



Discover the Cosmos Deliverable

D4.7 Interim Report on Implementation Activities (International Level)

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Short Description:

This report documents the implementation activities of Discover the COSMOS undertaken at international level throughout the first year of the project, as they have been described in Deliverable 4.1. This deliverable is best read in conjunction with the interim reports on local and national level implementation activities.

List of Recipients: Discover the COSMOS participants



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1. Introduction

Discover the COSMOS (DtC) aims to address the declining interest of students in science and in following scientific careers by demonstrating innovative ways through which the educational potential of existing e-Infrastructures in the fields of particle physics and astronomy can be fully exploited by providing powerful applications and interactive tools for the effective uptake of eScience by secondary schools framed in an inquiry-based pedagogical approach to science education. To serve this aim, a wide array of local, national and international level implementation activities have been planned in the framework of the project. Collectively, these activities tap into the intellectual capital of the education and outreach groups that participate in the project in order to help the educational communities to value and realise the potential of eScience initiatives by adopting and using tools and interfaces, the Discover the COSMOS Demonstrators, which in turn will enable students to get familiarised with the scientific methodology leading to higher levels of student engagement with science.

This document details the international level implementation activities undertaken during the first year the project (Sept11- Aug12). Where applicable, and consistent with Deliverable 4.1, these activities are presented under a common framework highlighting in a structured and integrated manner their learning objectives, participants' profiles, methodology and process, outcomes and follow up actions.

Table 1 provides a summary of the international level implementation activities undertaken by the Consortium partners during the aforementioned period. All activities are listed in the [Annex](#).

Title of Activity	Type of Activity	Date(s) of Activity	Place of Activity	Organising Institute(s)
8th International Particle Physics Masterclasses	MC	27 Feb - 24 Mar 2012	Athens, Heraklion, Dresden	IASA, TUD
Discover the COSMOS Summer School	SS	1-6 Jul 2012	Panormo (Crete, Greece)	EA
High School Teachers Programme at CERN	SS	1-21 Jul 2012	Geneva	CERN
Training Sessions and Workshops (e.g. Comenius, GTTP, EU-HOU)	T	Oct 2011 – Aug 2012	Various countries (e.g. Chile, China, Cyprus, India, Italy, Morocco, US, etc.)	IAP/CNRS, NUCLIO, UoG, LBL

MC=Masterclass; SS=Summer School; T= Training Seminar or Workshop

Table 1: International level activities implemented for Year One of the DtC Project




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2. International Level Implementation Activities

2.1 International Masterclasses

2.1.1 The 8th International Particle Physics Masterclasses



Hands-On Particle Physics
International Masterclasses
27th February – 24th March, 2012

Objectives

International Masterclasses provide a unique opportunity for high-school students to be "scientists for a day". 16- to 19-year-old students in 31 countries around the whole world are invited to one of about 120 nearby universities or research centres for one day in order to take part in an authentic research process. They hear lectures from active scientists and gain insight into topics and methods of basic research into the fundamentals of matter and the forces. Thus prepared, students perform measurements themselves on real data from particle physics experiments at the LHC (ALICE, ATLAS, CMS). At the end of each day, as in an international research collaboration, the participants join in a video conference for discussion and combination of their results. In summary, International Masterclasses offers students the chance to close their textbooks and experience modern science first-hand.

The International Masterclasses are a core activity of IPPOG, the International Particle Physics Outreach Group. The program is organized and run by Dr. Michael Kobel of the Technical University Dresden (TUD), Germany, and coordinated by Dr. Uta Bilow from TUD.

Preparation

There is no particle physics knowledge required for the students participating in the International Masterclasses.

Participants

The 8th International Masterclasses series, which took place from 27 February to 24 March 2012, comprised 173 Masterclasses (143 plus 30 in the US) organised by 117 institutes (plus 30 in the US) bringing together ca. 9,000 high-school students and ca. 500 teachers from 31 countries (plus the US). CERN, IASA and TUD were among those institutes. The full schedule of the 8th International Masterclasses is available at: <http://physicsmasterclasses.org/index.php?cat=schedule>

Methodology

The Masterclasses are a full-day activity that is structured into three main parts as follows:

- In the morning, students come to their respective university/institute where they are introduced to particle physics, experiments and detectors within lectures. Typically, two



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lectures, 45 min each, are scheduled for the morning session. Guided tours to the university's/institute's can also be scheduled, if appropriate.

- After having lunch with the lecturers and staff, including their tutors, students work on particle physics data on their own. For this afternoon activity a PC-pool is required as students work in pairs. One tutor per ten students is also present providing support and guidance to students.
- Having performed the measurements, students are then participating in an international video conference, together with three or four other institutes, according to the schedule, and moderators from CERN. The video conference goes from 4 pm to 5 pm CET. Students give their results and combine them with students from other countries. The video conference also includes discussion of results with the moderators, a Q&A session, and a quiz. Before students leave, they are handed out certificates of participation.

A short description of the Masterclasses organised by IASA and TUD is provided below.

