Space Panel of the Astronomy and Astrophysics Survey Committee (1989-1991)
Member, NASA Space Physics Subcommittee (1991-1994)
Member, EUVE User's Committee (1994-1996)
Member, Solar-B Science Definition Team (1996-March 1998)
Member, Solar-B Science Working Group (2003-present)

Prof. Dr. Sami K. Solanki – METIS Co-I

Prof. Dr. Sami K. Solanki, born 2 October 1958

Curriculum Vitae:

- Education: PhD in 1987 from ETH Zürich
- Since 1999 Director at the Max Planck Institute for Solar System Research (MPS)
- 1992-1999 Senior research associate and lecturer at the Institute of Astronomy, ETH Zürich
- 1989-1991 PostDoc at the Institute of Astronomy, ETH Zürich
- 1987-1989 PostDoc at the Department of Mathematical Sciences of the University of St. Andrews, Scotland

Professional:

- PI of the SUNRISE project of DLR, NASA and NPE
- Co-I of HMI on the SDO mission of NASA
- Co-I of the SECCHI instrument package for the STEREO mission of NASA
- Co-I of the SOVIM experiment on the ISS
- Co-I of the VIRGO instrument on SOHO

Relevant Publications:

Over 240 articles in peer reviewed journals

- Feng L., Inhester B., Solanki S. K., et al.: First Stereoscopic Coronal Loop Reconstructions from STEREO SECCHI Images. *ApJ* 671, L205 (2007).
- Tripathi D., Solanki S.K., Mason H.E., Webb D.F.: A Bright Coronal Downflow Seen in Multi-Wavelength Observations: Evidence of a Bifurcating Flux-Rope? *A&A* 472, 633 (2007).
- Raouafi N.-E., Harvey J.W., Solanki S.K.: Properties of Solar Polar Coronal Plumes Constrained by UVCS Data. *ApJ* 658, 643 (2007).
- Wiegelmann T., Solanki S.K.: Similarities and Differences Between Coronal Holes and the Quiet Sun: Are Loop Statistics the Key? *Solar Phys.* 225, 227 (2004).
- Solanki S.K., Usoskin I.G., Kromer B., Schüssler M., Beer J.: Unusual Activity of the Sun During Recent Decades Compared to the Previous 11,000 Years. *Nature* 431, 1084 (2004).
- Raouafi N.-E., Solanki S.K.: Effect of the Electron Density Stratification on Off-Limb O VI Line Profiles: How Large is the Velocity Distribution Anisotropy in the Solar Corona? *A&A* 427, 725 (2004).
- Solanki S.K., Lagg A., Woch J., Krupp N., Collados M.: Three-Dimensional Magnetic Field Topology in a Region of Solar Coronal Heating. *Nature* 425, 692 (2003).
- Ning Z., Innes D.E., Solanki S.K.: Line Profile Characteristics of Solar Explosive Event Bursts. *A&A* 419, 1141 (2004).
- Wang T., Solanki S.K., Innes D.E., Curdt W., Marsch E.: Slow-Mode Standing Waves Observed by SUMER in Hot Coronal Loops. *A&A* 402, L17 (2003).

Philippe Lamy – METIS Co-I

Philippe Lamy, born 18 May, 1947 at Le Havre, France

Curriculum Vitae:

- Diploma, Ecole Nationale Supérieure de l'Aéronautique et de l'Espace", Paris (1969)
- Master of Science, Cornell university, USA (1971)
- Doctorate (Ph.D.), Cornell university, USA (1975)
- Since 1975, staff scientist at Laboratoire d'Astrophysique de Marseille
- Presently Director of Research and Leader of the Solar System Group

Professional:

Dr. Lamy has over 30 years of experience in solar system studies: interplanetary dust, the solar corona, comets and the development of laboratory and space experiments. His current interests in coronal studies include the nature and evolution of polar plumes, the temporal evolution of the streamer belt, the physical properties of coronal holes and the 3-D reconstruction of coronal structures. He was a CoI on the PIRAMIG and PCN experiments aboard the SOYOUZ spacecraft and the HOPE photopolarimeter for the GIOTTO mission. He was. He is presently, and.

He has analyzed LASCO C2 and C3 images to perform accurate photopolarimetric measurements and to derive the electron density in the corona.

- Team Leader for the study of a coronagraph for the PROBA 3 formation flying mission
- CoI and Team Leader of the LASCO-C2 coronagraph for the SOHO mission
- CoI of the SECCHI coronal suite of instruments for the STEREO mission
- CoI and Team Leader of the OSIRIS Narrow Angle Camera for the ROSETTA mission
- CoI of CIVA on the ROSETTA Lander

Relevant Publications:

- *Absolute photometry of the June 30, 1973 Solar Corona*, Koutchmy, S., Lamy, P.L., et al. (1978) *Astron. Astrophys.* 69, 35.
- *No evidence of a circumsolar dust ring from infrared observations of the 1991, solar eclipse*, Lamy, P.L., Kuhn, J.R., Lin, H., Koutchmy, S., Smartt, R.N. (1992) *Science* 257, 1377.
- *The large angle spectroscopic coronagraph (LASCO)*, Brueckner, G.E.,..., Lamy, P.L., ... (1995) *Solar Physics* 162, 357.
- *A coronal optical imager for a solar probe*, Lamy, P.L., Koutchmy, S. (1996) *Adv. Space Res.* 17, 3(95).
- *Geomagnetic storms caused by coronal mass ejections (CMEs): March 1996 through June 1997*, Brueckner, G. E., ... Lamy, P., ... (1998) *Geophy. Res. Letters* 25, 3019.
- *Streamer disconnection events observed with the LASCO coronagraph*, Wang, Y.-M., Sheeley, N. R., Jr., Howard, R. A., Rich, N. B., Lamy, P. L. (1999) *Geophy. Res. Letters*, 26, 1349.
- *Solar polar plume lifetime and coronal hole expansion: determination from long-term observations*, DeForest, C. E., Lamy, P. L., Llebaria, A., (2001) *ApJ* 560, 490.
- *On the 3-dimensional structure of the streamer belt of the solar corona*, Saez, F., Zhukov, A., Lamy, P.L., Llebaria, A. (2005) *Astron. Astrophys.* 442, 351.
- *Three-dimensional reconstruction of the streamer belt and other large-scale structures of the solar corona. I. Method*, Saez, F., A., Lamy, P.L., Llebaria, A. (2007) *Astron. Astrophys.* 473, 265.

Frédéric Auchère – METIS Co-PI

Frédéric Auchère born 13 November 1974
in Paris, France

Curriculum Vitae:

- 2000 – Plasma physics Ph.D from Université Paris VI
- 2000-2002 – EIT support scientist at NASA/Goddard
- Since 2002- Astronomer at IAS
- ...

Professional:

- PI of *SOHO* / EIT
- Lead of HECOR on the *Herschel* sounding rocket
- Co-I on *STEREO* / SECCHI
- Instrument scientist of *SMESE* / LYOT

Dr F. Auchère has over 10 years' experience of working on solar EUV data and has expertise on the design, calibration and operations of space EUV instruments. Hi main research interests are the acceleration of the solar wind and the origin of the solar irradiance variability.

Relevant Publications:

- Auchère, F. 2005, “*Effect of the H I Lyman α chromospheric flux anisotropy on the total intensity of the resonantly scattered coronal radiation*”, *ApJ*, 622, 737
- Auchère, F., Cook, J. W., McMullin, D. R., Newmark, J. S., vonSteiger, R. & Witte, M. 2005, “*The heliospheric He II 30.4 nm solar flux during solar cycle 23*”, *ApJ*, 625, 1036
- Zhukov, A. & Auchère, F. 2004, “*On the initiation of CMEs manifested by EIT waves and EUV dimmings*”, *Astronomy & Astrophysics*, 427, 705
- Dudok de Wit, T. & Auchère, F. 2006, “*Multispectral analysis of solar EUV images: linking temperature to morphology*”, 466(1), 347

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Affiliation	INAF-IFSI
Address	Via Fosso del Cavaliere 100, 00133 Rome, Italy
E-mail	roberto.bruno@ifsi-roma.inaf.it
Position	Co-I
Responsibility	Scientific requirements/data analysis
CV	<p>Education:</p> <ul style="list-style-type: none"> • Obtained Degree in Physics (Laurea) with honors, L'Aquila University 28-7-1978 • Research Fellow at Department of Physics, University of L'Aquila 1978-1980 • Research Fellow at NASA-GSFC 1980-1981 <p>Employment:</p> <ul style="list-style-type: none"> • 1982-2001 Researcher at IFSI • 2002–present Senior Researcher at IFSI <p>Professional Experience:</p> <ul style="list-style-type: none"> • Taught at Department of Physics, University of L'Aquila 1981-1982 • Head of Data Analysis Group at IFSI in 1997-1998 • Teaches at University of Calabria (Cs), Italy since 2000 • Member of IFSI Scientific Council 1993-2001 • PI of several research projects funded by the Italian Space Agency and National Research Council • Col of the proposal for an Ion Spectrometry experiment onboard the Russian mission MARS-94. • Col of Composition and Ion Spectrometry experiments onboard ESA-CLUSTER 1 and 2. • Col of the Ion Spectrometry experiment onboard the Chinese space mission DOUBLE-STAR. • Col of SERENA-MPO and MEA-MMO Bepi Colombo • Collaborated to the Solar Orbiter Assessment Study Report <p>Research Field</p> <ul style="list-style-type: none"> • Solar wind large scale structure, • MHD turbulence, • Numerical studies on electrostatic ion analysers for solar wind and magnetospheric plasmas. <p>7.1 Bibliography</p> <ul style="list-style-type: none"> • Co-author of more than 110 papers published on international refereed journals and over 30 papers on conference proceedings; • Received over 30 invitations at international conferences and international schools; <p>Selected Scientific Publications</p> <ol style="list-style-type: none"> 1. R. Bruno , L. F. Burlaga, A. J. Hundhausen, Quadrupole distortion of the heliospheric current sheet in 1976 and 1977, J. Geophys. Res., 87, 10339, 1982 2. Bruno, R. and V. Carbone, The Solar Wind as a Turbulence Laboratory, Invited Review on Living Reviews in Solar Physics, 4, p. 1-187, 2005 3. Bruno, R., R. D'Amicis, B. Bavassano, V. Carbone, L. Sorriso-Valvo, Magnetically dominated structures as an important component of the solar wind turbulence, Ann. Geophys., 25, 1913, 2007. <p>Selected Technical Publications</p> <ol style="list-style-type: none"> 4. A. Di Lellis, R. Bruno , M.B. Bavassano-Cattaneo, V. Formisano, Experimental activity and numerical simulations for the plasma experiment of the ESA CLUSTER project, Nuovo Cimento C, 657-664, 1992. 5. D'Amicis R., Bruno, R., Bavassano, B., Cattaneo, MB., Baldetti, P., Pallocchia, G., Numerical study of a quasi 3D top-hat solar wind plasma analyser, Proc. of "Solar Encounter: The first SOLAR ORBITER Workshop", Puerto de la Cruz, Tenerife, Spain, 14--18 May 2001 (ESA SP-493, September 2001) 6. D'Amicis, R. Bruno, M.B. Cattaneo, B. Bavassano, G. Pallocchia, J.A. Sauvaud, Solar wind plasma experiment on SOLAR ORBITER: dealing with the need for a sufficient phase-space resolution, Solar Wind X Conference, Pisa (It), 17-21 June 2002, M. VELLI, R. BRUNO, and F. MALARA editors, AIP, 679, 822, 2003

Luigi Ciminiera – METIS PI/Co-PI/Co-I/Ass. Scientist/etc.

