Summer School Alpbach 2004
„The Birth, Life and Death of Stars””

powered by

60 students from among the member states of the European Space Agency, plus a Hungarian student, attended the 28th annual Alpbach Summer School on the theme “The Birth, Life and Death of Stars”, held from 27th July – 5th August. The Alpbach Summer School is organised by the Austrian Space Agency in cooperation with the Austrian Federal Ministry of Transport, Innovation and Technology, the European Space Agency and the national space authorities of all ESA member states with the support of the International Space Science Institute (ISSI).

The purpose of the Summer School is to foster the practical applications of knowledge derived from lectures, to develop organisational and team-work skills and to encourage creativity.

During the first week of the programme, introductory lectures dealt with the issues specific to Stellar Mysteries, Stellar Evolution, Star Formation, Stellar Interiors, Stellar Activity Cycles, Nucleosynthesis, Space Telescopes and space science instrumentation.

The second week focused on spectroscopy and the link between stellar astrophysics. extra-solar planets and cosmology. A significant fraction of the week was devoted to workshop activities

Within the workshops the students were organized into four teams of 15 participants each which competed to come up with the best idea for an innovative space science mission related to stellar life cycles which were subsequently judged by an independent expert-review panel. The teams themselves were responsible for the selection of the subject of the project and for the team structure and working methods. The teams had to

- Identify a “stellar mystery” related to life cycles;
- Identify and detail the mission’s scientific objectives;
- Define and outline the design of a “payload” to make the scientific measurements;
- Establish a mission architecture considering all technical and planning aspects (location, structure, transportation, power, communications and operations).

The work culminated in the design of the following space missions which were presented to an international expert review panel which warmly congratulated the students on their achievements. The panel was chaired by Mme Catherine Turon, Professor at the Observatoire Paris-Meudon who was highly impressed by the students’ accomplishments.

MAPS

MAPS is devoted to study stellar chemical abundances, magnetic fields and fundamental astrophysical parameters, hence linking the photosphere to stellar interiors and to the circumstellar medium. High resolution spectroscopy and asteroseismology were the chosen tools. A focus of MAPS research is on Population III stars, objects which originate from the first epoch of star formation after the "Dark Ages" in cosmology at z~10-30 and which therefore are supposed to contain only elements created in the Big Bang.

The design of the telescope refers to HERSCHEL and the selection of the targets in the field of view makes use of micro shutter arrays currently developed for JWST. Next to the telescope, the core of the instrument are two high resolution spectrometers with polarimetric capability optimized for the UV and, respectively, the near UV-visible spectrum. The payload is intended to be launched to L2.

The Jury acknowledged the depth of the study very favourably.

SUGAR-1: Spectrometry in Ultraviolet of Galaxies at Redshift-1

The focus of this mission was on stars formed at about z=1, corresponding to about 5 Gyr, that is the time when our Solar system was borne. Observing galaxies in this redshift domain tells a lot about star forming processes and the conditions of the interstellar medium (ISM) of galaxies like ours when the star formation was triggered. The team proposed to address this topic by investigating different metal lines in the ISM linked to star forming regions, hence to determine age and history of star formation from UV and visual spectroscopy and to decide between concurrent star burst models.

To determine the leakage of photoionizing photons into the intergalactic medium (IGM) was another scientific goal. This leakage can be used to probe the re-ionization of the universe, which is an important phase in the evolution of our universe.

The planned investigation consists of a 3.5 m telescope with a dedicated low and medium resolution spectrograph optimized for the UV.

The Jury was particularly impressed by the conversion of the science goals into the mission specifications.

MOOD – Multi Object Occulting Device

The objective of the project MOOD was to put an artificial moon into space used as an occulting shield for the planned James Webb Space Telescope (JWST). The main scientific goal was to observe, detect and investigate so-called extra solar planets. These planets orbiting not around our Sun but around other stars have only been discovered in the last 10 years. These celestial objects are very difficult to observe, because they are very close to their host stars and dimmer by many order of magnitudes. The proposed occulting shield will have a large square structure consisting of lightweight material and will fly away from the James Webb Space Telescope at a distance of at least 13500 km. The occultation will allow to obtain a light curve with a high spatial resolution and should not only detect and observe extra solar planets, but also secondary proto-planetary discs, star diameters, and binaries with a Brown Dwarf.

The project was worked out well starting from the scientific objectives to the mission architecture, mission design and an economic analysis. The jury appreciated especially the innovative imagination with respect to the science technology in this project.

X-red - Early Universe Gamma Ray Burst Detection

The objective of this proposed space mission to be launched between 2015 and 2025 is to investigate the most energetic events in our Universe, namely the gamma ray bursts (GRBs). The most popular theories predict that the GRBs are connected intimately with the death of massive stars and should be detectable also in the early stages universe. The payload of the proposed mission consists of a wide field X-ray camera to observe the highly red-shifted gamma rays, and an infrared camera to detect the high redshift afterglow of the GRBs. The mission is expected to detect and identify for the first time GRBs at a redshift $z>10$ and therefore give us important clues and insights to the early stages of our universe.

The scientific case and justification of the mission is addressed well in the proposed project. The payload design starting from the observable science data and the instrumentation in the X-ray range and the near infrared was implemented in the project with considerable professionalism. Also the mission analysis (orbit description, propulsion) and spacecraft engineering (spacecraft structure, power system, telemetry, attitude control) was described excellently. Finally, reasonable cost estimations were given for the project.

The innovative and visionary status of the project as well as its technical and programmatic feasibility convinced the jury that the chosen mission was worked out with great care in every respect. Therefore, this mission was chosen as the best space mission project of the Summer School Alpbach 2004.

The Summer School Alpbach once again proved the high quality of work accomplished by the students participating in the programme.

For additional information and the individual presentations please see ASA's homepage www.asaspace.at/alpbach.

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