Date of Event: 19 March, 2012

Place of Event: University of Athens, Greece

Sixteen high-school students from Annesy, France came to CERN for one day Athens for one day in order to learn about particle physics, CERN and become researchers for a day. In the morning, the students were welcomed by CMS physicists and introduced to particle physics, the LHC and CMS and were prepared for the hands-on exercise. In the afternoon session, the students worked with real CMS data using the iSpy event display tool to look for W and Z bosons. This was followed by a discussion of their results over a videoconference with students in Padova and Trieste (Italy), Split (Croatia) and Lodz (Poland).

Date of Event: 19 March, 2012

Place of Event: University of Athens, Greece

Sixty high-school students accompanied by fifteen teachers came to the University of Athens for one day in order to learn about particle physics, CERN and become researchers for a day. In the morning, lectures were given by professors from the University of Athens and Ellinogermaniki Agogi, and in the afternoon a laboratory was held where students used the HYPATIA event display to look for Z bosons. Finally the students compared their results in a videoconference with those of students in University College London (UK), Technical University of Dortmund (Germany), and University of Udine (Italy).

Date of Event: 19 March, 2012

Place of Event: Technical University of Dresden, Germany

One hundred and ten high-school students accompanied by fifteen teachers came to TUD for one day in order to learn about particle physics, CERN and become researchers for a day. In the morning, lectures were given by TUD professors and in the afternoon a laboratory was held where students used the MINERVA event display to look for W bosons. Finally the students compared their results in a videoconference with those of students in the Centre de Physique des Particules de Marseille (France) and University of Wuppertal (Germany).

Date of Event: 24 March, 2012

Place of Event: University of Crete, Heraklion, Greece

One hundred and twenty high-school students accompanied by fifteen teachers came to come to the University of Crete for one day in order to learn about particle physics, CERN and become researchers for a day. The event was held at the Department of Physics of the University. In the morning, lectures were



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given by professors from the University of Crete and Ellinogermaniki Agogi, and in the evening a laboratory was held where students used the HYPATIA event display to look for Z bosons. Finally the students compared their results in a videoconference with those of students in other institutions (University of Porto [Portugal], Technical University of Lisbon [Portugal], LIP [Portugal] and the State University of Rio de Janeiro [Brasil]).

Outcomes and Follow Up

There are five core learning outcomes for students participating in the Masterclasses:

1. Learning about fundamental subatomic particles and interactions
2. Learning about particle accelerators and detectors
3. Getting acquainted with analyzing particle collisions
4. Performing a measurement with real data from the LHC experiments (ALICE, ATLAS, CMS)
5. Gaining insight into modern research in particle physics and scientific methods

Moments from the 8th International Particle Physics Masterclasses

A selection of pictures from the 2012 IPPOG Masterclasses at CERN and TUD are presented below.

CMS Masterclass at CERN, 12 March 2012 (© 2012 CERN)



ATLAS W Masterclass at Technical University of Dresden, 19 March 2012
(Source: http://physicsmasterclasses.org/downloads/Masterclass_Dresden_2012/album/index.html)



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2.2 Summer Schools

There have been two Summer Schools conducted during the first year of the project. These are:

1. The Discover the COSMOS Summer School
2. The High School Teachers Programme at CERN

A detailed description of each activity is provided below.

2.2.1 The Discover the COSMOS Summer School



Discover the COSMOS Summer School

Heraclion, Greece, 1-6 July 2012

Objectives

The aim of the Discover the COSMOS Summer School was to enhance science education by presenting the fabric of the cosmos as was shaped by scientific evidence and explanations through 400 years of scientific advancement. This 1-week course focused on:

- 17th century's optics instruments (i.e. telescopes and microscopes) and how these instruments have influenced the making of modern science
- 20th century's telescopes and accelerators, which have probed the inner and outer boundaries of the matter and the universe
- 21st century's facilities such as CERN's Large Hadron Collider (LHC) and the new generation of space telescopes, providing answers to the yet open sub-atomic and cosmological questions.

The objectives of the course have been to familiarise participants with a large amount of digital science education content, which currently exists in history-of-science museums, archives and science centres' collections and digital repositories. Participants were also expected to develop skills in using learning technologies in modes and settings as diverse as a history-of-science museum visit, or a virtual tour in ATLAS-CERN. The integration of the past, present and future of the scientific endeavour will impart, to the school's science curriculum, the dynamics of a common European scientific heritage, strong enough to address the challenges of tomorrow.

The course also aimed at strengthening its socially cohesive and Europe-wide dimension by introducing the participating teachers/trainers to social-tagging learning objects, educational metadata and learning objects repositories, together with hands-on experiences on practical approaches and tools that are commonly used to support the learning object paradigm. To this end, the proposed training course was anticipated to facilitate European teachers and trainers in finding a way that will allow for integration of educational resources of the science centres and history-of-science museums to the science curriculum.

Preparation



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A [web site](#) (including a common web space where participants were able to download and upload materials) was developed, which provided the participants with all the necessary course information such as: the course description, program, educational materials and relevant websites prior to the start of the course, as well as guidelines for travelling. The organisers also provided the participants with most recent and updated educational and informational materials as well as recent European reports in the fields of formal and informal science education and technology-enhanced learning, history of science, current and next-generation European science initiatives in astronomy and particle cosmology.