Luigi Ciminiera, born in Ortona (Chieti), Italy, 13-2-1954

Curriculum Vitae:

- Graduated in Electronic Engineering in 1977 at Politecnico di Torino.
- Professor of Computer Engineering with Dipartimento di Automatica e Informatica, Politecnico di Torino, Italy. (From 1991 until now)
- Associate Professor of Computer Engineering with Dipartimento di Ingegneria Elettrica ed Elettronica, Università di Bari, Italy (1988-1991)
- Assistant Professor of Computer Engineering with Dipartimento di Automatica e Informatica, Politecnico di Torino. (1983-1988)

Professional:

- Responsible for the DPU in the proposal XUVI for the Orbiting Solar Laboratory.
- Designer of the software for scientific analysis of the UVCS/SOHO instrument.

Relevant Publications:

- SANNA A., ZUNINO C., CIMINIERA L. (2004). A federation of solar observation archives realized by a JXTA-based architecture. FUTURE GENERATION COMPUTER SYSTEMS. vol. 21, pp. 349-359 ISSN: 0167-739X.
- HILL F., CSILLAGHY A., BENTELY R.D., ABOUDARHAM J., ANTONUCCI E., FINKELSTEIN A., CIMINIERA L., GURMAN J., SCHOLL I., PIKE D., ZARKHOVA V., EGSO in need for a global schema, PROC. SPIE 4846, 35 (2002).

Vania Da Deppo – METIS Co-I

Vania Da Deppo, born in 1972 in Auronzo (BL) - Italy

Curriculum Vitae:

- 1999 Degree in Physics
- 2003 PhD in ‘Space Science and Tecnology’
- Since 2004 researcher at the National Research Council (CNR-INFM) with the aim of developing innovative optical instrument for space applications.

Professional:

- Since 2000 involved in the analysis and definition of the optical design for an UV-VIS coronagraph and an EUV spectrometer for the SOLO ESA Mission.
- Since 2002 involved in the analysis and definition of the optical design for UVCI coronagraph for the HERSCHEL Sounding Rocket experiment (NASA).
- Since 2004 co-I for the Simbio-Sys experiment for the Bepicolombo ESA mission, responsible of the optical design of the stereo channel.
- Since 1998 involved in the optical design, realization, test and calibration of the Wide Angle Camera for the Rosetta mission.

Relevant Publications:

- *V. Da Deppo, L. Poletto, Design of a grazing incidence EUV imaging spectrometer for the Solar Orbiter ESA mission, 6th International Conference on Space Optics, Proceedings of ESA/CNES ICSO 2006, held 27-30 June 2006 at ESTEC, Noordwijk, The Netherlands. Edited by A. Wilson. ESA SP-621. European Space Agency, 2006. (Published on CDROM, p.34.1)*
- *K. Middleton, V. Da Deppo, L. Poletto, U. Schüle, R. J. Thomas, P. Young, Optical design of the Extreme Ultraviolet Spectrometer (EUS) on board Solar Orbiter, to be published in Proc. Of the 2nd Solar Orbiter Workshop held 16-20 October 2006 in Athens (Greece), ESA SP-641, 2006*
- *S. Fineschi, E. Antonucci, D. Gardiol, V. Da Deppo, G. Naletto, M. Romoli, A. Cacciani, M. Malvezzi, Extended UV corona imaging from the Solar Orbiter: the Ultraviolet and Visible-light Coronagraph (UVC), in Solar encounter. Proceedings of the First Solar Orbiter Workshop, 14 - 18 May 2001, Puerto de la Cruz, Tenerife, Spain. ESA SP-493, 217-222, 2001*
- *S. Fineschi, E. Antonucci, M. Romoli, D. Gardiol, G. Naletto, S. Giordano, M. Malvezzi, V. Da Deppo, L. Zangrilli, G. Noci, Ultraviolet and Visible-light Coronagraphic Imager (UVCI) for HERSCHEL (Helium Resonance Scattering in Corona & HELiosphere), in “Innovative Telescopes and Instrumentation for Solar Astrophysics”, Proc. SPIE 4853, 162-171, 2003*

Giulio Del Zanna – METIS Ass. Scientist

Giulio Del Zanna, born 22-05-1964 in Firenze, Italy

Curriculum Vitae:

- 8 Education
- 9 1999: PhD on 'Extreme Ultraviolet Spectroscopy of the Solar Corona', Univ. of Central Lancashire, UK.
- 10 1994: Degree in Physics, University of Florence, Italy
- 11 Jul 2007--: STFC Advanced Fellow, UCL Mullard Space Science Laboratory (UK)
- 12 Oct 04--Jul 07: Research fellow, UCL (UK)
- 13 Apr 02—Sept 04: Research Associate, Univ. of Cambridge (UK)
- 14 Oct--Dec 01: Research Associate, Univ. of Florence, Italy
- 15 Dec 99 – Aug 01: Research Associate, Univ. of Cambridge (UK)
- 16 Jul 99 – Nov 99: Research Fellow at Univ. of Central Lancashire, UK.

Professional:

- I have extensive experience on the interpretation of XUV spectra of stellar coronae, having worked on all space spectrometers flown since 1990. In particular, with the SOHO/CDS and Hinode/EIS, the main EUV solar spectrometers of the last decade.
- I am an expert on atomic physics applied to plasma diagnostic techniques, especially on line identifications in the EUV. Within the CHIANTI collaboration, I have been providing atomic data used by the solar physics community world-wide.
- I have worked extensively on the solar corona, in particular to measure chemical abundances, densities and temperatures from coronal holes, active regions and flares.
- I have contributed over the last few years to the science cases for the solar orbiter imager and spectrometer.

Relevant Publications:

- Young, P.R., Del Zanna, G., Mason, H.E., et al., 2007, EUV emission lines and diagnostics observed with Hinode/EIS, PASJ, in press*
- Young, P.R., Del Zanna, G., Mason, H.E., et al., 2007, Transition region features observed with Hinode/EIS, PASJ, in press*
- Kuin, N.P.M. , Del Zanna, G., 2007, The In-Flight Performance of the SOHO Grazing Incidence Spectrometer, Sol. Phys.,242,187*
- Landi, E., Del Zanna, G., Young, P.R., Dere, K.P., Mason, H.E., Landini, M., 2006, CHIANTI version 5, ApJS, 162, 261*
- Del Zanna, G., Schmieder, B., Berlicki, A., Mason, H.E., 2006, The gradual phase of the X17 flare on Oct 28 2003, Sol. Phys., 239, 173*
- Del Zanna G., Mason H.E. 2005, Benchmarking atomic data for astrophysics: Fe XII, A&A, 433, 731
- Del Zanna, G., Mason, H.E., 2003, Solar active regions: SOHO/CDS and TRACE observations of quiescent coronal loops A&A, 406, 1089*
- Del Zanna, G., 2003, Solar active regions: the footpoints of 1 MK loops, A&A, 406, L5*
- Andretta, V., Del Zanna, G., Jordan, S., 2003, The EUV helium spectrum in the quiet Sun: a by-product of coronal emission?, A&A, 400,737*
- Young, P.R., Del Zanna, G., Landi, E., Dere, K.P., Mason, H.E., Landini, M., 2003, CHIANTI version 4, ApJS, 144,135*
- Del Zanna, G., Bromage, B.J.I., and Mason, H.E., 2003, Spectroscopic characteristics of polar plumes, A&A, 398, 743*
- Del Zanna, G., Bromage B.J.I., E. Landi, M. Landini, 2001, Solar EUV spectroscopic observations with SOHO/CDS I. An in-flight calibration study, A&A, 379, 708*

Silvio Giordano – METIS Co-I (Investigation Scientist)

Silvio Giordano,

Place and date of birth: Cuneo (Italy, prov. Cuneo) – 15 August 1966

Curriculum Vitae:

- Mar/1992: Degree in Physics from University of Torino; thesis on *Inclusive production of η mesons with protons in the 800-150 MeV energy range on ^{12}C* .
- Feb/1999: PhD in Physics from University of Torino; thesis on *Ultraviolet Spectroscopic Observations of the solar corona with UVCS - Origin of the fast solar wind*.
- Since Sep/1999: Research Astronomer at Istituto Nazionale di Astrofisica - Osservatorio Astronomico di Torino (Pino Torinese, Italy).
- May/1995 - Aug/1995: Short Term Visitor at the Harvard-Smithsonian Center for Astrophysics, (Cambridge, MA, USA).
- May/2004 - Oct/2004: Short Term Visitor at the Harvard-Smithsonian Center for Astrophysics, (Cambridge, MA, USA).

Professional:

- Expertise in the analysis and interpretation of UV solar corona spectra and Visible light pB data; e.g.: data obtained with the UltraViolet Coronal Spectrometer (UVCS) aboard SOHO.
- Data analysis scientist at the NASA's Goddard Space Flight Center Mission (Greenbelt, Maryland, USA) for UVCS, 1996/1997.
- Expertise in UV solar corona spectroscopic observations with UVCS. Lead scientist of several observation campaigns and participant to SOHO Joint Observing Programs (JOP)
- Expertise in data processing and image reconstruction software. Main contributor to the UVCS Data Analysis Software.
- Expertise in data catalog and archiving. Responsible for development of IDL data catalog of UVCS observations and contributor to European Grid of Solar Observatories (EGSO).

Relevant Publications:

- Antonucci, A., Dodero, M.A., Giordano, S., Krishnakumar, V. & Noci, G., 2004, *Spectroscopic measurement of the plasma electron density and outflow velocity in a polar coronal hole*, A&A, **416**, 749–758.
- Fineschi, S., Antonucci, E., Romoli, M., Gardiol, D., Naletto, G., Giordano, S., et al. 2003, *Ultraviolet and Visible-light Coronagraphic Imager (UVCI)*, Proc. SPIE **4853**, 162–171.
- Marocchi, D., Antonucci, E., Giordano, S., 2001, *Oxygen Abundance in Coronal Streamers During Solar Minimum*, Annales Geophysicae, **19**, 135–145.
- E. Antonucci, M.A. Dodero, Giordano, S., 2000, *Fast Solar Wind Velocity in a Polar Coronal Hole during Solar Minimum*, Sol.Phys., **197**, 115–134.
- Giordano, S., Antonucci, E., Noci, G., Romoli, M. & Kohl, J.L., 2000, *Identification of the Coronal Sources of the Fast Solar Wind*, ApJ Letters, **531**, L79–L82.
- Giordano, S., Antonucci, E., Dodero, M.A., 2000, *Oxygen Outflow Velocities in a Polar Coronal Hole*, Adv. in Space Res., **25**, 9, 1927–1930.
- Antonucci, E., Giordano, S., Dodero, M.A., 2000, *Hydrogen and Oxygen Temperature in Coronal Holes*, Adv. in Space Res., **25**, 9, 1923–1926.

Curriculum Vitae: Dr. Clarence M. Korendyke

Solar Physics Branch, Space Science Division, Naval Research Laboratory.

