

## II. Inaugural Ceremony Tuesday, 17th August 1982, 20<sup>h</sup>

The Inaugural Ceremony was held in the Ancient Odeon, near the centre of the city of Patras, in the presence of His Excellency, Mr. Euripides Kafantaris, Governor of the Prefecture of Achaia and representatives of the City and University of Patras.

The chair was taken by Professor Constantine Goudas, Chairman of the Local Organizing Committee for the XVIIIth General Assembly of the IAU.

Two musical interludes were provided by the OTE Mixed Choir, Athens, directed by Mr. A. Papayannopoulos and the Patras Mixed Choir, directed by Mr. S. Solomos.

Professor Goudas introduced Academician J. Xanthakis, Chairman of the Greek National Organizing Committee.

### Allocution de M.J. Xanthakis, Président du Comité National d'Organisation

"C'est un grand événement pour la Grèce et un grand honneur pour l'Université de Patras d'accueillir le 18ème Congrès International d'Astronomie. Des savants et des jeunes astronomes venus des différents pays du monde sont ici réunis pour présenter les résultats de leurs recherches récentes dans les différentes disciplines d'astronomie et d'astrophysique. Ils vont aussi discuter et exposer leurs idées nouvelles et leurs opinions pour les recherches de l'avenir.

Chers collègues, nous sommes ici, dans la région où a vu pour la première fois la lumière du jour, ce nouveau né, qui était la Science du Ciel, avec les observations des peuples anciens du Proche et d'Extrême Orient. Ce nouveau né, dans ce pays des Grecs anciens, avec le génie de Thalès de Millet, de Pythagore, de Philolaos, d'Héraclite et d'Aristarque de Samos est devenu un adulte.

C'est dans l'âge de la puberté que ce jeune homme a émigré quelques siècles après dans l'Occident pour se former en un jeune savant, sous l'impulsion des découvertes de Copernic, de Galilée, de Képler, de Newton et d'autres grands savants de la Renaissance et des années récentes.

C'était donc une nécessité pour les successeurs des astronomes des peuples anciens, de vouloir visiter, après 25 siècles, le lieu où a vu la lumière et a fait ses premiers pas solides, la science du ciel. Nous vous accueillons ici cordialement, dans ce petit coin de l'Europe avec sa longue histoire et sa civilisation ancienne. Mais nous regrettons que nos moyens financiers ne nous permettent pas d'être à la hauteur de notre tradition hospitalière, de "Ἐννίοζ Διαζ", de dieu Jupiter de nos

ancêtres. Les Comités d'Organisation National et Local ont essayé de faire tout ce qu'ils pouvaient pour faciliter autant que possible votre travail ici, et pour rendre votre séjour sur cette côte pittoresque du Péloponnèse aussi agréable que possible.

Professor Goudas regretted that the President of the Hellenic Republic, Mr. Constantine Karamanlis, due to urgent duties elsewhere, had been unable to come to Patras. Professor Goudas delivered the President's speech in Greek; it was thereafter given in French and English translation.

#### ΜΗΝΥΜΑ ΠΡΟΣ ΤΗΝ 18Η ΓΕΝΙΚΗ ΣΥΝΕΛΕΥΣΗ

Ἀποσταλέν ἀπό τόν Πρόεδρο τῆς Δημοκρατίας κ. Κ. ΚΑΡΑΜΑΝΛΗ

Μέ ιδιαίτερη ἱκανοποίηση χαιρετίζω τήν σύγκλιση τῆς 18ης Γενικῆς Συνελεύσεως τῆς Διεθνοῦς Ἀστρονομικῆς Ἐνώσεως εἰς τήν Ἑλλάδα καί καλωσορίζω τά μέλη της, εἰς τήν χώρα αὐτή, ἡ ὁποία ὑπῆρξε μία ἀπό τίς ἀρχαῖες κοιτίδες τῆς Ἀστρονομίας. Καί λυποῦμαι διότι, λόγω ἐκτάκτου ἀπασχολήσεως, δέν μοῦ εἶναι δυνατόν, παρά τήν μεγάλη ἐπιθυμία μου, νά κηρύξω αὐτοπροσώπως τήν ἔναρξη τῶν ἐργασιῶν τοῦ Συνεδρίου σας.