Prior to the beginning of the course, all participants were able to familiarize themselves with both the training course topic (by accessing via the course's website the relevant resources and materials) and with the course methodology (by getting access to the course structure and tools). The participants were also invited to participate to the [LEARNINGwithATLAS@CERN](#) user group as well as the [COSMOS](#) user group. Moreover, the participants were asked to prepare educational pathways through history-of-science content, introducing inquiry-based techniques in science teaching and making use of resources from History of Science Museums, Archives, and Science Centres. These educational pathways scenarios were discussed in detail during the course.

Participants

Twelve science teachers from nine countries (Austria, Croatia, Finland, Germany, Greece, the Netherlands, Portugal, Spain, Turkey) participated in the Summer School.

Methodology

The training course included presentations and practical sessions (workshops) on:

- WWW and educational uses for teachers and history-of-science museums, archives, and science centres' staff
- The role and resources of museums, archives, and science centres; strategies for searching information online; introduction to the concept of learning objects
- Introduction to learning repositories; introduction to preparing, uploading and sharing learning resources; introduction to metadata, educational metadata, and metadata-based searching
- Presentation of popular social tools and scenarios for their use in the classroom
- Pedagogical strategies and best practices for using digital teaching & learning resources in the classroom
- Hands-on session working on resources related to science (use of LearningwithATLAS@CERN and COSMOS)

The educators were given the tools that allowed them to design educational pathways on digital content resources (i.e. specimens) from the collections of the museums and archives; they were able to select an educational pathway of interest, and then navigating through digital specimens, either within the collection of a particular museum or through different collections of various museums.



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The training course comprised 15 hours of lectures and demonstrations, and 10 hours of hands-on workshops. The lectures and the demonstrations of the training course were held in an auditorium equipped with a data projector and a laptop, whereas, the workshops were held in a multimedia laboratory where each participant had direct access to a PC and carried out planned exercises. A visit to the Skinakas Observatory introduced the participants to the scientists' use of the telescopes, in-situ.

The Programme of Discover the COSMOS Summer School (also available at: www.dtc.ea.gr)

PROGRAMME						
Sunday	Monday	Tuesday	Wednesday	Thursday	Friday	
1 July 2012	2 July 2012	3 July 2012	4 July 2012	5 July 2012	6 July 2012	
09:00-11:00 Introduction to Inquiry-Based Science Education Dr. Pani Stylianidou Elinogermaniki Agogi	11:15 - 13:00 Interactive Session with all participants (in situ)	11:15 - 12:15 Plenary Session (Knoossoc A) SimAULA: Teachers' Professional Development in Virtual Worlds Eva Vazquez de Prada Indiana Software Labs Dr. Roumiana Paytdcheva - Parosyth University Of Sofia St. Kliment Ohridski	Visit to Natural History Museum of Crete and the "Dinos of Patagonia" exhibition	11:15 - 13:00 Plenary Session (Knoossoc A) Open Discovery Space: Listening to Teachers' Voice and Designing the Future of eLearning Resources with Social Data Hendrik Draehler Open University of Netherlands Kiki Clements University of Jyväskylä	12:15 - 13:00 Plenary Session (Knoossoc A) Scientific Community for Science Education in Europe Gina Mihai European Schoolnet	
17:00 - 19:00 Opening Session (Knoossoc A) Chair: Prof. George Neofotistos University of Crete Introduction to Inquiry-Based Science Education Dr. Pani Stylianidou Elinogermaniki Agogi Computational Thinking as Inquiry: Technology in the Service of Science Dr. Robert Panoff Shodor @ NCS The Inspiring Nature of Inquiry: Natural Europe as Mediator of Innovative and Effective Learning Vassiliki Markaki Elinogermaniki Agogi Gamification and RealLife Prof. Sara de Freitas Coventry University and Serious Games Institute	Science Café Practices and Science Education SciCafé Network	15:00 - 18:00 Plenary Session (Knoossoc A) Discover the COSMOS: From Telescopes to Accelerators Eleftheria Tsourtidaki Elinogermaniki Agogi Dr. Rosa Doran ANILCO Prof. Christine Kourkoumelis National Kapodistrian University of Athens	Workshop 2 (Matala) Hunting the Higgs particle with HYPATHIA data analysis tool Prof. Christine Kourkoumelis National Kapodistrian University of Athens Stavros Vourakis National Kapodistrian University of Athens	Workshop 3 (Matala) Crashing Galaxies in a classroom with the UKS SchoolLab5 Toolkit Eleftheria Tsourtidaki Elinogermaniki Agogi	Participants' Presentations	
	17:00 - 19:00 Opening Session (Knoossoc A) Chair: Prof. George Neofotistos University of Crete Introduction to Inquiry-Based Science Education Dr. Pani Stylianidou Elinogermaniki Agogi Computational Thinking as Inquiry: Technology in the Service of Science Dr. Robert Panoff Shodor @ NCS The Inspiring Nature of Inquiry: Natural Europe as Mediator of Innovative and Effective Learning Vassiliki Markaki Elinogermaniki Agogi Gamification and RealLife Prof. Sara de Freitas Coventry University and Serious Games Institute	11:15 - 13:00 Interactive Session with all participants (in situ)	Workshop 1 (Matala) A hands-on introduction to Cosmology principles Serafim Spanos Hellenic Astronomy and Space Society Dr. Angelos Lazoudis Elinogermaniki Agogi	Workshop 4 (Matala) Finalization of Participants' Discover the Cosmos educational scenarios		

