



EUROPEAN COMMISSION
RESEARCH DG HUMAN RESOURCES
AND MOBILITY

RTN Mid-Term Activity Report

Project No: 33481

Project Acronym: ELSA

Project Full Name: European Leadership in Space Astrometry

Marie Curie Actions

RTN Mid-Term Activity Report

Period covered: from 01/10/2006 to 02/01/2009

Start date of project: 01/10/2006

Project coordinator name:

Project coordinator organisation name:
LUNDS UNIVERSITET

Date of preparation: 07/01/2009

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Marie Curie Actions

RTN Mid-Term Activity Report

GENERAL INFORMATION

Project No:	33481
Project acronym:	ELSA
Project full name:	European Leadership in Space Astrometry
Period number:	1st
Period covered - start date:	01/10/2006
Period covered - end date:	02/01/2009
Project start date:	01/10/2006
Project duration [months]:	48
Project coordinator name:	
Project coordinator organisation name:	LUNDS UNIVERSITET
Date of submission:	02/01/2009

SUMMARY OF THE RECRUITMENT SINCE THE START OF THE PROJECT

Contractor: LUNDS UNIVERSITET

Name of the Researcher (as stated at time of selection)	Type	Origin		Gender	Start date of recruitment	End date of recruitment	Working time commitment	No. of full-time equivalent months
		Country	LFR					
Holl, Berry	ESR (<4 years)	NL-Netherlands	No	Male	01/09/2007	31/08/2010	Full Time	16.0

Contractor: NATIONAL AND KAPODISTRIAN UNIVERSITY OF ATHENS+A348

Name of the Researcher (as stated at time of selection)	Type	Origin		Gender	Start date of recruitment	End date of recruitment	Working time commitment	No. of full-time equivalent months
		Country	LFR					
Belcheva, Maya	ESR (<4 years)	BG-Bulgaria	No	Female	01/10/2007	30/09/2010	Full Time	15.0

Contractor: UNIVERSITAT DE BARCELONA

Name of the Researcher (as stated at time of selection)	Type	Origin		Gender	Start date of recruitment	End date of recruitment	Working time commitment	No. of full-time equivalent months
		Country	LFR					
Alfieri, Sebastian	ESR (<4 years)	IT-Italy	No	Male	04/09/2007	31/05/2008	Full Time	9.0
Czekaj, Maria	ESR (<4 years)	PL-Poland	No	Female	01/09/2008	30/09/2010	Full Time	4.0
Fries, Aidan	ESR (<4 years)	IE-Ireland	No	Male	09/09/2008	15/07/2009	Full Time	4.0

Contractor: UNIVERSITE LIBRE DE BRUXELLES

Name of the Researcher (as stated at time of selection)	Type	Origin		Gender	Start date of recruitment	End date of recruitment	Working time commitment	No. of full-time equivalent months
		Country	LFR					
Pasquato, Ester	ESR (<4 years)	IT-Italy	No	Female	01/10/2007	30/09/2010	Full Time	15.0

Contractor: THE CHANCELLOR, MASTERS AND SCHOLARS OF THE UNIVERSITY OF CAMBRIDGE

Name of the Researcher (as stated at time of selection)	Type	Origin		Gender	Start date of recruitment	End date of recruitment	Working time commitment	No. of full-time equivalent months
		Country	LFR					

Contractor: DUTCH SPACE BV

Name of the Researcher (as stated at time of selection)	Type	Origin		Gender	Start date of recruitment	End date of recruitment	Working time commitment	No. of full-time equivalent months
		Country	LFR					

Contractor: UNIVERSITE DE GENEVE

Name of the Researcher (as stated at time of selection)	Type	Origin		Gender	Start date of recruitment	End date of recruitment	Working time commitment	No. of full-time equivalent months
		Country	LFR					
Váradi, Mihály	ESR (<4 years)	HU-Hungary	No	Male	01/10/2007	30/09/2010	Full Time	15.0

Contractor: RUPRECHT-KARLS-UNIVERSITAET HEIDELBERG.