Εἶναι δι' ἡμᾶς ἰδιαίτερος σημαντικό τό γεγονός ὅτι εἰς τό Συνέδριό σας μετέχουν ἐπιστήμονες ἀπ' ὄλο τόν κόσμο. Ἡ ἐνότις αὐτή μεταξύ τῶν σπουδαστῶν τοῦ διαστήματος ἀποτελεῖ ὑπόδειγμα εἰρηνικῆς συνεργασίας καί παράδειγμα, τό ὅποιο θά ἦταν εὐχῆς ἔργο νά ἀκολουθήσει ὁ ταραγμένος κόσμος τῆς ἐποχῆς μας, γιά νά ἀνακαλύψει νέους δρόμους προόδου, χάριν ὄλων τῶν λαῶν τῆς Γῆς.

Τό πρόγραμμα τῶν ἐργασιῶν σας προδίδει τήν ἐπιθυμία τῶν συνέδρων νά καταστήσουν τήν συνάντησιν αὐτή σταθμό εἰς τόν τομέα τῆς ἀνταλλαγῆς πληροφοριῶν μεταξύ τῶν μελετητῶν τοῦ διαστήματος.

Εὐχομαι ἡ προσπάθειά σας αὐτή νά ἐπιτύχει, ὄχι μόνο διὰ τό καλό τῆς ἐπιστήμης, ἀλλά καί διὰ τό καλό τῆς ἀνθρωπότητος, γενικώτερον.

MESSAGE TO THE ASSEMBLY sent by the President of the Republic

Mr. CONSTANTINE KARAMANLIS

"It is a great pleasure for me to salute the convocation of the 18th General Assembly of the International Astronomical Union in Greece, and to welcome its members to this country, which is one of the ancient cradles of Astronomy. I am very sorry, indeed, that due to unforeseen duties, it has become impossible for me inaugurate personally the works of your Assembly.

I deeply appreciate the fact that in your Assembly participate scientists from all over the world. This unity among students of space constitutes a model of peaceful cooperation and an example, which would be most desirable if the troubled world of our times could follow, in order to find new ways towards progress, for the sake of all peoples of the Earth.

The program of this Convention manifests the wish of the participants to make this meeting a landmark in the field of exchanging information among students of space.

I wish full success to your efforts, not only for the benefit of science, but also for the good of humanity in general."

Allocution de bienvenue par M. G. Maniatis,  
Recteur de l'Université de Patras

"Dear Participants of the Eighteenth General Assembly of the International Astronomical Union, Ladies and Gentlemen:

It gives me great pleasure to welcome you on behalf of the University of Patras. It is an honour for our young University to be the host of the Eighteenth General Assembly of the IAU.

Your meeting is the largest international gathering ever held on our campus, but I trust that, thanks to the hard work of the Organizing Committee, we will succeed in meeting our responsibilities.

I am not in a position to speak about the particular scientific significance of your meeting, since I am not a specialist in astronomy. As a biologist, however, I feel a kinship with astronomy: In a way astronomy and biology are both concerned, although from opposite ends, with the same fundamental problem: the understanding of the Universe and of man's position in it.

Meetings such as this are extremely important for the progress of science. The personal contacts and exchanges afforded by these meetings can not be substituted by the conventional means of scientific communication. They are essential for the development of new ideas.

But your meeting is especially important for our University, which although young and relatively small, has a sizable and active community of astronomers. We hope that your presence here will provide an impetus for the further development of this group.

In closing, I wish you a productive meeting and a pleasant stay in Greece."

In the absence of the President of IAU, Professor M.K.V. Bappu, his written speech was read by Vice-President, Academician E.K. Kharadze.