Outcomes and Follow Up

Consistent with its aims, all participants developed educational pathways in particle physics and astronomy. The titles of those scenarios, which have been uploaded on the Discover the COSMOS Portal, are:

1. Types of Orbits in the Gravitational Field
2. A Short Story of Elementary Particles
3. Meteorite Impact
4. Expanding Universe
5. Planetary Calculator
6. Planning and Realisation of an Evening-long Astronomical Observation



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During the weeks following the Summer School, the participants will have the opportunity to conduct mini-projects to further apply what they have learnt by producing educational resources following the learning objects paradigm and sharing them through the establishment of a teachers' community of best science education practice. The participants will be welcome to systematically participate to the LEARNINGwithATLAS@CERN user group as well as the [COSMOS](#) user group. They will be part to a community that numbers more than 1,200 science teachers who are applying inquiry based techniques in their everyday teaching.

Moments from the Discover the COSMOS Summer School

A selection of pictures from the Discover the COSMOS Summer School is presented below.

Pic 1: Day One Session



Pic 2: Participants with certificates





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2.2.2 The High School Teachers Programme at CERN



High School Teachers (HST) Programme

CERN, Geneva, Switzerland, 1-21 July 2012

Objectives

Established in 1998, the High School Teachers (HST) Programme is a 3-week residential training summer course addressed to physics teachers from CERN member, observer and non-members states, with the ultimate objective to bring modern science, physics, particle physics and CERN closer to schools. Structured around a combination of lectures, visits to experimental facilities, hands-on workshops, working group activities and team building initiatives, the programme aims to infuse inspiration, motivation and confidence to teachers, who in turn can motivate and inspire their students and communicate science to their colleagues and the general public, thereby acting as ambassadors for science, physics, particle physics and CERN. Specifically, the goals of the HST Programme are:

- To promote the teaching of physics and, in particular of particle physics, in high schools
- To promote the exchange of knowledge and experience among teachers of different nationalities
- To expose teachers to the world of research
- To stimulate activities related to the popularization of physics within and beyond the classroom
- To help CERN establish closer links with schools from Europe and beyond
- To encourage the cooperation between CERN and existing programs sponsored by the European Union in the area of science education

The 15th edition of the HST Programme, which took place from July 1st to 21st 2012, was characterised by an emphasis on targeted training designed and implemented in line with the principal aim of Discover the COSMOS' implementation activities, that is, to overcome the limitations of science classroom instruction by helping teachers to appreciate the inquiry-based science methodology; to learn about and experiment with eScience tools and applications; and to co-create inquiry-based educational pathways scenarios for pilot testing, further development and online sharing across an international community of science teachers through the Discover the COSMOS Portal.

Participants

Forty-two physics teachers from twenty-five countries across Europe (59%), Africa (17%), America (17%) and Asia (7%) participated in the HST 2012 Programme. Of these, 62% were males and 38% females. 38 percent of teachers were between 31 and 40 years old, 33 percent between 19 and 30 years old, 22 percent between 41 and 55 years old, and the remaining 7 percent were more than 55 years old.



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Preparation

Four weeks prior to their arrival at CERN, participants were contacted by email and were informed about the IBSE training activity in the context of the HST Programme. Educational material was also provided to participants in order to help them familiarise with IBSE and its application to ICT-enhanced learning with the use of specific eScience applications (i.e. HYPATIA) in the area of particle physics. In particular, this material included: a brief overview of Inquiry-based Learning (University of Birmingham, 2010); an introductory chapter in Inquiry Learning (Minstrell & van Zee, 2000); a recent report on perspectives on Inquiry-based Learning (The Wellcome Trust, 2011); the "Conservation of Momentum" Demonstrator developed by Ellinogermaniki Agogi; and a PowerPoint template serving as a guide for building educational pathways scenarios during the HST Programme. Participants were invited to review this material and were assured that they would also have opportunities to review and reflect on the IBSE activity throughout the duration of HST Programme.

Methodology

Overall, the HST 2012 Programme included:

- More than 25 hours of lectures from CERN scientists covering topics such as particle physics, dark matter and anti-matter, neutrinos and quantum fluctuations, cosmic rays and the concept of mass, particle detectors and accelerators, medical applications in particle physics, cosmology, the history of scientific ideas and Nobel stories
- Numerous visits to experimental facilities and CERN's permanent public exhibitions, including the CMS experiment, the Super Conducting Magnet Test Facility, the CERN Computer Centre and AMS, and the Globe and Microcosm exhibitions
- Hands-on practical sessions, including the "How to Build a Cloud Chamber" workshop and the "Hands-on HYPATIA" training session
- Dedicated sessions on: IBSE, creating links between schools and the research community, bringing CERN closer to the classroom, and the Discover the COSMOS Portal
- Working group activities focused on the construction of educational pathways scenarios
- Special events, including a Q&A Session with Sir. Peter Higgs a day before the July 4th "Higgs Seminar" and also a Q&A Session with Prof. Rolf-Dieter Heuer, Director General of CERN
- Social events and team building activities, including the "Discover Geneva Treasure Hunt" and the International Evening