Name of the Researcher (as stated at time of selection)	Type	Origin		Gender	Start date of recruitment	End date of recruitment	Working time commitment	No. of full-time equivalent months
		Country	LFR					
Bombrun, Alex	ER (4-10 years)	FR-France	No	Male	01/09/2007	31/08/2009	Full Time	16.0

Contractor: HELSINGIN YLIOPISTO

Name of the Researcher (as stated at time of selection)	Type	Origin		Gender	Start date of recruitment	End date of recruitment	Working time commitment	No. of full-time equivalent months
		Country	LFR					
Oszkiewicz, Dagmara	ESR (<4 years)	PL-Poland	No	Female	01/08/2007	31/07/2010	Full Time	17.0

Contractor: ISTITUTO NAZIONALE DI ASTROFISICA

Name of the Researcher (as stated at time of selection)	Type	Origin		Gender	Start date of recruitment	End date of recruitment	Working time commitment	No. of full-time equivalent months
		Country	LFR					
Saguner, Tenay	ESR (<4 years)	TR-Turkey	No	Female	01/10/2007	30/09/2010	Full Time	15.0
Abbas, Ummi	ER (4-10 years)	FR-France	No	Female	05/06/2008	04/06/2009	Full Time	7.0

Contractor: UNIVERSITEIT LEIDEN.

Name of the Researcher (as stated at time of selection)	Type	Origin		Gender	Start date of recruitment	End date of recruitment	Working time commitment	No. of full-time equivalent months
		Country	LFR					
Prod'homme, Thibaut	ESR (<4 years)	FR-France	No	Male	15/09/2007	14/09/2010	Full Time	15.75
Risquez, Daniel	ER (4-10 years)	ES-Spain	No	Male	01/07/2008	30/06/2010	Full Time	6.0

Contractor: UNIVERZA V LJUBLJANI

Name of the Researcher (as stated at time of selection)	Type	Origin		Gender	Start date of recruitment	End date of recruitment	Working time commitment	No. of full-time equivalent months
		Country	LFR					
Re Fiorentin, Paola	ESR (<4 years)	DE-Germany	No	Female	01/09/2007	31/08/2009	Full Time	16.0

Contractor: CENTRE NATIONAL DE LA RECHERCHE SCIENTIFIQUE (CNRS)

Name of the Researcher (as stated at time of selection)	Type	Origin		Gender	Start date of recruitment	End date of recruitment	Working time commitment	No. of full-time equivalent months
		Country	LFR					
Brand, Léopoldine	ESR (<4 years)	SE-Sweden	No	Female	01/09/2007	31/01/2008	Full Time	5.0
Santoro, Luca	ESR (<4 years)	IT-Italy	No	Male	01/11/2008	30/09/2010	Full Time	2.0

Contractor: Observatoire de Paris

Name of the Researcher (as stated at time of selection)	Type	Origin		Gender	Start date of recruitment	End date of recruitment	Working time commitment	No. of full-time equivalent months
		Country	LFR					
Weiler, Michael	ER (4-10 years)	DE-Germany	No	Male	01/07/2007	30/06/2009	Full Time	18.0

TOTAL PMM PER CONTRACTOR**Contractor: LUNDS UNIVERSITET****No. of full-time equivalent months to be delivered according to the contract: 6**

No. of full-time equivalent months covered by this recruitment during this reporting period
16.0

Contractor: NATIONAL AND KAPODISTRIAN UNIVERSITY OF ATHENS+A348

No. of full-time equivalent months to be delivered according to the contract: 6

No. of full-time equivalent months covered by this recruitment during this reporting period

15.0

Contractor: UNIVERSITAT DE BARCELONA

No. of full-time equivalent months to be delivered according to the contract: 6

No. of full-time equivalent months covered by this recruitment during this reporting period

17.0

Contractor: UNIVERSITE LIBRE DE BRUXELLES

No. of full-time equivalent months to be delivered according to the contract: 6

No. of full-time equivalent months covered by this recruitment during this reporting period

15.0

Contractor: THE CHANCELLOR, MASTERS AND SCHOLARS OF THE UNIVERSITY OF CAMBRIDGE

No. of full-time equivalent months to be delivered according to the contract: 0

No. of full-time equivalent months covered by this recruitment during this reporting period

0.0

Contractor: DUTCH SPACE BV

No. of full-time equivalent months to be delivered according to the contract: 0

No. of full-time equivalent months covered by this recruitment during this reporting period

0.0

Contractor: UNIVERSITE DE GENEVE

No. of full-time equivalent months to be delivered according to the contract: 6

No. of full-time equivalent months covered by this recruitment during this reporting period

15.0

Contractor: RUPRECHT-KARLS-UNIVERSITAET HEIDELBERG.