Education:

B.A., Kalamazoo College, 1984

M.A., University of Maryland, College Park, 1988

Ph.D., University of Maryland, College Park, 1992

Positions Held: 1984-present: Research Physicist, Naval Research Laboratory

Background: Dr. Korendyke's principal scientific interest is in following the transport of mass, momentum and energy through the solar atmosphere into interplanetary space using advanced optical telescopes. As assistant project scientist, he played a central role in the development of the LASCO instrument. Dr. Korendyke has also carried out the HRTS sounding rocket program as project scientist under the direction of Dr. Guenter E. Brueckner. He successfully launched four HRTS sounding rockets.

As principal investigator, Dr. Korendyke led the development of the VAULT payload at NRL. The instrument successfully flew in 1999. An improved version of this payload (VAULT 2) was flown in June 2002. This flight produced images of the solar atmosphere of unprecedented quality.

Anticipated Role: Dr. Korendyke and Dr. Thomas are the optical designers. He will assist the principal investigator to procure the TVLS grating and participate in the EUV optical testing. Dr. Korendyke was responsible for procuring and testing the optical performance of the EIS grating.

Relevant Publications:

Korendyke, Clarence M.: "Imaging channeled spectrograph: a high resolution spectrometer providing multiple simultaneous 2 D monochromatic images over a large spectral range", *Applied Optics* 1988 20, 4187.

Korendyke, Clarence M., Prinz, Dianne K. and Socker, Dennis G.: "Optical design of a near UV coronagraph for a sounding rocket platform", *Optical Engineering*, 1994, 33, 479.

Korendyke, Clarence M., Dere, K.P., Socker, D.G., Brueckner, G.E., and Schmeider, B.: "Ultraviolet Observations of the Structure and Dynamics of an Active Region at the Limb", *Ap.J.* 1995, 443, 869.

Brueckner, G.E., Howard, R.A., Koomen, M.J., Korendyke, C.M., Michels, D.J., Moses, J.D., Socker, D.G., Dere, K.P., Lamy, P.L., Llebaria, A., Bout, M.V., Schwenn, R., Simnett, G.M., Bedford, D.K. and Eyles, C.J. 1995, "The Large Angle Spectroscopic Coronagraph (LASCO), Visible Light Coronal Imaging and Spectroscopy", *Solar Physics* 162, 357.

Wang, Y.M., Sheeley, N.R., Jr., Hawley, S.H., Kraemer, J.R., Brueckner, G.E., Howard, R.A., Korendyke, C.M., Michels, D.J., Moulton, N.E. and Socker, D.G.: 1997, "The Green Line Corona and its Relation to the Photospheric Magnetic Field", *Ap.J.* 485: 419-429.

C.M. Korendyke, A. Vourlidas, J.W. Cook, K.P. Dere, R.A. Howard, J.S. Morrill, J.D. Moses, N.E. Moulton and D.G. Socker, "High resolution imaging of the upper solar chromosphere: First light performance of the very high resolution advanced ultraviolet telescope", *Solar Physics* 200: 63-73.

Martin Laming received a B.A.(Hons) degree in Physics in 1984, and obtained a D.Phil. in Atomic Physics in 1988, both from Oxford University. From 1989--1990 he held a Lindemann Fellowship which was tenured at the Smithsonian Astrophysical Observatory. Since that time he worked on contract at the Naval Research Laboratory in the Solar-Terrestrial Relationships Branch, becoming a Federal employee in 1999. His main research interests are in atomic and plasma physics applications to the physics of the solar transition region and corona, which naturally extends to include studies of late-type stellar coronae, and to the physics of shocks in supernova remnants. Recent work in solar physics includes a comprehensive model for the FIP fractionation which produces the coronal elemental composition, and work to understand the ionization balance observed in the fast solar wind and coronal mass ejections. He also runs the HULLAC (Hebrew University Lawrence Livermore Atomic Code) in its most recent 2007 incarnation with which cross sections and rates for all relevant atomic processes (collisional and photo excitation and ionization, radiative and dielectronic recombination) may be computed in the distorted wave approximation. Laboratory work has included the first use of a microcalorimeter for laboratory astrophysics experiments on an electron beam ion trap and more recently studies of radiative shock structure in laser irradiated shock tubes. He has authored or coauthored over 100 papers in refereed literature, and is a member of the American Astronomical Society and American Geophysical Union.

Recent relevant publications:

"The Solar Helium Abundance in the Outer Corona Determined from Observations with SUMER/SOHO" **J. M. Laming** & U. Feldman, 2001, ApJ, **546**, 552

"The Variability of the Solar Coronal Helium Abundance: Polar Coronal Holes Compared to the Quiet Sun" **J. M. Laming** & U. Feldman, 2003, ApJ, **591**, 1257

"On Collisionless Electron-Ion Temperature Equilibration in the Fast Solar Wind" **J. M. Laming**, 2004, ApJ, **604**, 874

"A Unified Picture of the FIP and Inverse FIP Effects" **J. M. Laming**, 2004, ApJ, **614**, 1063

"A Physical Relationship Between Electron-Proton Temperature Equilibration and Mach Number in Fast Collisionless Shocks" P. Ghavamian, **J. M. Laming**, & C. E. Rakowski 2007 ApJ, **654**, L69

"Ion Charge States in the Fast Solar Wind: New Data Analysis and Theoretical Refinements" **J. M. Laming** & S. T. Lepri 2007, ApJ, **660**, 1642

"Ion Charge State in Halo CMEs: What can we Learn about the Explosion?" C. E. Rakowski, **J. M. Laming**, & S. T. Lepri, 2007, ApJ, **667**, 602

Dr. Enrico Landi - Co-investigator

Education:

PhD, University of Florence, Italy 1998

Positions Held:

Research Physicist, ARTEP, Inc. (at Naval Research Laboratory), 2000-present. Post-doc, Max-Planck Institute for Aeronomy, Germany, 1999-2000. Contractor, University of Florence, Italy 1995-1999. Contractor, Naval Research laboratory, 1995.

Background:

Dr. Landi has worked in the field of solar EUV and UV spectroscopy since the beginning of his career.

Dr Landi has participated to the creation and maintenance of the CHIANTI database of atomic data and transition probabilities for the analysis of spectra from optically thin plasmas. CHIANTI is used worldwide for spectroscopic studies of astrophysical sources. Dr. Landi is currently responsible for any issue on the CHIANTI data.

Dr. Landi carried out extensive studies of the physical properties and thermal structure of coronal holes and of the off-disk solar corona, searching for tracers of the source regions of the solar wind. Dr. Landi also carried out in-depth studies of spectral line widths, ion temperatures and non-thermal velocities in the solar atmosphere to investigate solar wind acceleration. Dr Landi extensively analyzed SOHO/CDS, SOHO/SUMER and Hinode/EIS observations to investigate the structure and dynamics of quiet and active Sun, the origin of the solar wind, the evolution of the slow/fast wind boundaries and plasma loop models.

Recent Relevant Publications:

Landi, E., "Ion temperatures in the quiet solar corona", 2007, ApJ, 663,1363

Landi, E., Feldman, U., Doschek, G.A. "Ne and O absolute abundances in the solar corona" 2007, ApJ, 659, 743

Spadaro, D., Susino, R., Ventura, R., Vourlidis, A., Landi E. "SOHO investigation of physical parameters of a mid-latitude streamer observed during the decay phase of the solar activity cycle" 2007, A&A, 475, 707

Landi, E., Feldman, U., Doschek, G.A. "Plasma diagnostics of the large-scale corona with SUMER – I. Measurements at the west limb" 2006, ApJ, 643, 1258

Landi,E, Del Zanna,G., Young,P.R., Dere,K.P, Mason,H.E., Landini, M., "CHIANTI–an atomic database for emission lines.VII." 2007, ApJS, 162, 261

Feldman, U., Landi, E., Schwadron, N.A. "On the sources of fast and slow solar wind" 2005, JGR, 110, A07109

Parenti, S., Landi, E. Bromage, B.J.I "SOHO-Ulysses Spring 2000 Quadrature: CDS and SUMER results" 2003, ApJ, 590, 519

Landi, E., Mason, H.E., Lemaire, P., Landini, M., "SUMER observations of transition region fine structures", 2000, A&A, 357, 743

Dere, K.P., Landi, E., Mason, H.E., Monsignori Fossi, B.C., Young, P.R., "CHIANTI – an atomic database for EUV emission lines", 1997, A&AS, 125, 149

LANDINI Massimo – METIS Co-I

LANDINI Massimo, born 25.10.1939 in Florence (ITALY)

Curriculum Vitae: (min2 - max 5 bullets)

- 17 Education:
18 1963 Laurea in Physics University of Florence
19 1970 PHD Astrophysics
20 actual position and role-
21 1990 - today - Full Professor of Astronomy, University of Florence, Italy
22 1986 - 1989 - Full Professor of Astronomy, University of Naples, Italy ...
23 1969 - 85 - Associate Professor of Spectroscopy, Solar Physics, Technical Astrophysics, University of Florence.

Professional:

- 2002- Co-I in the proposal of the Atmospheric Imaging Spectrometer (AIS) on Solar Dynamics Observatory (SDO)
- 1996- Co-I on Coronal Diagnostic Spectrometer experiment on Solar Heliographic Observatory mission.
- 1990 - Co-I, X-ray EUV Imager (OSL/XUVI)
- 2003-today Director of Department of Astronomy and Space Science, University of Florence,
- 1991-1997 - Director of Department of Astronomy and Space Science, University of Florence,
- 1979-86 - Director of the Center for Infrared Astronomy, National Council of Research, Italy

....

Relevant Publications:

1. YOUNG P. R., DEL ZANNA G., MASON H. E., DERE K. P., LANDI E., LANDINI M., DOSCHEK G. A., BROWN C. M., CULHANE J. L., HARRA L.K., WATANABE T., HARA H. (2007). EUV emission lines and diagnostics observed with Hinode/EIS. PUBLICATIONS OF THE ASTRONOMICAL SOCIETY OF JAPAN. ISSN: 0004-6264.
2. DEL ZANNA G., WORTERS H. L., BROMAGE G. E., FOLEY C. A., MASON H. E., LANDINI M., WHITING A. (2006). X-ray emission from PTT stars. ADVANCES IN SPACE RESEARCH. vol. 38, pp. 1475 ISSN: 0273-1177. doi:10.1016/j.asr.2006.05.020.
3. LANDI E., DEL ZANNA G., YOUNG P. R., DERE K. P., LANDINI M., MASON H. E. (2006). CHIANTI-An Atomic Database for Emission Lines. VII. New Data for X-Rays and Other Improvements. ASTROPHYSICAL JOURNAL SUPPLEMENT SERIES. vol. 162, pp. 261 ISSN: 0067-0049.
4. LANDI E., DEL ZANNA G., YOUNG P. R., DERE K. P., MASON H. E., LANDINI M., M. (2006). CHIANTI-An Atomic Database for emission Lines. VII. New Data for X-Rays and Other Improvements. ASTROPHYSICAL JOURNAL SUPPLEMENT SERIES. vol. 162, pp. 261-280 ISSN: 0067-0049.
5. LANDI E., LANDINI M. (2005). Models for Solar Magnetic Loops. V. A New Diagnostic Technique to Compare Loop Models and Observations. ASTROPHYSICAL JOURNAL. vol. 618, pp. 1039-1043 ISSN: 0004-637X.
6. LANDI E., LANDINI M. (2004). Model for solar magnetic loops. III. Dynamic models and coronal diagnostic spectrometer observations. ASTROPHYSICAL JOURNAL. vol. 608, pp. 1133 ISSN: 0004-637X.
7. YOUNG P. R., DEL ZANNA G., LANDI E., DERE K. P., MASON H. E., LANDINI M. (2003). CHIANTI-An Atomic Database for Emission Lines. VI. Proton Rates and Other Improvements. ASTROPHYSICAL JOURNAL SUPPLEMENT SERIES. vol. 144, pp. 135 ISSN: 0067-0049.
8. BRKOVIC A., LANDI E., LANDINI M., M. RUEDI, SOLANKI S. (2002). Models for solar magnetic loops. Paper II: Comparison with SOHO-CDS observation on the solar disk. ASTRONOMY & ASTROPHYSICS. vol. 383, pp. 661 ISSN: 0004-6361.
9. DEL ZANNA G., LANDINI M., MASON H.E. (2002). Spectroscopic diagnostics of stellar transition regions and coronae in the XUV: AU Mic in quiescence. ASTRONOMY & ASTROPHYSICS. vol. 385, pp. 968 ISSN: 0004-6361