The complete agenda of the HST 2012 Programme, which includes all material covered in lectures along with the videos from the presentations of the educational pathways scenarios, can be found at: <https://indico.cern.ch/conferenceDisplay.py?confId=193928>

While the IBSE activity was viewed as embedded in the goals and objectives of the HST 2012 Programme, targeted and systematic efforts were made to optimise its process and expected outcomes. These are described in a sequential order below:

- On the third day of the programme, an hour-and-a-half session was held in which participants were introduced to the objectives of the HST 2012 Programme, and the "what", "why" and



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“how” of IBSE. Examples of educational scenarios structured around the IBSE methodology were presented and participants’ questions on the IBSE activity were answered. This was followed by an interactive session during which participants exchanged their experiences with IBSE and discussed challenges and opportunities for applying the IBSE methodology to their teaching practice.

- At the end of Week 1, and following team building exercises that took place during the same week, participants were divided into seven working groups and invited to propose topics for the educational pathways scenarios.
- At the end of Week 2, all seven groups presented their progress reports to the HST team and received feedback.
- At the beginning of Week 3 (final week), all seven working groups presented their educational scenarios to members of the Discover the COSMOS team (Dr. Sofoklis Sotiriou and Dr. Angelos Lazoudis, Ellinogermaniki Agogi) in a full-day session, which also included presentations and demonstrations by the latter. This was followed by customised feedback provided to each of the seven working groups.
- The following day (July 17), participants were introduced to the Discover the COSMOS Portal in a presentation given by Dr. Angelos Lazoudis. A hard copy of the “Discover the COSMOS: Guidelines for Developing Technology Enhanced Science Education Activities” booklet, developed by Ellinogermaniki Agogi and Science View, was also provided to participants.
- On the second last day of the programme, a dedicated half-day training session on HYPATIA was organised and run by the Discover the COSMOS Project Co-ordinator, Prof. Christine Kourkoumelis (IASA), and a team of three ATLAS physicists from the University of Athens. A hard copy of the HYPATIA manual was also provided to participants. The training was concluded by a discussion on ways in which HYPATIA can be implemented effectively in the classroom.
- On the last day of the programme, all seven groups presented their educational pathways to the Discover the COSMOS Co-ordinator and members of CERN Education.

Outcomes and Follow Up

Participants’ quantitative and qualitative feedback (n=41) was used to evaluate the HST 2012 Programme in terms of: (1) learning outcomes, (2) attitudinal and motivational outcomes, and (3) programme satisfaction outcomes.

Based on participants’ responses on a 5-point Likert scale (1=disagree, 5=agree), the results of quantitative analysis indicated:

- Better insight into particle physics (mean: 4.63)
- Increased motivation (mean: 4.59) and confidence (mean: 4.43)
- Satisfaction with the organisation (mean: 4.33) and usefulness (mean: 4.63) of the programme



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The highest score was for the item "I will recommend this programme to others" (mean: 4.73).

Participants were also asked to describe the HST Programme using three words. In total, 45 words were used 112 times. The ten most frequently used words were: *inspiring* (12 times), *exciting* (11 times), *motivating* (8 times), *informative* (8 times), *interesting* (7 times), *amazing* (6 times), *educational* (5 times), *sharing* (5 times) and *fun* (4 times).

Besides its overall positive evaluation, the HST 2012 Programme produced some tangible outcomes which are of value and relevance to participants, their science education communities and the Discover the COSMOS Consortium. Seven educational pathways scenarios structured around the inquiry-based approach to science learning were created by respective groups of physics teachers and are ready to be pilot tested in high-schools in 25 countries. The titles of those scenarios are:

1. Particle Accelerators: Looking Inside a Particle
2. The Bosémon Game
3. An Integrated Introduction to Particle Physics
4. What's the Matter?
5. CERN Mini-Expo
6. Detecting Cosmic Rays
7. Resolving the Mess about Mass

Notably, the "The Bosémon Game" has been included in the list of the Discover the COSMOS Demonstrators (see Deliverable 2.6).

As a follow up to the HST 2012 Programme, regular communication has been established with participants through email and their social media (i.e. Facebook) page with the aim to:

- Track and provide them with feedback on the pilot-testing of their educational pathways scenarios
- Help them participate actively in the Discover the COSMOS user group by uploading and sharing improved versions of their scenarios
- Inform them on forthcoming training activities in the context of Discover the COSMOS
- Support them in the organisation of e-Masterclasses and participation in related activities (e.g. school visits to CERN mini-expo travelling exhibition in Serbia and Spain, contests, etc.)

Moments from the HST 2012 Programme

A selection of pictures from the HST 2012 Programme is presented below.