No. of full-time equivalent months to be delivered according to the contract: 0

No. of full-time equivalent months covered by this recruitment during this reporting period

16.0

Contractor: HELSINGIN YLIOPISTO

No. of full-time equivalent months to be delivered according to the contract: 6

No. of full-time equivalent months covered by this recruitment during this reporting period

17.0

Contractor: ISTITUTO NAZIONALE DI ASTROFISICA

No. of full-time equivalent months to be delivered according to the contract: 6

No. of full-time equivalent months covered by this recruitment during this reporting period

22.0

Contractor: UNIVERSITEIT LEIDEN.

No. of full-time equivalent months to be delivered according to the contract: 6

No. of full-time equivalent months covered by this recruitment during this reporting period

21.75

Contractor: UNIVERZA V LJUBLJANI

No. of full-time equivalent months to be delivered according to the contract: 6

No. of full-time equivalent months covered by this recruitment during this reporting period

16.0

Contractor: CENTRE NATIONAL DE LA RECHERCHE SCIENTIFIQUE (CNRS)

No. of full-time equivalent months to be delivered according to the contract: 6

No. of full-time equivalent months covered by this recruitment during this reporting period

7.0

Contractor: Observatoire de Paris

No. of full-time equivalent months to be delivered according to the contract: 6

No. of full-time equivalent months covered by this recruitment during this reporting period
18.0

TOTAL PMM FOR ALL CONTRACTORS

No. of full-time equivalent months to be delivered according to the contract	No. of full-time equivalent months covered by this recruitment during this reporting period
66.0	195.75

SUMMARY OF THE MAJOR PROJECT ACHIEVEMENTS SINCE THE START OF THE PROJECT

Describe what you would consider to be the most outstanding or more particularly significant outcome of the work performed during the period covered by this report, in terms of scientific/technological results, research training methodologies, opening up of career opportunities to researchers, international networking of the concerned scientific community, etc.

**** Brief overview of the ELSA network

The network consists of 14 nodes, 12 of which have recruited PhD students (Early Stage Researchers, ESRs) and/or postdocs (Experienced Researchers, ERs) to collaborate on a number of research projects related to the ESA Gaia mission. (ESRs and ERs are subsequently referred to as 'fellows'.) Two of the nodes, Institute of Astronomy at Cambridge University, and aerospace company Dutch Space in Leiden, do not appoint any fellows, but contribute to the network-wide training and transfer of knowledge (ToK) principally by hosting short visits and secondments and participating in the organization of workshops. ESA is not a member of the network, but scientists at the Gaia Science Operations Centre at ESAC (near Madrid) have key roles in the project as senior advisors on many aspects of software development and management.

At the present time (Jan 2009) the network employs 10 ESRs and 5 ERs. All have been recruited by open international competition. 7 of the 15 fellows are women. All ESRs are enrolled for full-time studies according to the PhD programme of their respective host university. They are thus expected to obtain their PhDs in late 2010 to 2012, depending on the starting date and the length of the PhD education at the different universities (which may be 3 or 4 years).

The research carried out by the network is strongly connected to, and increasingly integrated into the activities of the Gaia Data Processing and Analysis Consortium (DPAC).

**** Outline of research projects

Many different constraints had to be considered when defining the research project of each appointed fellow: the partner's research environment, the project's academic suitability in terms of PhD studies and/or future career opportunities, its relevance to the overall objectives of ELSA and to the partner's commitment within DPAC, and the specific background and skills of the individual fellow. Moreover, the subjects have to be flexible enough to accommodate inevitable shifts in emphasis and feasibility resulting from the scientific development of the Gaia mission.