Allocution de M. M.K.V. Bappu, Président de l'UAI

"Your Excellency, Mr. President, Mr. Chancellor, Professor Xanthakis, Professor Goudas, Ladies and Gentlemen:

It is with great pleasure that I wish to convey to you the sincere gratitude of the International Astronomical Union, for your very kind invitation to hold our General Assembly in Greece, and for the very warm welcome you have ex-

tended to us. This delightful seaside venue with its ancient castle, the several attractions for the visitor, and its place of learning, provides a setting for our deliberations of the forthcoming week, that is both popular and practical. Sitting here today, in this ancient Odeon of Patras, whose walls have held the rapturous silence of deep concentration or the thunderous ovation of approval of many a Greek classic, here beneath a glowing canopy of stars, a present generation of astronomers seeks to keep a tryst as it were, with their predecessors of an ancient past. The Greek philosophers of antiquity have provided us much of the basis of our present concept of man, state and society. From the point of view of those gathered here, the Greek mind has demonstrated the power of abstract thought and mathematical ingenuity. Its picture of the world was intertwined with reasoning and apparent harmony.

It is therefore very gratifying to find that Astronomy in the Greece of today has not just rested on these very creditable laurels that assure it a place in the history of Mankind. There are several flourishing schools at many centres of learning whose contributions in such fields as mechanics, galactic dynamics and solar physics, to mention just a few, have been highly rated by the astronomical fraternity. This awareness of its role in human history and willingness to participate in international cooperation is seen in the fact that Greece has been a member country of our Union since its inception. Its individual members have contributed very effectively to the progress of our science. We can offer no better testimony of your interest in the affairs of the Union, than the fact that our General Secretary of a few years ago, has been a distinguished colleague from this country.

We are happy to be here today. There is an air of excitement akin to homecoming. For it is a privilege to be invited as astronomers to this cradle of human endeavour from where Man first speculated on the nature of the Universe and his environment."

Finally, Prof. Goudas introduced Professor Pericles Theocaris, President of the Academy of Athens, who spoke as follows:

Allocution de M. Pericles Theocaris,  
Président de l'Académie d'Athènes

"Mr. Chairman, Ladies and Gentlemen:

It is an honour and pleasure to me, as President of the National Academy of Athens, to welcome you in Patras, the city of my origin, and to declare open the Eighteenth General Assembly of the International Astronomical Union.

The organization in Greece of this activity, as befittingly mentioned by the General Secretary of your Society, looks like pilgrimage of Astronomy to the place of its birth.

It is true that the Greek contribution to Astronomy, the most ancient of all sciences, is particularly marked in the following three spheres: (a) the improvement of astronomic measurements; (b) the development of geometrical models for the explanation of stellar movements; (c) the calculation of cosmic dimensions. In the first case the Greeks merely carried on, from the point reached by the Egyptians and Babylonians. But, in the other two, they opened new chapters in the history of astronomy, which resulted in far-reaching advances.

The best criterion of the improvement made in astronomical observations during the Greek period is the degree of accuracy attained in determining the length of the year. The solar year of 365 days was known to the Greeks at the end of the sixth century B.C. from Egyptian sources, just as they got their knowledge

of the monthly period from Babylonia.

The Greek astronomers of the fifth century B.C. narrowed down the earlier approximation by observations of the solstices on the shortest and longest days of the year. In 432 B.C. Meton of Athens estimated the length of the year as 365 days, 6 hours, 18 minutes, 56 seconds, a figure which is only 30 minutes, 10 seconds more than the correct value. In the next three hundred years the margin of error was steadily reduced, until Hipparchus, whose main observations were completed by about 130 B.C., arrived at the figure of 365 days, 5 hours, 55 minutes, 12 seconds - an error of only 6 minutes, 26 seconds. Thus, the accuracy was of the order of approximately one part in one hundred thousand, and still more accurate was the mean length of the month, as known in the time of Hipparchus.

This degree of accuracy, which so remarkably demonstrates the patient perseverance of the Greek astronomers in their observations of the heavens, set the standard for medieval and modern workers in the same field.

Bearing in mind the paucity of precise measurements, made by the Ancient Greeks in all the other physical sciences, we cannot help asking why astronomy was an exception. It is usual to stress the practical, and particularly the economic, factors which led to the development of astronomical research. The importance of the stars to navigation is frequently mentioned in ancient poetry; and there is literary evidence from very early times for the connection between agriculture and the knowledge of the heavens.