Alessandro C. Lanzafame – METIS Co-I

Alessandro C. Lanzafame, born 11 June 1961 in Catania, Italy

Curriculum Vitae:

- Education: 1994 Doctor of Philosophy (PhD), Queen's University Belfast, N. Ireland; 1990 Laurea in Fisica, University of Catania, Italy, full honors cum laude
- Since 1997: Researcher, University of Catania, Italy
- 1995-1996: Research Fellow, University of Strathclyde, Glasgow, Scotland
- 1994: Post-doctoral Research Assistant, Armagh Observatory, N. Ireland
- 1990-1994: Post-graduate Research Assistant, Armagh Observatory, N. Ireland

Professional:

- Worked as Research Fellow on SOHO/CDS and SUMER data analysis
- Member of the Atomic Data and Analysis Structure (ADAS) steering committee
- Coordinator of the Catania group on solar-like activity for the Gaia ESA mission
- Tutor/supervisor of several PhD research project on solar outer atmosphere and stellar solar-like magnetic activity
- Member of the WSO/UV working group

Relevant Publications:

- *Lang J., Brooks D. H., Lanzafame A. C., Martin R., Pike C. D., Thompson, W. T., 2007, "The in-flight monitoring and validation of the SOHO CDS Normal Incidence Spectrometer radiometric calibration", A&A, 463, 339.*
- *Lanzafame A. C., Brooks, D. H., Lang J., 2005, "ADAS analysis of the differential emission measure structure of the inner solar corona. II A study of the 'quiet Sun' inhomogeneities from SOHO CDS-NIS spectra.", A&A, 432, 1063.*
- *Spadaro D., Lanza A. F., Lanzafame A. C., Karpen J. T., Antiochos S. K., Klimchuck J. A., MacNeice P. J., 2003, "A Transient Heating Model for Coronal Structure and Dynamics", ApJ, 582, p 486 – 494*

- *Lanzafame A. C., Brooks D. H., Lang J., Summers H. P., Thomas R. J., Thompson A. M., 2002, "ADAS analysis of the differential emission measure structure of the inner solar corona: Application of the data adaptive smoothing approach to the SERTS-89 active region spectrum", A&A, 384, 242*
- *Lanza A.F., Spadaro D., Lanzafame A.C., Antiochos S.K., MacNeice P.J., Spicer D.S., O'Mullane M.G., 2001, "EUV Transition Region Emission during the Dynamic Formation of Prominence Condensations", ApJ, 547, 1116*
- *Spadaro D., Lanzafame A.C., Consoli L., Marsch E., Brooks, D.H., Lang J., 2000, "Structure and dynamics of an active region loop system observed on the solar disc with SUMER on SOHO", A&A 359, 716*
- *Brooks D. H., Fischbacher G.A., Fludra A., Harrison R.A., Innes D.E., Landi E., Landini M., Lang J., Lanzafame A.C., Loch S.D., McWhirter R.W.P., Summers H.P., 2000, "A study of opacity in SOHO-SUMER and SOHO-CDS spectral observations I. Opacity deduction at the limb", A&A 357, 697*
- *Brooks D. H., Fischbacher G. A., Fludra A., Harrison R. A., Innes D. E., Landi E., Landini M., Lang J., Lanzafame A. C., Loch S. D., McWhirter R. W. P., Summers H. P., Thompson W. T., 1999, "The quiet Sun extreme ultraviolet spectrum observed in normal incidence by the SOHO coronal diagnostic spectrometer", A&A, 347, 277*
- *Lanzafame, A. C., 1999, "Diagnostics of Stellar Chromospheres and Transition Regions" (invited review), in Solar and Stellar Activity: Similarities and Differences, ASP Conference Series 158, ed. C. J. Butler & J. G. Doyle, p.285*
- *Brooks D. H., Summers H. P., Harrison R. A., Lang J., Lanzafame A. C., 1998, "EUV Spectral Variability and Non-Equilibrium Ionisation in the 'Quiet' Sun", Astrophysics and Space Science, v. 261, Issue 1/4, p. 91*
- *Lanzafame, A. C.: 1994 "Si II Resonance Multiplets in the Sun", A&A, 287, 972*

Andrea Marco Malvezzi – METIS Co-I

Andrea Marco Malvezzi, born 28 august 1947 in Cogne (Italy)

Curriculum Vitae:

- Education: *Laurea* in Physics, Milano 1971
- Since 1988 professor at Department of Electronics, Università degli Studi di Pavia
- From 1983 to 1987. research associate, Harvard University, Cambridge, Ma, USA
- 1979 – 1980 Guest Worker, Physics Division, National Bureau of Standards, Washington, D.C, USA
- From 1971 to 1982: researcher, CISE Spa Segrate, Italy

Professional:

- Design and realization of spectroscopic equipment for the XUV and Soft X-Ray region.
- Co-I, SOHO mission, NASA, 1993
- Co-I, XUVI package, SOLO, ASI-ESA, 2000,
- Co-I, SHARPP-AIA, NRL / NASA, 2002
- Co-I, SCORE mission, 2007

Relevant Publications:

- *A.M.Malvezzi, G.Tondello: A Grazing Incidence Spectrograph - Monochromator for XUV Spectroscopy in the 5 - 900 Å Region of Modular Concept, Rev. Sci. Instrum. 49, 1642 (1978)*
- *L.Garifo, A.M.Malvezzi, G.Tondello: Grazing Incidence Spectrograph - Monochromator with a Focussing Mirror, Appl. Optics 18, 1900 (1979)*
- *A.M.Malvezzi, G.Tondello: Grazing Incidence Toroidal Mirror Pairs in Imaging and Spectroscopic Applications, Appl. Optics 22, 2444 (1983)*
- *C.Lenardi, A.M.Malvezzi: Thermal Effects on Optical Performances of a Prefocusing Mirror for High-Resolution Soft X-Rays Beamlines, Nucl. Instrum. and Methods in Phys. Res. A291, 332 (1990)*
- *E. Antonucci, A.M.Malvezzi et al.: The X-ray Ultraviolet Imager for the Orbiting Solar Laboratory", in Electromechanical Coupling of the Solar Atmosphere , D.S.Spicer, P.Pac Neice eds., American Institute of Physics Conference Proceedings 267, 126 (1992)*
- *A.M.Malvezzi, F.G.Omenetto: Image aberrations of optical systems evaluated through an analytical approach, Pure Appl. Optics 5 (1996) 157*
- *L.Floreato, G.Naletto, D.Cvetko, R.Gotter, M.Malvezzi, L.Marassi, A.Morgante, A.Santaniello, A.Verdini, F.Tommasini, G.Tondello, Performance of the grating-crystal monochromator of the ALOISA beamline at the Elettra Synchrotron, Rev. Sci. Instrum, 70, 3855 (1999)*
- *A.M.Malvezzi and G.Secondi: A calibration facility in the XUV Region for reflective optics, in Ultraviolet and X-Ray Detection, Spectroscopy, and Polarimetry III, SPIE 3764, (1999) p 40*

Salvatore Mancuso – METIS PI/Co-PI/Co-I/Ass. Scientist/etc.

Salvatore Mancuso,

born on April 21, 1965 in Chivasso, Italy

Curriculum Vitae:

- 24 1993: Laurea Degree in Physics, Università degli Studi di Torino, Italy
- 25 1999: Ph.D. in Physics (specialization in Astronomy), University of Iowa, IA, USA
- 26 2001-present: Research Astronomer, INAF - Osservatorio Astronomico di Torino, Italy
- 27 2000-2001: Astrophysicist, NASA Goddard Flight Space Center, Greenbelt, MD, USA
- 28 1999-2000: Postdoctoral Research Assistant, University of Iowa, USA

Professional:

- Working as a Research Astronomer since 2001 for the Torino Solar Physics group on the analysis, interpretation and modeling of UV spectroscopic observations of the solar corona. The major effort is devoted to constraining the coronal plasma physical parameters through combined SOHO/UVCS and radio observations, and analysing/modelling Coronal Mass Ejections (CMEs) and their associated shock waves using both spectral and imaging multi-wavelength data.
- Worked as an astrophysicist from 2000 to 2001 for the Harvard-Smithsonian Center for Astrophysics on the interpretation of coronal spectral observations and directly participated to the observation planning and operation of the Ultraviolet Coronagraph Spectrograph (UVCS) aboard the Solar and Heliospheric Observatory (SOHO) at NASA's Goddard Space Flight Center.
- Worked as a research assistant at the University of Iowa from 1995 to 2001 on the observation, analysis, and modelling of the coronal plasma through polarimetric observations of occulted radio sources. The aim of this work was to apply and develop techniques for constraining both main physical parameters (density, magnetic field, etc.) and plasma turbulence in the corona.

Relevant Publications:

- Mancuso S., & Avetta D., *UV and Radio Observations of the Coronal Shock Associated with the 2002 July 23 CME Event*, ApJ, in press
- Mancuso S., *Coronal transients and metric type II radio bursts. II. Accelerations at low coronal heights*, A&A, 463, 1137, 2007
- Mancuso S., & Garzelli M. V., *Assessing the tilt of the solar magnetic field axis through Faraday rotation observations*, A&A, 466, 5, 2007
- Lin J., Mancuso S., & Vourlidas A., *Theoretical Investigation of the Onsets of Type II Radio Bursts during Solar Eruptions*, ApJ, 649, 1110, 2006
- Mancuso S., & Raymond J. C., *Coronal transients and metric type II radio bursts. I. Effects of geometry*, A&A, 413, 363, 2004
- Mancuso S., & Abbo L., *Bifurcation of the metric type II radio emission associated with the giant solar flare of April 2 2001*, A&A, 415, L17, 2004
- Raouafi N.-E., Mancuso S., Solanki S. K., Inhester B., Mierla M., Stenborg G., Delaboudinière J. P., & Benna C., *Shock wave driven by an expanding system of loops*, A&A, 424, 1039, 2004
- Mancuso S., Raymond J. C., Kohl J., Ko Y.-K., Uzzo M., & Wu R., *Plasma properties above coronal active regions inferred from SOHO/UVCS and radio spectrograph observations*, A&A, 400, 347, 2003
- Mancuso S., Raymond J. C., Kohl J. L., Ko Y.-K., Uzzo M., & Wu R., *UVCS/SOHO Observations of a CME-driven Shock: Consequences on Ion Heating Mechanisms behind a Coronal Shock*, A&A, 383, 267, 2002
- Mancuso S., & Spangler S. R., *Faraday Rotation and Models for the Plasma Structure of the Solar Corona*, ApJ, 539, 480, 2000
- Mancuso S., & Spangler S. R., *Coronal Faraday Rotation Observations: Measurements and Limits on Plasma Inhomogeneities*, ApJ, 525, 195, 1999

Mauro Messerotti – METIS Co-I

Mauro Messerotti, born in Trieste (Italy) on 1954 July 29.