The research projects can be broadly divided into four subject areas, with numerous overlaps and interactions within and between the areas:

1. Astrophysical modelling for simulation and data interpretation
 - a. Spatial distribution of stellar populations for galaxies resolved in stars by Gaia (ESR in Athens, Maya Belcheva)
 - b. Refinement of the Universe model in the Gaia simulator (ESR in Barcelona, Maria Czekaj)
 - c. Impact of stellar brightness asymmetries on Gaia astrometry (ESR in Brussels, Ester Pastquato)
 - d. Synthetic and observed stellar spectra for training data, automated classification algorithms and astrophysical parameter determination (ESR in INAF/Padova, Tenay Saguner)
 - e. Tests of new input physics in the code CESAM: application to Gaia (ESR in CNRS/Nice, Luca Santoro)
2. Numerical, statistical and computational data analysis tools
 - a. High Performance aspects of the Gaia data processing (ESR in Barcelona, Aidan Fries)
 - b. Small amplitude and short period variable stars in large photometric surveys (ESR in Geneva, Mihály Váradi)
 - c. Markov-Chain Monte Carlo methods for asteroid orbit computation (ESR in Helsinki, Dagmara Oszkiewicz)

- d. Classification and astrophysical parameter estimation using machine learning algorithms (ER in Ljubljana, Paola Re Fiorentin)
3. Modelling the Gaia Instrument beyond the standard concepts
 - a. Theoretical and empirical modelling of Charge Transfer Inefficiency in Gaia CCDs (ESR in Leiden, Thibaut Prod'homme)
 - b. Gaia Point-Spread Function modelling for pixel level simulations (ER in Paris, Michael Weiler)
 - c. Improved attitude modelling for Gaia (ER in Leiden, Daniel Risque)
 4. Global astrometric solution
 - a. Characterisation and analysis of the astrometric errors in the global astrometric solution for Gaia (ESR in Lund, Berry Holl)
 - b. Alternative astrometric solution methods for Gaia (ER in Heidelberg, Alex Bombrun)
 - c. Gaia Sphere Reconstruction (ER in INAF/Torino, Ummi Abbas)

**** Major achievements to date

The major achievements of the network up to the end of 2008 are here described in relation to the specific objectives of ELSA, as given in the Description of Work (Annex I to the contract, Section 5.1). The objectives are given in quotes below.

Objective 1: "To elucidate the principles of absolute astrometry and of photometric and spectroscopic measurements from a self-calibrating space platform like Gaia. To characterize possible sources of systematic errors and quantify limitations due to instrument calibrations and satellite attitude determination."

Achievements: The main method for this is the development of a flexible software package for simulating Gaia observations at an intermediate level (i.e., not at pixel level, but derived quantities such as centroid positions and fluxes), including methods to perform the global solution of stellar, attitude and instrument parameters for a reduced number of stars (so as to be able to run a complete simulation plus solution in a matter of hours). A first version of this package (AGISLab) has been developed in Lund with contributions from Heidelberg and using general software tools developed in many other places. It is now available network-wide and has already been used at other nodes (Heidelberg, Geneva, Brussels, INAF/Torino) for specific simulations. For example, Váradi (Geneva) is using AGISLab to predict the times of observation for variable stars, which is an important input for testing their period determination algorithms. AGISLab has also been interfaced with models of stellar surface structures (Pasquato, Brussels) and weak microlensing by halo stars (Abbas, INAF/Torino) to study these specific error sources. The global characterisation of astrometric errors is the main subject of the PhD thesis by Holl (Lund), for which AGISLab will be extensively used.

Objective 2: "To obtain a detailed understanding of the physical output signal from Gaia, taking into account the many different astronomical, instrumental and environmental factors influencing the data. To derive an accurate model of the CCD output in TDI readout mode, including the effects of charge-trapping and charge-release due to radiation damage of the CCD."