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		<p>2 Lectures & Presentations</p>
<p>1. Dr. Sofoklis Sotiriou (EA) presents on Organisation of CERN Days.</p> <p>2. HST2012 participants with members of Discover the COSMOS team.</p> <p>3. "Two Nobel Stories" by Prof. Cecilia Jarlskog (Lund University).</p>		
		<p>4. HST2012 participants with Prof. John R. Ellis (CERN) after his "Introduction to CERN" presentation.</p> <p>5. HST2012 participants at CERN's Main Auditorium after Manjit Dosaanjh's (CERN) lecture on "Medical Applications of Particle Physics".</p>
		<p>6. Presentation and Q&A session on Update on Higgs Search by Dr. Rolf Landua (CERN).</p>
<p>Hands-on Sessions</p>		
		<p>1-2. HYPATIA half-day training session by Prof. Christine Kourkoumelis (IASA) and members of the ATLAS group of the University of Athens.</p>
		<p>3-4. "Building a Cloud Chamber" workshop run by Mick Storr (CERN).</p>



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<p>1</p>	<p>3</p>	<p>Working Group Activities</p> <ol style="list-style-type: none"> HST2012 participants and members of the "Bosemon Game" work group after the presentation of their educational pathway on the last day of the programme. HST 2012 participants try the "Bosemon Game" Dr. Goronowy Jones (University of Birmingham) with HST 2012 participants. HST2012 participants in a brainstorming session in CERN's cafeteria.
<p>2</p>	<p>4</p>	
<p>1</p>	<p>3</p>	<p>Visits & Special Events</p> <ol style="list-style-type: none"> HST2012 participants on their way down to the CMS cavern (©CERN 2012). HST 2012 participants outside the CERN Control Centre with Dr. Lyn Evans, project leader of the Large Hadron Collider. A very special moment with Sir. Peter Higgs a day before the discovery announcement at CERN. HST2012 participants with Prof. Rolf-Dieter Heuer, Director General of CERN (©CERN 2012).
<p>2</p>	<p>4</p>	



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2.3 Training Sessions

In addition to the implementation activities organised in the context of the DtC Summer School and CERN's HST Programme, nineteen international training sessions took place throughout the first year of the project. The majority of those activities were astronomy related and implemented by IAP/CNRS, LBL, NUCLIO, UC and UoG in Europe but also N. Africa and Asia during year one of the DtC project in the context of the Galileo Teacher Training Program (GTTP) and the EU/Global-Hands on Universe (EU/G-HOU). Other astronomy related training was implemented by NUCLIO, LBL, LJMU in the framework of international conferences, workshops and scientific meetings. A more detailed description of selected training sessions is provided below.

Title of Event: **GTTP in Chile**

Date of Event: 9-14 January 2012

Place of Event: Calama, Chile



Forty-seven teachers attended from all around Chile (Arica to Puerto Williams) representing 18 cities (some of them are part of the American Corners net: Arica, Putre, Valdivia, Puerto Montt, Punta Arenas and Puerto Williams; with 8 teachers attending). All the teachers represented public and private schools (from Science and Physics areas, elementary and secondary education) and were trained in the topics considered in the Physics curricula modification started 2 years ago by the Ministry of Education.

The goal was training teachers in the effective use and transfer of astronomy tools and existing resources that are freely available on the internet, into classroom science curricula (robotic optical and radio telescopes, webcams, astronomy exercises, cross-disciplinary resources, image processing software, among others). Six monitors attended from University of California, Berkeley; Lycée Louis Le Grand de Paris; OPCC; NOAO and U. de Antofagasta, attracting 2,700 members of the general public. These monitors' classes and activities were supported by four assistants (GTTP trained teachers in Chile).



Title of Event: **European Week of Astronomy and Space Science (EWASS)**

Date of Event: 5-7 July 2012

Place of Event: Rome, Italy

In the scope of EWASS 2012, a special teacher training session was organised to introduce modern tools for science education, including Planetaria software, image processing software, hands-on activities with readily available material, etc., to ten teachers and trainers who had the



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opportunity to get in touch with the DtC tools and learn how they can be involved with the project that brings real research into the classroom. The conveners for this training session were: Rosa Doran (Portugal), Magda Stavinschi (Romania) and Livia Giacomini (Italy). Although the number of participants was low, these were mostly teacher trainers from different countries: Italy, Netherlands, Austria and Portugal. In the case of Italy and Austria a discussion about future possibilities of bringing Discover the Cosmos to their countries was initiated.



Title of Event: **Galileo Teacher Training Program (GTTP) – Morocco 2012**

Date of Event: 8-14 July 2012

Place of Event: Ifrane, Morocco

In the context of GTTP, a special training session for thirty Moroccan teachers participating in this event took place in the Al Akhawayn University in Ifrane. The DtC project and tools were introduced to participants.



Title of Event: **The 39th COSPAR Scientific Assembly**

Date of Event: 15-22 July 2012

Place of Event: Mysore, India

The DtC tools and resources were presented in a special training session attended by thirty teachers and trainers, who had the opportunity to experiment with the use of robotic telescopes and image processing using SalsaJ and ultimately to learn how they can include such resources in regular school curricula. Participants were also introduced to citizen science programs.





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Title of Event: **Swastik's Sattava Vikas School**

Date of Event: 20 July 2012

Place of Event: Ahmedabad, India

A special DtC training session was organised for twenty-five students and five teachers of a private school in India (7th to 9th grade) that was organized by the Manthan Educational Programme, a local partner of GTTP. It was agreed that the school will pilot one of DtC Demonstrators in the classroom.