Curriculum Vitae:

- Since 2001, Adjunct Professor, Dept. of Physics, University of Trieste (IT).
- Since 1987, Research Astronomer (Permanent Staff), National Institute for Astrophysics-Astronomical Observatory of Trieste (IT).
- Magister Philosophiae (Astrophysics), SISSA-ISAS, Trieste (IT), 1986.
- Doctor in Physics (Astrophysics) with honors, University of Trieste (IT), 1982.

Professional:

- Worked as Associate Scientist in SOHO/UVCS from 1994.
- Coordinated the Italian team involved in the development of the European Grid for Solar Observations (EGSO) project (2003-2006)
- Developed the Solar Radio Archive. (SOLRA) of the Trieste Solar Radio System.
- Collaborated in the development of the Italian Solar Archive Network (SOLARNET).
- Is the promoter of the development of the Italian Virtual Observatory for Sun-Earth Connections (IVOSEC).
- Is Responsible for Task 2200 (Study of magnetic perturbations in the framework of space weather) of the Project “Studies for the Exploration of the Solar System” funded by the Italian Space Agency (ASI)
- Is Chair of the eGY (Electronic Geophysical Year) European Committee and of the Italian eGY Committee, with special interest in the development of Virtual Observatories.
- Is Member of the Space Weather Working Team of the European Space Agency (ESA).
- Is Scientific Discipline Representative (SDR) of SCOSTEP (Scientific Committee on Solar-Terrestrial Physics).
- Was National Representative for Italy in the EU-COST Action 724 (Developing the Scientific Basis for Monitoring, Modeling and Predicting Space Weather) and Leader of Working 1 on Solar Activity (2003-2007).
- Is the responsible for the Trieste Solar Radio System.

Relevant Publications:

- *Volpicelli, C.A., et al., SOLARNET-Italian Solar Archive Federation. The First Italian Virtual Observatory Application, Mem. S.A.It. Suppl., 9, 129 (2006)*
- *Abouadarham, J., et al., European Grid of Solar Observations (EGSO), In Proc. International Heliophysical Year - First European General Assembly, 10-13 January 2006, Paris, France, C. Briand (ed.), 18 (2006)*
- *Abouadarham, J., et al., A New Way to look at Observations with EGSO, in Solar Activity and its Magnetic Origin, Proc. of the 233rd Symposium of the International Astronomical Union held in Cairo, Egypt, March 31 - April 4, 2006, Edited by Volker Bothmer; Ahmed Abdel Hady. Cambridge: Cambridge University Press, 229 (2006)*
- *Messerotti, M., Candidi, M., Storini, M., and Zuccarello, F., COST Action 724: the Italian contribution, Mem. S.A.It. Suppl., 9, 117 (2006)*
- *Reardon, K. P., Bentley, R. D., Messerotti, M., and Giordano, S., A Solar Data Model for Use in Virtual Observatories, American Astronomical Society Meeting 204, #70.03; Bulletin of the American Astronomical Society, Vol. 36, 796 (2004)*
- *Messerotti, M., et al., The Italian solar data archives: national and European perspectives, Mem. S.A.It., 74, 391 (2003)*
- *Messerotti, M., Embedding knowledge in scientific databases via concept maps as metadata, ESA SP-477, Noordwijk: ESA Publications Division, ISBN 92-9092-749-6, 607 (2002)*
- *Messerotti, M., and Zlobec, P., Architecture of SOLRA (Solar Radio Archive), the Italian archiving facility for solar radio data, Mem. S.A.It., 72, 595 (2001)*
- *Messerotti, M., Solar and Geophysical Databases: the Tiles of a Planetary Meta-archive, ESA SP, 463, ISBN 9290926937, 563 (2000)*
- *Messerotti, M., Data Storage Management in Solar Databases: Present Status and New Perspectives, ESA SP-448, ISBN: 92-9092-792-5., 1261 (1999)*

Piergiorgio Nicolosi – METIS Co-I

Piergiorgio Nicolosi born 10 Nov 1951 Pordenone-Italy

Curriculum Vitae:

- Education

1975 Degree in Physics at University of Padua.

Institutional Appointments

- Since 2004 Full Professor in the Physics of Matter Scientific Section at Faculty of Engineering University of Padova
- 1988-2004 Associate Professor at Faculty of Engineering University of Padova
- 1981-1988, Researcher scientist at the Department of Information Engineering, University of Padova
- 1979-1981 Research scientist of Italian National Council of Research at "Centro di Studio sui Gas Ionizzati – Padova"
- 1976-1979 Research Fellow of Italian National Council of Research at "Centro di Studio sui Gas Ionizzati – Padova"

Other appointments

- Director of Master Course in Applied Optics, second level master course of University of Padova, since 2004
- Member of Scientific Committee of the "Center of Studies and Activities for Space University, G. Colombo", University of Padova

Professional:

- 2007-2010 National Coordinator of the "Prototypes development and laboratory experiments" within the contract between the Italian Space Agency (ASI) and the National Institute for Astrophysics (INAF) "Solar System Exploration"
- 2007-2010 National Coordinator of the activities subtask "Development and realization of optical coating prototypes in the EUV" within the contract between ASI and INAF "Solar System Exploration"
- 2006-2010 Italian representative on behalf of CNR-INFM in the Management Committee of the
- COST MP601 ACTION "Short Wavelength Laboratory Sources", coordinator prof. Alan Ichette, King's College London UK, within the VI Framework program of EU.
- 2007-2008 Management responsible on behalf of Italian Space Agency for the activities related to the calibration of the space instrument PHEBUS for the BEPI-COLOMBO Mission of European
- 2003-2007 Local coordinator of PADOVA Unit MIUR-FIRB project: "NANOFABBRICAZIONE DI CHIP PER ELETTRONICA CON MICROLITOGRAFIA EUV"

Relevant Publications:

- NICOLOSI P., M.G. PELIZZO, M. SUMAN, D. WINDT. (2007). a-PERIODIC MULTILAYER STRUCTURES FOR EUV LITHOGRAPHY. PCT/EP2007/060477. UNIVERSITA' DI PADOVA, CNR-INFM, RXOLLC (N.Y. USA).

- M. SUMAN, F. FRASSETTO, NICOLOSI P., M.G. PELIZZO. (2007). Design of a-periodic multilayer structures for attosecond pulses in the EUV. APPLIED OPTICS. 46, 8159 (2007)
- D. GAROLI, F. FRASSETTO, G. MONACO, NICOLOSI P., M.-G. PELIZZO, F. RIGATO, V. RIGATO, A. GIGLIA, S. NANNARONE. (2006). Reflectance measurements and optical constants in the EUV-VUV region for SiC with different C/Si ratio. APPLIED OPTICS. vol. 45, pp. 5642-5650 ISSN: 0003-6935.
- GAROLI D, MONACO G, FRASSETTO F, PELIZZO M.G, NICOLOSI P., ARMELAO L, MATTARELLO V, RIGATO V. (2006). Thin film and multilayer coating development for the extreme ultraviolet spectral region. RADIATION PHYSICS AND CHEMISTRY. vol. 75, pp. 1966-1971 ISSN: 0969-806X
- MARIA-GUGLIELMINA PELIZZO, F. FRASSETTO, NICOLOSI P., A. GIGLIA, N. MAHNE, S. NANNARONE. (2006). Polarization and higher order content measurement of a soft-x-rays monochromatized beam with Mo/Si multi-layers. APPLIED OPTICS. vol. 45, pp. 1985-1992 ISSN: 0003-6935
- NALETTO G., FINESCHI S., ANTONUCCI E., DADEPPO V., NICOLOSI P., ZANGRILLI L., ROMOLI M., MALVEZZI M., MOSES D. (2005). Optical design of a high-spatial-resolution extreme-ultraviolet spectroheliograph for the transition region. APPLIED OPTICS. vol. 44, pp. 5046-5054 ISSN: 0003-6935
- NICOLOSI P., L.POLETTO, M.G.PELIZZO, L.EPULANDI, P.ZAMBOLIN, J. FELDHAUS, U. JASTROW, U. HAHN, E. PLOENJES, K. TIEDTKE. (2005). Grazing incidence spectrometer for the monitoring of the EUV FEL beam at DESY. JOURNAL OF ELECTRON SPECTROSCOPY AND RELATED PHENOMENA. vol. 144-147, pp.1055-1058 ISSN: 0368-2048
- NICOLOSI P., M.G. PELIZZO, L.POLETTO, L. EPULANDI. (2005). Spectroscopic system for emission and absorption studies of laser produced plasmas in the extreme ultraviolet. REVIEW OF SCIENTIFIC INSTRUMENTS. vol. 76, pp. 083116-083123 ISSN: 0034-6748
- NICOLOSI P., M.G. PELIZZO, D.GAROLI, V.RIGATO, A.PATELLI, F.RIGATO. (2005). VUV Reflectance measurements and optical constants of SiC thin films. JOURNAL OF ELECTRON SPECTROSCOPY AND RELATED PHENOMENA. vol. 144-147, pp. 987-992 .S.HIRSCH, K.D.KAVANAGH, E.T.KENNEDY, J.T.COSTELLO, NICOLOSI P., L.POLETTO. (2004). Tracking

Giancarlo Noci – METIS Co-I

Giancarlo Noci, born 23/07/1932 at Pistoia (Italy) **Relevant Publications:**

Curriculum Vitae:

- 1957 Degree in Physics
- Since 1984 Professor of Astronomy, University of Florence
- 1980 Professor of Astronomy, University of Padua
- 1972 – 2008 Research Associate, Harvard University

He has been the director of the Department of Astronomy and Space Science of the University of Florence, and, in the same university, the president of the physics section of the Faculty of Science and of the PhD program in Astrophysics

Professional:

- 1993 Co-Principal Investigator of the SOHO/UVCS (Ultraviolet Coronagraph Spectrometer) investigation (The UVCS/SOHO is a joint program, with an important contribution of the Italian Space Agency to the hardware)
- 1972 – 2008 Research Associate, Harvard University
- 1979-87 Member of JOSO board
- 1980-83 Member of Solar System Working Group of ESA
- 1981 Visiting scientist at Stanford University (U.S.A.)
- 1973-79 Coordinator for the physics of the solar system in Italy
- 1966 Visiting scientist at Culham Laboratory (U.K.)