Achievements: Efforts have focused on so-called Charge Transfer Inefficiency (CTI) effects in the Gaia CCDs, which are caused by charge trapping in the silicon material due to radiation damage in space. Potentially, these could be very damaging to the astrometric, photometric and (in particular) spectroscopic observations of Gaia, and they cannot be entirely eliminated by the planned radiation shielding and periodic charge injection. To bring down the CTI errors to an acceptable level it will be necessary to model the effect very accurately. This is the objective of an on-going collaboration between EADS Astrium (the industrial contractor building Gaia), the Gaia project management at ESA, the DPAC Consortium (jointly between CU3 and CU5), and part of ELSA. Within ELSA, the nodes at Leiden, Cambridge, Paris and Lund are directly involved in this effort. Prod'homme (Leiden) is building a very detailed physical model of the charge trapping and release processes, which is already capable of predicting with reasonable precision the main effects seen in laboratory tests: a shift (delay) of the image centroid position (affecting mainly astrometry), a reduction of the

size of the charge package (affecting photometry and spectroscopy), and a distortion of the image profile (affecting all measurements). It is hoped that tuning and refinement of this model will eventually allow it to represent the real effects to sufficient accuracy. Weiler (Paris) has implemented quasi-analytical models of the CTI effects in the Gaia data simulator. These models (partly developed in collaboration with Lund and ESA) will eventually be tuned to the behaviour of the detailed physical model developed in Leiden. Holl (Lund) has studied the properties of "self-injection" by stars, using AGISLab and a stellar distribution model from INAF/Torino. Extensive laboratory tests made by EADS Astrium are being analyzed in Cambridge and INAF/Torino as part of the bigger DPAC effort within the "Radiation Task Force" led by the scientist in charge at Cambridge, F. van Leeuwen. Cambridge has hosted two longer visits (Mar-Apr and Sep-Oct 2008) by ELSA fellows Prod'homme, Holl and Weiler to work on the CTI effects. A workshop on CCD modelling and CTI mitigation will be held at Dutch Space (Leiden), 19-21 Jan 2009.

Objective 3: "To obtain a detailed understanding of the numerical behaviour of the very large systems of unknowns (model parameters) characterizing the Gaia data analysis problem, in terms of their stability properties, error propagation, convergence of practical solution methods and their computational efficiency."

Achievements: Using AGISLab, Bombrun (Heidelberg), Holl (Lund) et al. have demonstrated that a direct solution of the global astrometric problem (i.e., the simultaneous determination of stellar, attitude and instrument parameters) is unfeasible by many orders of magnitude with state-of-the-art computers. A joint paper for Astronomy & Astrophysics exists in draft form. As a consequence, this problem must be attacked by iterative methods (as was always foreseen for the core Gaia data processing). A problem so far has been that the simplest iteration methods converge very slowly (>100 iterations needed, which is unacceptable for the full-size problem). The Heidelberg-Lund collaboration has recently shown how the so-called conjugate gradient (iterative) method can be adapted to the Gaia problem, and demonstrated (by means of AGISLab) that it converges at least four times faster than the simple iteration. This is a major breakthrough in terms of convergence and computational efficiency, which is extremely interesting for the full-scale Gaia data processing (where the same method will probably be implemented). A joint publication describing this method is planned. At INAF/Torino (Abbas et al.) the global solution is attacked by a slightly different approach (still using conjugate gradient, but without forming normal equations). It will be interesting to compare results.

Objective 4: "To bring together space astrometry with advanced methods in data processing, data management, numerical methods and statistics in a significant contribution to the Gaia data processing system. To develop the most appropriate data storage, data management and data processing concepts consistent with the understanding and requirements of space astrometry developed by synthesis of the results from objectives 1 through 3 above."

Achievements: As should be apparent from the achievements already described, AGISLab has acted as a focus point for bringing together, implementing and testing many different ideas and algorithms related to simulations and the solution of very large systems of equations. Other numerical methods that have been developed and tested within the network concern period determination for variable stars (Varadi, Geneva) and advanced methods for asteroid orbit estimation (Oszkiewicz, Helsinki). They are examples of computationally intense applications where supercomputing, parallel or distributed computing will be useful and have been tested in some cases.

Objective 5: "To train, in the context of the Gaia project, the next generation of researchers in space astrometry and related research methods, and to transfer the experience from the Hipparcos project and early Gaia studies on the principles of space astrometry, the corresponding data reduction methods, and the correct use of astrometric information in astrophysical research."