Title of Event: **Sanskar Tirth Nursing Training School**

Date of Event: 20 July 2012

Place of Event: Ahmedabad, India



A special DtC session was promoted for two-hundred students and ten teachers of a rural school in India (7th to 9th grade). The event was organized by the Manthan Educational Programme, a local partner of GTTP. It was agreed that the school will



pilot one of DtC Demonstrators in the classroom. This session had a simultaneous translation to the local language of the students (all girls).

Title of Event: **Astronomy/Astrobiology Workshop**

Date of Event: 26 August 2012

Place of Event: Beijing Planetarium, China

The DtC Project was introduced to twenty-five Chinese teachers and a special session was promoted piloting the use of the "Black Hole in the center of our galaxy" DtC Demonstrator. Participants were very excited about learning to use the software and the possibilities of the exercise.



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3. Conclusions and Steps Ahead

In this report the international level implementations activities for the first year of the DtC project's life cycle have been documented in a structured manner by describing their learning objectives, participants' profile, process and methodology applied, outcomes and follow up actions. Two Summer Schools, four International Masterclasses and 17 training sessions and workshops have been implemented. Table 2 provides a summary of all international-level implementation activities for the first year of the project classified per country of organising institute and categories of involved actors (i.e. teachers, students, other), while the geographical spread of those activities is shown in Figure 1.

Country	Events	Teachers	Students	Other
France	5	150	0	0
Germany	2	0	126	0
Greece	3	44	180	0
Portugal	6	87	225	10 (Amateur Astronomers and Teacher Trainers)
Switzerland	1	42	0	0
UK	5	94	0	70 (Astronomy Educators and Researchers)
US	1	47	0	~2,700 (General Public)
Total	23	464	531	~2,780

Table 2: International-Level Implementation Activities (Year 1)

Figure 1: Geographical spread of DtC International-Level Implementation Activities (Year 1)





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While this can be viewed as a good start, there is a lot to be expected and implemented in the second half of the project's life cycle, when the final set of the DtC Demonstrators (see D2.6) are to be tested in-situ by teachers, teacher trainers and students. According to the implementation plan, there is also the need for action in relation to the organization of additional large scale activities, including two teachers and students contests and one international conference. In effectively doing so, all partners involved in large scale international implementation activities are expected to co-ordinate further their actions and support actively these efforts.



Discover the Cosmos Deliverable

4. ANNEX

Table 1 and 2 list all international level implementation activities conducted during the project's first twelve months (September 2011 – August 2012). The type of the event is marked according to the following table:

Type	Event	Classification	Coverage
V	Visionary Workshop	Participatory Engagement	
PR	Practice Reflection Workshop	Participatory Engagement	Local/National
S	Summative Workshop	Participatory Engagement	
T	Training and demonstration activities: workshop or seminar	Training / Implementation	Local/National/International
MC	MasterClasses	Implementation	National/International
SS	Summer School	Implementation	International



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Type	Event	Date (Project Month)	Location	Purpose	Participants	Requirements
October 2011						
T	UNESCO/ UNOOSA Teacher Training workshop during World Space Week	03–05/10/2011 (M2)	Enayetpur, Bangladesh	Introducing and training teachers on available Astronomy resources	UoG UNOOSA	25 high school teachers and teacher trainers
T	Astronomy Workshop for International Schools	12/10/2011 (M2)	Nakhon Pathom, Thailand (via Video Conference)	Introducing and training teachers on available Astronomy resources	LJMU Mahidolwittayanusorn school.	Teachers from 44 international high schools in Thailand.
December 2011						
T	Comenius teacher training workshop	07-08/12/2011 (M4)	Limassol, Cyprus	EU-HOU, Hands-on radio astronomy	IAP/CNRS	~ 30 high school teachers from Cyprus

Table 1: Implementation Activities 2011

	Event	Date (Project Month)	Location	Purpose	Participants	Requirements
January 2012						
T	GTTP in Chile	9-14/01/2012 (M5)	Calama, Chile	Teachers' training in use of astronomy tools and resources	LBL	47 high school teachers ~2,700 general public



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	Event	Date (Project Month)	Location	Purpose	Participants	Requirements
February 2012						
T	Comenius teacher training workshop	6-7/02/2012 (M6)	University P&M Curie, Paris, France	EU-HOU, Hands-on radio astronomy	IAP/CNRS	~ 30 high school teachers from Europe
T	ESA / GTPP Workshop	14-17/02/2012 (M6)	European Space Operations Centre, Madrid, Spain	Presentation of the project objectives and strategies during the workshop presentation sessions. Training on the use of some DtC tools and resources.	NUCLIO	20 European Physics and Chemistry teachers
March 2012						
MC	Particle Physics International Masterclasses	12-16/03/2012 (M7)	Observatorio Astronomica de Coimbra, Portugal	High school students come to CERN for one day in order to learn about particle physics, CERN and become researchers for a day. In the morning, talks are given by CMS physicists, and in the afternoon a laboratory is held where students use the MINERVA event display to look for W bosons. Finally the students compare their results with those of other institutions from other countries in a videoconference.	UoC	~ 30 high school teachers from Europe