- G. Noci, J.L. Kohl and G.L. Withbroe: "Solar wind diagnostics from Doppler enhanced scattering", ApJ. 315, 706 (1987).
- E. Antonucci, J.L. Kohl, G. Noci, et al.: "Velocity fields in the solar corona during mass ejections as observed with UVCS-SOHO", ApJ. 490, L183 (1997).
- J.L. Kohl, G. Noci, E. Antonucci, et al.: "First results from the SOHO ultraviolet coronagraph spectrometer", Solar Phys. 175, 613 (1997).
- G. Noci, J.L. Kohl, E. Antonucci, et al.: "The quiescent corona and slow solar wind", in "The Corona and Solar Wind near Minimum Activity", Proc. Fifth SOHO Workshop, Oslo, 17-20 June 1997, ESA SP-404 (1997).
- G. Noci, J.L. Kohl, E. Antonucci, et al.: "First results from UVCS/SOHO", Adv. Space Res. 20, 2219 (1997).
- S. Giordano, E. Antonucci, G. Noci, M. Romoli and J.L. Kohl: "Identification of the coronal sources of the fast solar wind", ApJ. L531, 79 (2000).
- J. L. Kohl, G. Noci, S. R. Cranmer, J. C. Raymond: "Ultraviolet spectroscopy of the extended solar corona", Astron. Astrophys. Rev. 13, 31 (2006).
- G. Noci and E. Gavryuseva: "Plasma Outflows in Coronal Streamers", ApJ. 658, L63 (2007).

□

Susanna Parenti – METIS PI/Co-PI/Co-I/Ass. Scientist/etc.

Susanna Parenti, born in Florence the 16th May 1968.

Curriculum Vitae:

- ‘*Laurea*’ in Physics at the University of Florence, IT, 1998.
- 2001- PhD in Astrophysics at the University of Central Lancashire, Preston, UK
- Since 2006 supplement researcher at the Royal Observatory of Belgium.
- 2003-2005 Research Assistant at the Institut d’Astrophysique Spatiale, Orsay, Fr in the frame of the European network *TOSTISP*.
- 2001-2002 Research Assistant at the University of Florence, IT

Professional:

- Co-I in a European Consortium for the EU telescope of Solar Orbiter.
- Leader of an international group of thirteen people to work on a project title “*The role of spectroscopic and imaging data in understanding the coronal heating*”. This project is funded by ISSI (International Space Science Institute in Bern).
- Leader of the high cadence synoptic program (Shutterless) for the telescope EIT on SOHO.
- Active participation at the campaigns of SOHO observations regularly organized at MEDOC (Multi-Experiment Data Operations Center) at IAS, Orsay (Fr) between 2002-2005. My roles were planner for SOHO/CDS, assistant planner for SUMER, and Science Operations Leader. I coordinated the observations between the instruments from space (SOHO, TRACE, RHESSI) and from Earth (i.e. Themis, Pic du Midi).

Relevant Publications:

- Parenti S. & Vial J.C., 2007, “*Prominence and Quiet-Sun plasma parameters derived from FUV spectral emission*”, 2007, *A&A*, 469, 1109
- Reale F., Parenti S., Reeves K., Weber M., Bobra M G., Barbera M., Kano R., Narukage N., Shimojo M, Sakao T., DeLuca E.E., Peres G., Golub L., “*Fine thermal structure of coronal active regions from Hinode/XRT*”, 2007, *Science*, 318, 1582
- Parenti S., Lemaire P., Vial J.-C., 2005, “*Solar hydrogen-Lyman continuum observations with SOHO/SUMER*”, *A&A*, 443, 685.
- Parenti S., Vial J.-C, Lemaire P., 2005b, “*Prominence atlas in the SUMER range 800-1250 Å. II. Line profile properties and ions identifications*”, *A&A*, 443, 679.
- Parenti S., Vial J.-C, Lemaire P., 2004, “*Prominence atlas in the SUMER range 800-1250 Å: I. Observations, data reduction*”, *Solar Phys*, 220, 1, 61
- Parenti S., Landi E., Bromage B.J.I, 2003, “*SOHO-Ulysses Spring 2000 Quadrature: Coronal Diagnostic Spectrometer and SUMER Results*”, *A&A*, 590, 519
- Parenti S., Bromage B. J. I., Bromage G. E., 2002, “*An erupting macrospicule. Characteristics derived from SOHO-CDS spectroscopic observations*”, *A&A*, 384,303
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- Parenti S., Velli M., Poletto G., 1997, “*Magnetic Flux Tubes at 3 Au?*”, *Sol. Phys.*, 174, 329
- Poletto G., Parenti S., Noci G. et al, 1996, “*Searching for coronal plumes in ULYSSES observations of the far solar wind*”, *A&A*, 316, 374

Maria-Guglielmina Pelizzo – METIS Co-I

Maria Guglielmina Pelizzo, born in Cividale del Friuli, on July 14th, 1970

Curriculum Vitae: (min2 - max 5 bullets)

- Education: University of Padova, Ph.D. in Space Science and Technology, 2000; Physics Degree, 110/110 cum laude, 1996.
- CNR-National Institute for the Physics of the Matter (INFM): Research Scientist since 2003
- University of Padova, Assegnista Post-Doc, April 2001 - December 2002
- University of California at Berkeley, Space Sciences Laboratory: Visiting scientist, August 1998 - December 2000
- National Institute for the Physics of the Matter: Research fellow, April 1996 – February 1997

Professional: (relevant professional experience or achievements in fields related to METIS/SO most important first)

- Presently Responsible for ASI for calibration of the PHEBUS instrument on board of Bepi-Colombo, PI: Eric Chassefiere
- Presently, co-Responsible for CNR-INFM of Management of the Project “Development and realization of optical coating prototypes in the EUV” (Responsible for ASI: Prof. P. Nicolosi)
- Presently team member of the COST MP601 ACTION, Prof. Alan Michette
- 2004-2007 Team member the program MIUR FIRB RBNE01ABPB PI: Prof. A. Reale
- 2003-2005: CNR-INFM PONTE 2002 Project, PI: M.G. Pelizzo; co-holder of patent (06727462.1-2217-IB2006000868)
- 2002-2004: Team member of the ASI project “High Reflectance Multilayer Coatings for EUV Optics”, Responsible: Prof P.Nicolosi
- 1999-2000: Optical Engineer for the Hot Interstellar Plasma Spectrometer – NASA Space Mission, PI: M. Hurwitz
- 1997-1998: Design of the Wide Angle Camera of ESA Rosetta – P.I. U. Keller
- 1997-1998: Design of the BEAR beamline at Elettra Synchrotron (Trieste), funded INFM, Responsible: Prof. S. Nannarone
- She is co-holder of a patent PCT/ EP2007/ 060477 related ML multilayer for EUVL

Relevant Publications: (again in fields related to METIS/SO)

- M. Suman, F. Frassetto, P. Nicolosi, M.G. Pelizzo, *Design of a-periodic multilayer structures for attosecond pulses in the EUV, Applied Optics, Vol. 46 Issue 33, pp.8159-8169, 2007*
- M.G. Pelizzo, V. Da Deppo, G. Naletto, R. Ragazzoni, A. Novi, *Quasi-null lens optical system for the fabrication of an oblate convex ellipsoidal mirror. Application to the Wide Angle Camera of the Rosetta space mission, Applied Optics, Vol.45, Issue 24, pp. 6119-6125, 2006*
- D. Garoli, F. Frassetto, G. Monaco, P. Nicolosi, M.G. Pelizzo, F. Rigato, V. Rigato, A. Giglia, S. Nannarone, *Reflectance measurements and optical constants in the EUV-VUV region for SiC with different C/Si ratio, Applied Optics, Vol. 45, Issue 22, pp. 5642-5650, 2006*
- D. Garoli, G. Monaco, F. Frassetto, M.G. Pelizzo, P. Nicolosi, L. Armelao, V. Matterello, V. Rigato, *Thin film and multilayer coating development for the extreme ultraviolet spectral region, Radiation Phys. And Chemistry 75, 1966-1971, 2006*
- M.G. Pelizzo, F. Frassetto, P. Nicolosi, A. Giglia, N. Mahne, S. Nannarone, *Polarization and higher order content measurement of a soft-x-rays monochromatized beam with Mo/Si multi-layers, Applied Optics, Vol. 45, Issue 9, pp. 1985-1992, 2006*
- S. Zuccon, D. Garoli, M.G. Pelizzo, P. Nicolosi, S. Fineschi, D. Windt, *Multilayer coatings for multiband spectral observations, Proc. ‘6th Internat. Conf. on Space Optics’, ESTEC, Noordwijk, The Netherlands, 2006 (ESA SP-621, June 2006)*
- Maria-Guglielmina Pelizzo, Daniele Gardiol, Piergiorgio Nicolosi, Alessandro Patelli, Valentino Rigato, *Design, Deposition, and Characterization of Multilayer Coatings for the Ultraviolet and Visible-Light Coronagraphic Imager, Applied Optics, Vol. 43 Issue 13 Page 2661, May 2004*

Thomas Straus – METIS Co-I

Thomas Straus, born April 26, 1963 in Würzburg, Germany.

Curriculum Vitae:

- Ph.D. in Astronomy, Università di Firenze, Italy, November 1995
- Diplomphysiker (Univ.), diploma in physics, with highest honors, Julius-Maximilians-Universität Würzburg, Germany, September 1990
- Since December 2005 staff researcher at INAF-Osservatorio Astronomico di Capodimonte, Napoli
- 1995-2005: Post-Doc and non-staff scientist in the solar group at INAF-Osservatorio Astronomico di Capodimonte, Napoli

Professional:

- Co-I in CONCORDIASTRO/Italy project (INAF-OAC, Napoli), 2001-2006
- Scientific consultant in the DISCO database project (INAF-OAC, Napoli) since 1996
- Associate Scientist in VAMOS project (INAF-OAC, Napoli) since 1995
- Observational solar scientist since 1991, main interest in waves in the Solar atmosphere, convection, and their relationship.
- Expertise in the analysis and interpretation of spectroscopic investigations of the dynamics of the Solar Atmosphere
- Expertise in joint observations involving various, ground-based and space-born instruments
- Expertise in the analysis of large data volumes

Relevant Publications:

- *Straus, Th., Fleck, B., Jefferies, S.M., Cauzzi, G., McIntosh, S.W., Reardon, K., Severino, G., & Steffen, M.* “Atmospheric Gravity Waves in the Sun - a Paradigm Shift in Chromospheric Heating”, submitted to *Science*
- *Straus, Th., Severino, G., & Steffen, M.* 2006, “Resonant Oscillation Modes and Background in Realistic Hydrodynamical Simulations of Solar Surface Convection”, in *ESA-SP 617, 4*
- *Volpicelli, C. A., et al.* 2006, “SOLARNET-Italian Solar Archive Federation. The First Italian Virtual Observatory Application”, *Mem. S.A. It. Supplement, 9, 129*
- *Vecchio, A., Carbone, V., Lepreti, F., Primavera, L., Sorriso-Valvo, L., Veltri, P., Alfonsi, G., & Straus, Th.* 2005, “Proper Orthogonal Decomposition of Solar Photospheric Motions”, *Phys. Rev. Letters, 95*
- *Severino, G., et al.* 2003, “CONCORDIASTRO/Italy: A Solar High-Resolution Observation Program at Dome-C”, *Mem. S.A. It. Supplement, 2, 181*
- *Oliviero, M., Moretti, P. F., Severino, G., Straus, Th., Magrì, M., & Tripicchio, A.* 2002, “Preliminary Results on the Solar Photospheric Dynamics Observed with VAMOS”, *Solar Phys., 209, 21*
- *Krijger, J. M., Rutten, R. J., Lites, B. W., Straus, Th., Shine, R. A., & Tarbell, T. D.* 2001, “Dynamics of the solar chromosphere. III. Ultraviolet brightness oscillations from TRACE”, *A&A, 379, 1052*
- *Straus, Th., Severino, G., Deubner, F.-L., Fleck, B., Jefferies, S. M., & Tarbell, T.* 1999, “Observational Constraints on Models of the Solar Background Spectrum”, *ApJ, 516, 939*
- *Straus, Th., & Bonaccini, D.* 1997, “Dynamics of the solar photosphere. I. Two-dimensional spectroscopy of mesoscale phenomena.”, *A&A, 324, 704*
- *Deubner, F.-L., Fleck, B., Schmitz, F., & Straus, Th.* 1992, “Dynamics of the solar atmosphere. V - Partial reflection and forced oscillation, and their signature in phase diagrams”, *A&A, 266, 560*

Luca Teriaca – METIS Co-I

Luca Teriaca, born in Catania, Italy on 05/10/1968.