Achievements: 10 PhD students and 5 postdocs have been recruited by the network and they are being systematically trained in various aspects of the Gaia mission and related research. Most of the scientists in charge, and many more researchers at the different nodes, have extensive experience from Hipparcos or Gaia studies, and are actively transferring knowledge to the young researchers. This is strengthened by their immersion in the overall activities of the Gaia Data Processing and

Analysis Consortium, to which all the ELSA fellows contribute. Two major network-wide training events have been organized (the ELSA School on the Science of Gaia, 19-28 Nov 2007 in Leiden, and the ELSA Workshop on Software Engineering and Numerics, 1-5 Sep 2008 in Barcelona), and most of the fellows have received complementary training e.g. in Java programming as organized by DPAC. Evaluations of the two network meetings are attached (eval_Leiden.pdf, eval_Barcelona.pdf).

Not all the achievements are easily classified under the above objectives: in particular the astrophysical modelling projects are not covered above. A complementary description of progress in terms of Work Packages and Tasks is given in the attached file:

MTR_wp_progress.pdf

**** Participation of fellows (ESRs and ERs) in research and training activities

Please refer to the attached files:

MTR_participation.pdf - participation of fellows in meetings etc

MTR_presentations_and_publications.pdf - presentation and publications by fellows

MTR_training_activities.pdf - participation of fellows in training events etc

**** Scientific community recognition

The ELSA network is now recognized as an important partner in the overall Gaia project, significantly contributing to many aspects of the scientific preparations mainly through its involvement in nearly all DPAC coordination units. All ELSA fellows are full members of the DPAC consortium, have access to its extensive documentation and software repositories, and participate in numerous DPAC progress meetings and software development units.

To single out one specific part of the many important activities of the network, its contribution to the CCD Charge Transfer Inefficiency modelling is seen as crucial for mitigating the negative impact of radiation damage in space.

The ELSA network can be seen as the precursor and inspiration for the GREAT initiative ('Gaia Research for European Astronomy Training', see <http://www.ast.cam.ac.uk/GREAT/>). The aim of GREAT is to build the European science capacity to successfully exploit the results of the Gaia mission through European Science Foundation (ESF) and EU Seventh Research Framework Programme (FP7) networks together with the contribution of the wider community.

**** Conclusions

Considerable progress has been made in the recruiting and training ESRs and ERs, as well as in the different parts of the research programme. Fellows have been recruited by all the partners that intended to do so, albeit with some delay and modifications compared to the original plan. The fellows are well integrated into the overall activities of ELSA and Gaia scientific community, and actively contribute to the work of the Gaia Data Processing and Analysis Consortium. The two network-wide meetings planned during the first half of the project have been held and were very successful. Important results have been obtained e.g. in the areas of instrument modelling (CTI effects in Gaia CCDs) and global astrometric solution (simulation and numerical algorithms), and good progress is being made in the areas of astrophysical modelling and data processing methods as well. The list of joint and refereed publications is still poor, as most fellows have only been employed for a little over one year. On the other hand, many oral and poster presentations have been made, collaborations have started up in earnest during 2008 and a number of substantial publications are in the pipeline.

DISSEMINATION OF RESULTS OF THE PROJECT

Participation in conferences and other scientific events

Type of Event	Active participation			Passive participation
	Oral	Poster	Of which were invited presentations	
Conferences	1	9	0	1
Workshops	18	5	0	0
Other Scientific Meetings	23	2	0	16

Publications

Type of Publication	Total	Of which involved recruited researchers	Of which joint publications involving at least 2 network contractors	Of which invited
Peer Reviewed - Articles in Journals	14	8	3	0
Peer Reviewed - Chapters in Books	0	0	0	0
Peer Reviewed - Articles in Conference Proceedings	29	5	7	3
Peer Reviewed - Books and Monographs	0	0	0	0
Non-Peer Reviewed	12	11	1	0
Submitted	1	1	0	0
Manuscripts in preparation	1	1	1	0

List of joint publications

**** Notes concerning the statistics of publications given above

(1) The statistics on "Participation in conferences and other scientific events" only refers to the ELSA fellows (ESRs and ERs). Moreover, it does not include 11 separate seminars given by fellows at various institutes. See attachment MTR_presentations_and_publications.pdf for details.

(2) The "Publications" above refer to both fellows and the main scientists involved at each partner, within the subject area of the research project. See attachment MTR_publications.pdf which complements the (fellows-only) publication list in MTR_presentations_and_publications.pdf.