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	Event	Date (Project Month)	Location	Purpose	Participants	Requirements
MC	Particle Physics International Masterclasses	19/3/2012 (M7)	CERN, Switzerland	High school students come to the University of Athens for one day in order to learn about particle physics, CERN and become researchers for a day. In the morning, talks are given by CMS physicists, and in the afternoon a laboratory is held where students use the iSpy CMS event display tool to look for W and Z bosons. Finally the students compare their results with those of other institutions from other countries over a videoconference.	TUD	16 high school students
MC	Particle Physics International Masterclasses	19/3/2012 (M7)	Dresden, Germany	High school students come to the Technical University of Dresden Athens for one day in order to learn about particle physics, CERN and become researchers for a day. In the morning, lectures are given by professors from TUD, and in the afternoon a laboratory is held where students use the	TUD	110 high school students



D4.7 Interim Report on Implementation Activities (International Level)

	Event	Date (Project Month)	Location	Purpose	Participants	Requirements
				MINERVA event display to look for W bosons. Finally the students compare their results with those of other institutions from other countries in a videoconference.		
MC	Particle Physics Masterclasses	24/3/2012 (M7)	Heraklion, Greece	High school students come to nearby universities or research centres for one day in order to learn about particle physics, CERN and become researchers for a day. The event was held at the Physics department of the University of Crete in Heraklion and the lectures were given by professors from the university of Crete, the University of Athens and Ellinogermaniki Agogi.	IASA	120 high school students 15 high school teachers
T	Comenius teacher training workshop	26-27/03/2012 (M7)	Argelander-Institut für Astronomie, Bonn, Germany	EU-HOU, Hands-on radio astronomy	IAP/CNRS	~ 30 high school teachers from Europe
T	UK National Astronomy Meeting joint	28/03/2012 (M7)	University of	Demonstration sessions about	UoG	70 astronomy educators and researchers



D4.7 Interim Report on Implementation Activities (International Level)

	Event	Date (Project Month)	Location	Purpose	Participants	Requirements
	with German Astronomical Association		Manchester, UK	asteroids, comets and impacts		
April 2012						
T	Comenius teacher training workshop	02-06/04/2012 (M8)	University P&M Curie, Paris, France	EU-HOU Hands-on astronomy	IAP/CNRS	~ 30 high school teachers from Europe
June 2012						
T	Comenius teacher training workshop	4-8/06/2012 (M10)	University P&M Curie, Paris, France	EU-HOU Hands-on astronomy	UoG	~15 high school teachers from Europe
July 2012						
SS	Discover the COSMOS Summer School 2012	01-06/07/2012 (M11)	Heraklion, Greece	Summer School to enhance science education by presenting the fabric of the cosmos as was shaped by scientific evidence and explanations through 400 years of scientific advancement.	EA	14 teachers from different countries; http://dte.ea.gr
SS	High School Teachers Programme at CERN	01-21 July 2012 (M11)	CERN, Switzerland	Summer School with the aim to bring modern science, physics, particle physics and CERN closer to schools. Integrated training on IBSE and development of educational scenarios coupled with hands-on sessions, such as	CERN	42 high school teachers from 25 countries



D4.7 Interim Report on Implementation Activities (International Level)

	Event	Date (Project Month)	Location	Purpose	Participants	Requirements
				HYPATIA and "Building a Cloud Chamber" workshops.		
T	EWASS 2012 – European Week of Astronomy and Space Science	05/07/2012 to 07/07/2012 (M11)	Rome, Italy	SM6 – Teacher Training Session http://www.ifs-roma.inaf.it/ewass2012/	NUCLIO	10 amateur astronomers and teacher trainers
T	Global-HOU 2012	9-15/07/2012 (M11)	Ifrane, Morocco	Talks, hands-on astronomy and teacher workshop	IAP/CNRS	International audience of astronomy educators; ~30 Moroccan teachers
T	COSPAR 2012	15-22/07/2012 (M11)	Mysore, India	Teachers Training session	NUCLIO	27 teachers from different countries
T	Swastik's Sattava Vikas School	20/07/2012 (M11)	Ahmedabad, India	Discover the Cosmos session for a private school in India (7th to 9th grade students)	NUCLIO	25 high school students 5 high school teachers
T	Sanskar Tirth Nursing Training School	20/07/2012 (M11)	Ahmedabad, India	Discover the Cosmos session for a rural school in India (7th to 9th grade) – the session had simultaneous translation	NUCLIO	200 high school students 10 high school teachers
August 2012						
T	"Down to Earth" workshop	06/08/12 (M12)	Astronomy Society of the Pacific Meeting, Tucson, Arizona	Workshop using the "Down to Earth" project resources (part of the Discover the Cosmos	UoG	10 high school teachers



D4.7 Interim Report on Implementation Activities (International Level)

	Event	Date (Project Month)	Location	Purpose	Participants	Requirements
				resource library, developed by the Faulkes Telescope Project at Univ. of Glamorgan), consisting of a talk and practical session.		
T	Astronomy/Astrobiology Workshop	26/08/2012 (M12)	Beijing Planetarium, China	Discover the Cosmos session combined with pilot use of "Black Hole in the Center of Our Galaxy" Demonstrator.	NUCLIO	25 Chinese teachers

Table 2: Implementation Activities 2012 (until 31st August)