Curriculum Vitae:

- Laurea in Fisica (Physics Degree): (1997) University of Catania, Italy.
- Ph.D.: (2001) Queen's University of Belfast, United Kingdom.
- Since 01/09/2005 research assistant at Max-Planck-Institut für Sonnensystemforschung, Katlenburg-Lindau, Germany.
- Max-Planck fellowship from 30/01/2003 to 31/08/2005, Max-Planck-Institut für Sonnensystemforschung, Katlenburg-Lindau, Germany.
- Post-Doctoral at Osservatorio Astrofisico di Arcetri from 01/11/2000 to 30/10/2002, Florence, Italy.

Professional:

- Member of the science team of the proposing Extreme Ultraviolet Spectrograph on Solar Orbiter.
- Working on the science and technical requirements of imaging and spectroscopic instrumentation for Solar Orbiter within the EUI and EUS teams at MPS.
- Co-I of the proposing Extreme Ultraviolet Imager on Solar Orbiter.
- Member of the SUMER team at MPS.
- Planning and organizing many space (and ground) multi-instrument/spacecraft campaigns.
- Member of the International Astronomical Union (since 2006).

Relevant Publications:

- **L. Teriaca**, U. Schühle, S. K. Solanki, W. Curdt, and E. Marsch, The Lower Transition Region As Seen In The H I Lyman-alpha Line, in: *The Second Solar Orbiter Workshop, 16-20 October 2006, Athens, Greece* (edited by E. Marsch, K. Tsinganos, R. Marsden, and L. Conroy), ESA SP-641, ESA Publ. Div., Noordwijk, 2007, on CD.
- U. Schühle, H. Uhlig, W. Curdt, T. Feigl, A. Theissen, and **L. Teriaca**, Thin Silicon Carbide Coating of the Primary Mirror of VUV Imaging Instruments for Solar Orbiter, in: *The Second Solar Orbiter Workshop* (edited by E. Marsch, K. Tsinganos, R. Marsden, and L. Conroy), ESA SP-641, ESA Publ. Div., Noordwijk, 2007, on CD.
- P.R. Young, and the EUS science team, Science with the extreme ultraviolet spectrometer for solar orbiter, in: *The Second Solar Orbiter Workshop* (edited by E. Marsch, K. Tsinganos, R. Marsden, and L. Conroy), ESA SP-641, ESA Publ. Div., Noordwijk, 2007, on CD.
- J.-F. Hochedez, T. Appourchaux, J.-M. Defise, L. K. Harra, U. Schühle, F. Auchère, W. Curdt, B. Hancock, M. Kretschmar, G. Lawrence, J.-C. Leclec'h, E. Marsch, R. Mercier, S. Parenti, E. Podladchikova, M.-F. Ravet, P. Rochus, L. Rodriguez, F. Rouesnel, S. Solanki, **L. Teriaca**, L. Van Driel, J. C. Vial, B. Winter, and A. Zhukov, EUI, The Ultraviolet Imaging Telescopes Of Solar Orbiter, in: *The Second Solar Orbiter Workshop, 16-20 October 2006, Athens, Greece* (edited by E. Marsch, K. Tsinganos, R. Marsden, and L. Conroy), ESA SP-641, ESA Publ. Div., Noordwijk, 2007, on CD.
- Over 60 publications (23 referred) since 1998.

Giuseppe Tondello – METIS Ass. Scientist

Giuseppe Tondello, born 17-5-1938 in Padova (I)

Curriculum Vitae:

- Degree in Physics in 1962
- Since 2004 Pro-Rector of University of Padova for Industrial Relations
- From 1992 to 2001 Director of the Department of Electronics and Informatics, University of Padova
- Since 2001 Director of Laboratory LUXOR (Laboratory for Ultraviolet and X-ray Optical Research) CNR-INFM, Padova
- Member of the Solar System Working Group (ESA) 1989-1991 and of Space Science Advisory Committee (ESA) 1998-2000

Professional:

- Responsible for the development of the Spectrograph in the Ultraviolet Coronagraph Spectrometer (UVCS) on the SOHO Satellite.
- Development of instrumentation for spectroscopy in the vacuum and extreme ultraviolet; development of novel grating mounts in the normal and grazing incidence regions.
- Instrumentation for the utilization of Synchrotron Radiation: development of novel designs for high resolution monochromators.
- Instrumentation for utilization of high order harmonics (in the extreme ultraviolet and soft X-rays) produced by interaction of fs laser pulses with matter.

Relevant Publications

- Cranmer, S. R., Kohl, J. L., Noci, G., Antonucci, E., Tondello, G., Huber, M. C. E., Strachan, L., Panasyuk, A. V., Gardner, L. D., Romoli, M., Fineschi, S., Dobrzycka, D., Raymond, J. C., Nicolosi, P., Siegmund, O. H. W., Spadaro, D., Benna, C., Ciaravella, A., Giordano, S., Habbal, S., Karovska, M., Li, X., Martin, R., Michels, J. G., Modigliani, A., Naletto, G., O'Neal, R. H., Pernechele, C., Poletto, G., Smith, P. L., and Suleiman, R. M. "An Empirical Model of a Polar Coronal Hole at Solar Minimum", *ApJ.*, 511, 481-501, 1999
- J.L.Kohl, G.Noci, E.Antonucci, G.Tondello, M.C.E.Huber, S.Cranmer, L.Strachan, A.Panasyuk, L.D.Gardner, M.Romoli, S.Fineschi, D.Dobrzycka, J.C. Raymond, P.Nicolosi, O.H.W.Siegmund, D.Spadaro, C.Benna, A.Ciaravella, S.Giordano, S.R. Habbal, M.Karovska, X. Li, R.Martin, J.Michels, A.Modigliani, G.Naletto, R.H. O'Neal, C.Pernechele, G.Poletto, Peter L.Smith, R.M.Suleiman, "UVCS/SOHO Empirical Determination of Anisotropic Velocity Distributions in the Solar Corona", *ApJ*, 501, L127-L132, 1998
- N. Thomas, H.U. Keller, E. Arijs, C. Barbieri, M. Grande, P. Lamy, H. Rickman, R. Rodrigo, K.-P. Wenzel, M.F. A'Hearn, F. Angrilli, M. Bailey, M.A. Barucci, J.-L. Bertaux, K. Bries, J.A. Burns, G. Cremonese, W. Curdt, H. Deceuninck, R. Emery, M. Festou, M. Fulle, W.-H. Ip, L. Jorda, A. Korth, D. Koschny, J.-R. Kramm, E. Kurt, M.L. Lara, A. Llebaria, J.J. Lopez-Moreno, F. Marzari, D. Moreau, C. Muller, C. Murray, G. Naletto, D. Nevejans, R. Ragazzoni, L. Sabau, A. Sanz, J.-P. Sivan, G. Tondello, "OSIRIS - The Optical Spectroscopic, and Infrared Remote Imaging System for the Rosetta orbiter", *Adv. Space Res.* 21(11), pp. 1505-1515, 1998

Prof. Kanaris Tsinganos – METIS Ass. Scientist

Professor Kanaris Tsinganos,
Born 29/7/51, Filiatra Messinias, Greece

Curriculum Vitae:

- 1974, Aristotelion Un. of Thessaloniki Greece, B.A. in Physics, 1980, Univ. of Chicago USA, PhD in Physics.
- 1980-1981, Research Associate, Enrico Fermi Institute, Univ. of Chicago, 1981-1984 Research Associate, Harvard University, 1983-1984, Lecturer, Dept. of Physics, Harvard University.
- 1984-1988, Assistant Professor, Dept. of Physics, Univ. of Crete, 1988-1997 Associate Professor, Dept. of Physics, Univ. of Crete, 1997- 2001 Professor, Dept. of Physics, University of Crete, 2001 - Professor, Dept. of Physics, Univ of Athens.
- 1991-1992, Visiting Scientist at Univ. of St-Andrews UK, University of Torino, Italy, Observatoire de Paris (France), 1996- Visiting Professor, Katholieke Universiteit Leuven, Bruxelles.
- **President** of the Hellenic Astronomical Society (<http://www.helas.gr>) & Member of Greek National Council for Science and Technology.

Professional:

- **Greek delegate** to ESA Science Programm Committee.
- **Organizer of Second Solar Orbiter Workshop**, Athens, 16 - 20 October 2006.
- **Director** of NATO Advanced Study Institute on Solar and Astrophysical MHD Flows, Heraklion, June 11 -- 22, 1995 (135 participants from 25 countries).
- **Node leader** of Plasma Astrophysics, Theory, Observations, Numerical Simulations (PLATON) European Research & Training Network.

- **Director** of Euroconference on Dynamical MHD Phenomena in Solar and Astrophysical Plasmas, June 21 -- July 3, 1998, Crete, Greece
- **Convenor** of Solar Physics Session of Joint European and National Astronomical Meeting for 1997 JENAM - 97, 2 - 5 July 1997, Thessaloniki, Greece
- **Member** of the Solar Physics Section of the EAS/EPS, 2001- 2005.

Relevant Publications:

- **Editor** of the Book, *Solar and Astrophysical Magnetohydrodynamic Flows*, Kluwer Academic Publishers, pages 750, 1996
- **Co-editor** of *Proceedings of Second Solar Orbiter Workshop*, Athens, 16-20 October 2006
- A solar active region loop compared with a 2D MHD model, Gontikakis, C., Petrie, G. J. D., Dara, H. C., **Tsinganos, K.**, *Astronomy and Astrophysics*, Volume 434, Issue 3, May II 2005, pp.1155-1163 (2005).
- Nonradial and nonpolytropic astrophysical outflows. VII. Fitting ULYSSES solar wind data during minimum, Sauty, C., Lima, J. J. G., Iro, N., **Tsinganos, K.**, *Astronomy and Astrophysics*, Volume 432, Issue 2, March III 2005, pp.687-698 (2005)
- Steady 2D prominence-like solutions of the MHD equations with field-aligned compressible flow, Petrie, G. J. D., **Tsinganos, K.**, Neukirch, T., *Astronomy and Astrophysics*, v.429, p.1081-1092 (2005).
- 2D MHD modelling of compressible and heated coronal loops obtained via nonlinear separation of variables and compared to TRACE and SoHO observations, Petrie, G. J. D., Gontikakis, C., Dara, H. C., **Tsinganos, K.**, Aschwanden, M. J., *Astronomy and Astrophysics*, v.409, p. 1065-1083 (2003)

Michela Uslenghi – METIS Co-I

Michela Uslenghi, born in Busto Arsizio (VA), Italy, March 23rd 1969

Curriculum Vitae:

- Education: Laurea in Physics, University of Milan
- Since 2001: Staff Researcher at CNR-IASF (now INAF-IASF) sez.Milano
- 2000-2001 Visiting Scientist at Lawrence Berkeley National Laboratory, USA
- 1998-2001 Researcher with technological profile (non permanent staff, ex art.36) at CNR-IASF
- 1997-1998 Catania Astrophysical Observatory contract
- 1996-1997 INFN (National Institute for the Physics of Matter) Fellowship

Professional:

- Responsible of the Far UV channel of the FCU (Field Camera Unit) camera for WSO-UV (World Space Observatory). Phase A and B1 carried out during 2007. Design of the photon counting UV detectors
- Co-I of the proposal for NASA MIDEX ASCE (Advanced Spectroscopic and Coronagraphic Explorer), selected for the phase A. Responsible for the detector and for the electronics sub system of the Italian instrument
- Design and development of photon counting Intensified Active Pixel Sensor
- Design and development of photon counting Intensified CCDs
- R&D and characterization of high resistivity p-channel CCDs for SNAP
- Assessment, phase A and B1 study of UVISS (Ultra-Violet Italian Sky Surveyor), responsibility on focal plane detectors
- R&D on CdZnTe detectors (responsible for Analog Front-End Electronics and detectors modeling)

Relevant Publications:

- M.Uslenghi, I.Pagano, C.Pontoni, S.Scuderi, B.Shustov - The World Space Observatory (WSO-UV) - Current status - Chinese Journal of Astronomy and Astrophysics, in press
- M.Uslenghi, M.Fiorini, G.Sarri - A wide dynamic range PC-ICCD for ground based astronomy - Nuclear Instruments and Methods in Physics Research Section A, Volume 518 (2004), Issue 1-2, p. 223-225
- M. Uslenghi, G. Bonanno, M. Belluso, A. Cali, C. Timpanaro, R. Cosentino, S. Scuderi, and A. Modica - Progress on Photon Counting Intensified APS - Proc.SPIE, Vol.4854, pp. 583-592 (2003)
- M.Uslenghi, G.Bonanno, M.Belluso, A.Modica, P.Bergamini - Characterization of a Photon Counting Intensified Active Pixel Sensor (PC-IAPS): Preliminary results - Proc.SPIE, Vol.4498, p. 185-196 (2001)
- G.Bonanno, M.Belluso, A.Cali, C.Timpanaro, M.Uslenghi, M.Fiorini, A.Modica - Photon Counting system based on intensified CMOS-APS: PC-IAPS - Proc.SPIE, Vol.4498, p. 173-184 (2001)
- M.Romoli, S.Fineschi, M.Uslenghi, G.Corti, E.Pace, A.Ciaravella, G.Tondello, G.Noci, L.D.Gardner and J.L.Kohl - The ASCE EUV Polarimeter - Mem. SAI, Vol.74, pp.835, 2003
- C. Bebek, B. Frye, D. Groom, S. Holland, A. Karcher, B. Kolbe, J. Lee, M. Levi, N. Palaio, B. Turko, M. Uslenghi, G. Wang - Proton Radiation Damage in P-Channel CCDs Fabricated on High-Resistivity Silicon - IEEE Transactions on Nuclear Science - 49 (3): 1221-1225 Part 2, 2002
- P.Bergamini, G.Bonelli, E.G.Tanzi, M.Uslenghi, L.Poletto, G.Tondello - A fast readout and processing electronics for photon counting ICCD's - Review of Scientific Instruments, vol.71, n.4, p.1841 - 2000

Name	Marco Velli
Address	Dipartimento di Astronomia e Scienza dello Spazio, Università di Firenze Largo E. Fermi 2, 50125 Firenze
E-mail	marco.veli@unifi.it, Marco.Velli@jpl.nasa.gov
Position	Senior Research Scientist, Jet Propulsion Laboratory, Pasadena and Associate Professor, Dipartimento di Astronomia e Scienza dello Spazio, Università di Firenze
Responsibility	Science Co-Investigator, Scientific Data analysis
Commitment	Science operations and analysis phase: 20%
Expected PhDs and post-docs	I expect to have 4 PhD students (12 student years) and 1-2 post-docs working for 2-4 years for a total of 4-5 post-doc years working on Solar Orbiter.
Brief CV	<p>Professional Background 1993-98 Research Scientist (with tenure) Department of Astronomy and Space Science, University of Florence ; 1998-present Associate Professor, (with tenure), Department of Astronomy and Space Science, University of Florence 2004 – Nov 2007: Principal Scientist, Jet Propulsion Laboratory, Since Nov 07 Senior Research Scientist, Jet Propulsion Laboratory.</p> <p>Expertise and experience M. Velli was member of the Science Definition Tem for Solar Orbiter and is presently member of the Solar Probe STDT, responsible for Scientific Objectives. Member of Solar System Working Group for the Italian Space Agency.</p> <p>Research Interests M. Velli's research has focused on space and astrophysical plasma physics and solar magnetic activity with particular emphasis on</p> <ol style="list-style-type: none"> the ideal and resistive stability of magnetic structures anchored in the photosphere such as coronal loops and arcades wave propagation and shock formation in inhomogeneous and stratified plasmas and acceleration of the solar wind nonlinear evolution of current sheets and magnetic reconnection with applications to coronal heating the properties of turbulence in dynamically forced, open systems with applications to coronal heating and Alfvénic turbulence in the solar wind. wave particle interactions in the solar corona and heliosphere applied to the formation of anisotropic distribution functions and beams in the solar wind. <p>M. Velli has developed codes for the simulation of compressible magneto-hydrodynamic flows using pseudo-spectral and finite difference methods, and shock – capturing high-order upwinding techniques. They have been used to study diverse phenomena from the evolution of turbulence in the expanding solar wind, the 2D evolution of turbulence in a cross section of a coronal loop in the Parker scenario, to the parametric decay of large amplitude Alfvén waves in a homogeneous and stratified medium and non-linear propagation of Alfvén waves at magnetic x-points.</p> <p>Publications M. Velli has published over seventy peer-reviewed research papers, invited papers and lecture notes, and was Chair main editor of the Solar Wind Ten Conference proceedings (2002).</p> <p>Recent relevant publications Verdini, A.; Velli, M.; Oughton, S. (2005) <i>Astron.&Astrophys</i> 233-244 Propagation and dissipation of Alfvén waves in stellar atmospheres permeated by isothermal winds. Landi S., Velli M., Einaudi G. (2005). Alfvén waves and shock wave formation at X-point magnetic field configuration, <i>Astrophysical J.</i> 624 pp 392-401 Landi, S.; Hellinger, P.; Velli, M. (2006) <i>Geophys.Res.Letts.</i> 33, L14101 Heliospheric magnetic field polarity inversions driven by radial velocity field structures. Rappazzo, F., Velli, M. Einaudi, G. and Dahlburg, R. (2007) <i>Astrophys J.</i> , 657,L47, Coronal Heating, Weak MHD Turbulence, and Scaling Laws. Verdini, A. and Velli, M. (2007) <i>Astrophys J.</i> 662, p 669, Alfvén Waves and Turbulence in the Solar Atmosphere and Solar Wind</p>

Rita Ventura – METIS Co-I

Rita Ventura, 17th July 1958, Ragusa, Italy

Curriculum Vitae:

- Education
1983 – Laurea in Physics, University of Catania, Italy
- Since 1991 – Researcher at INAF – Astrophysical Observatory of Catania

Professional:

- Associate Scientist of the UVCS/SOHO experiment
- UVCS Lead Observation Scientist during MEDOC Campaigns # 2 and #6 (1997, 2000) at the Institut d'Astrophysique Spatiale (Orsay, France)
- Contribution to UVCS mission operation at Goddard Space Flight Center (Maryland, US) on 1996
- Contribution to UVCS data reduction and analysis

Relevant Publications:

- *D. Spadaro, R. Susino, R. Ventura, A. Vourlidas, E. Landi, "Physical parameters of a mid-latitude streamer during the declining phase of the solar cycle", A&A 475, 707 (2007)*
- *R. Ventura, D. Spadaro, G. Cimino, M. Romoli, "Streamers and adjacent regions observed by UVCS/SOHO: A comparison between different phases of solar activity", A&A 430, 701 (2005)*
- *D. Spadaro, R. Ventura, G. Cimino, M. Romoli, "UVCS/SOHO investigation of the interface between streamers and coronal holes", A&A 429, 353 (2005)*
- *R. Ventura, D. Spadaro, M. Uzzo, R. Suleiman, "UV line intensity and flow velocity distribution in two coronal mass ejections as deduced by UVCS/SOHO observations" A&A 383, 1032 (2002)*
- *R. Ventura, S. Orlando, G. Peres, D. Spadaro, "Fast solar wind acceleration by Alfvén waves: observable effects on the EUV lines detected by SOHO/UVCS", A&A 352, 670 (1999)*
- *R. Ventura, D. Spadaro, "Wavelength shifts of emission line profiles due to velocity fields in the solar corona", A&A 341, 264 (1999)*
- *E. Antonucci, J. L. Kohl, G. Noci et al., "Velocity Fields in the Solar Corona during Mass Ejections as Observed with UVCS-SOHO", ApJ 490, 183 (1997)*
- *D. Spadaro, R. Ventura, "EUV spectral lines from solar wind source regions: The resonance doublets of N V, Mg X and Si XII, and the Fe XII λ 1242 forbidden line", A&AS 115, 531 (1996)*
- *D. Spadaro, R. Ventura, "The effect of non-equilibrium ionization on the H I Lyman-alpha line originating in the solar wind source regions", A&A 289, 279 (1994)*
- *D. Spadaro, R. Ventura, "The effects of non-equilibrium ionization on the O VI resonance doublet lines originating in the solar wind source regions", A&A 281, 245 (1994)*

Jean-Claude Vial – METIS Co-I

Jean-Claude Vial, Curriculum Vitae:

- Engineer from l'Ecole Supérieure d'Electricité
- D.E.A. Physique des Milieux Ionisés (Paris-Orsay)
- C.N.E.S. Fellow
- Thèse d'Etat de l'Université Paris VII
- Since 2005, 1st class C.N.R.S. Directeur de Recherche

Professional:

P.I. of LYOT on-board the SMESE satellite
 CoI of the LPSP spectrometer on board the NASA OSO8 satellite, IPHIR photometer on PHOBOS Martian probes, SUMER spectrometer on SOHO
 Scientific director of the Multi Experiment Data and Operations Center for SOHO in Europe (until 2000)
 Guest Observer of UVSP spectrometer on Solar Max (SMM) of NASA
 Proposer of various space solar missions in the frame of the C.N.E.S. microsatellite program
 Head of the Solar and Stellar Group at I.A.S. until January 2005
 Member of the Solar System Working Group of ESA (until 2000) and of the SPPG of ESA (1998- 2000)
 Member of the adhoc Committee "Sun-Heliosphere-Magnetosphere" of CNES (2000-2007)
 Chairman of the CNRS Committee "Système Solaire et Univers Lointain" (2000-2004)

Relevant Publications: *(again in fields related to METIS/SO)*

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 S. Parenti, J.-C. Vial, P. Lemaire, 2005,, Astron. and Astrophys., 443, 685
 J.-C. Vial, F. Auchère, J. Chang, C. Fang, W.Q. Gan , K.-L. Klein, J.-Y. Prado, G. Trottet, C. Wang, Y.H. Yan , 2007, *SMESE : a Small Explorer for Solar Eruptions*, Advances in space Research, 40, 1787
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