(3) Since the activities of ELSA are embedded in the larger DPAC and Gaia activities, it is seldom the case that a publication can be described as a "direct" result of the ELSA project. Consequently the selection included in the statistics above and attached lists is to some extent arbitrary.

**** Most important joint publications

The following publications provide overviews of the Gaia mission, the data analysis organisation, and of ELSA. Many, or most, of the authors are directly involved in ELSA activities:

Lindegren, L.; Babusiaux, C.; Bailer-Jones, C.; Bastian, U.; Brown, A. G. A.; Cropper, M.; Høg, E.; Jordi, C.; Katz, D.; van Leeuwen, F.; Luri, X.; Mignard, F.; de Bruijne, J. H. J.; Prusti, T.: 2008, 'The Gaia mission: science, organization and present status', in IAU Symp. No. 248, A Giant Step: from Milli- to Micro-arcsecond Astrometry, p.217

Lindegren, L.; Bijaoui, A.; Brown, A. G. A.; Drimmel, R.; Eyer, L.; Jordan, S.; Kontizas, M.; van Leeuwen, F.; Muinonen, K.; Pourbaix, D.; Torra, J.; Turon, C.; de Vries, J.; Zwitter, T.: 2008, 'ELSA

- training the next generation of space astrometrists', in IAU Symp. No. 248, A Giant Step: from Milli- to Micro-arcsecond Astrometry, p.529

Mignard, F.; Bailer-Jones, C.; Bastian, U.; Drimmel, R.; Eyer, L.; Katz, D.; van Leeuwen, F.; Luri, X.; O'Mullane, W.; Passot, X.; Pourbaix, D.; Prusti, T.: 2008, 'Gaia: organisation and challenges for the data processing', in IAU Symp. No. 248, A Giant Step: from Milli- to Micro-arcsecond Astrometry, p.224

O'Mullane, W.; Lammers, U.; Bailer-Jones, C.; Bastian, U.; Brown, A. G. A.; Drimmel, R.; Eyer, L.; Huc, C.; Katz, D.; Lindegren, L.; Pourbaix, D.; Luri, X.; Torra, J.; Mignard, F.; van Leeuwen, F.: 2007, 'Gaia Data Processing Architecture', in Astronomical Data Analysis Software and Systems XVI, ASP Conference Series, Vol. 376, p.99

Patents

Number of patents granted:

0

Number of patents pending:

0

MAJOR PROBLEMS/DIFFICULTIES

Please specify any major problems/difficulties you may have encountered until now or may anticipate in the near future, and suggest possible remedial actions at network and/or commission level.

The only major problem that we want to report is related to the recruitment of fellows, in particular the Early Stage Researchers (PhD students).

One part of the problem is that we underestimated the length and complexity of the recruitment process. While the intention was to have the ESRs in place after six months, they could in most cases only start after one year. Naturally, this gave a corresponding delay in the start of their research projects. Since the network-wide meetings had to go ahead as planned, there was less time for preparations before the meetings and for building collaborations. Apart from the resulting delay and schedule modification, nothing more can, or needs, to be done in this respect.

Another part of the problem was caused by our failure to keep two of the recruited ESRs (in Barcelona and Nice) for more than 9 and 5 months, respectively, and that consequently new ESRs had to be recruited at these places. Given the delay we had already with the initial recruitments, it was not possible to fill the intended number of person-months at these nodes before the end of the ELSA grant (30 Sep 2010) with the newly recruited ESRs. After consultation with the Project Officer, we decided to solve this by appointing one extra ESR at the Barcelona node. At the moment his employment contract is only for 10.25 months (it expires 15 July 2009, i.e. 14.5 months before the end of the ELSA grant). However, if contractual and financial provisions allow, we hope to extend his employment under the ELSA grant by these additional 14.5 months. In all cases the newly recruited ESRs are guaranteed to continue their PhD studies after the end of their ELSA employments.

A summary of the (past and present) appointments is attached (appointments_graph.pdf).

Attachments	eval_Leiden.pdf, eval_Barcelona.pdf, ELSA_table1_rev1.pdf, MTR_wp_progress.pdf, MTR_participation.pdf, MTR_presentations_and_publications.pdf, MTR_publications.pdf, appointments_graph.pdf, MTR_training_activities.pdf
Name	
Date	
Signature	