But more important than these practical considerations were irrational factors, the roots of which go down to still earlier times and which are connected with the history of astrology. Especially noteworthy in this connection is the effect produced on man by the cyclical character of heavenly phenomena. The changes in the phases of the moon and their periodicity, the progress of the sun along the zodiacal belt with its attendant changes of season, the complicated movements of the planets, which also have a cyclical regularity, and above all the twenty-four hours periodicity of the whole heavenly dome with the accompanying alternations of day and night, all this vast array of eternally recurring cycles awoke the consciousness of ancient man to the great contrast between the firm-set certainty of the heavens and the uncertainty of human life on the earth.

Here there is a twofold contrast: Man's life is unique and can be lived only once, whereas in the heavens there is endless recurrence; the individual is the plaything of chance, whereas the stars obey a law of marvellous constancy. This contrast is the source of that religious fascination, which from the earliest times held man's mind in thrall to the heavenly bodies, expressing itself as simple-star worship, or in a rationalized form as an urge to follow the minute details of those manifestations of precision and regularity.

To this irrational element there was added the practical aim of fixing the religious festivals by the calendar.

This union of science and religion in the approach to the phenomena of the heavens was disturbed by the new, intensely rational, scientific method introduced by the Milesian School, in the very early days of Greek science. We know that Anaximander explained the revolutions of the sun and the moon with the aid of mechanical models; moreover, Anaxagoras said that the sun and the stars were flaming stones, and similar opinions are attributed to Leucippus and Democritus, the founders of the atomic school. Some of Empedocles' conjectures about heavenly phenomena are also purely physical in character. Still, even at that time, the religious notion was not entirely excluded from scientific thought; indeed, the scientific sublimation of star-worship appears still more strongly in the Pythagorean School, where religious and mystic tendencies prevailed and combined with the scientific approach.

The cyclical motion of the heavenly bodies displays this combination of immortality and continuity in its purest form, thus giving dynamic proof of the divinity of the stars.

This linking together of the soul and the stars had a characteristic sequel in Plato's teaching. His famous proof of the immortality of the soul begins with the following sentence: "Every soul is immortal - for whatever is in perpetual motion is immortal"; and his view about the divinity of the stars found its classic expression in the *Epinomis*. In this culmination of the scientific sublimation of star-worship along Pythagorean lines we may also see some elements of the foundation, on which Aristotle's dynamics was built: "Men ought to have regarded the possession of intelligence by the stars and all their movements as proved by the uniformity of their action, and by the fact that they continue to carry out the counsels formed long ago, and do not wander about with varying revolutions, altering their counsels this way and that, and doing first one thing and then another. The majority of us have adopted exactly the opposite view, thinking, because of the uniformity of their actions, that these beings have no soul; the multitude thus follows the lead of fools, and considers that the human race shows intelligence and life by its mutability, whereas that of the gods is devoid of intelligence, because it remains in the same orbits. Man might, however, have adopted a view nobler, better, and acceptable - the view that which acts always in the same uniform way and under the influence of the same causes, should on the very account be regarded as possessed of intelligence; and this specially applies to the nature of stars, which form so glorious a spectacle, and, while performing the movements of their dance, of all dances the most lovely and magnificent, discharge their duty to all things that live. And, as a proof that we are right in ascribing life to them, let us first consider their size. For they are not small, as they appear to the eye, but each of them is immense in bulk; this we are bound to believe, for it is established by sufficient demonstrations. The sun as a whole may be rightly regarded as larger than the earth as a whole; and all the stars in their courses are of wonderful size. Let us consider how it could be that anything could cause so great a bulk to move in its orbit in exactly the same time in which it now performs its course" (Aristotle's *De caelo*).

We, of the machine age, have grown accustomed to an entirely different association of ideas. The essence of every machine is that it repeats the same movement exactly; so that we use the expression "automatic" to indicate precisely a movement that is devoid of reason, a "soulless" movement. But in the age of arts and handicrafts, the exact reproduction of a model or form was regarded as a sign of the artist's divine inspiration. It was Plato's educational influence that decided in favour of the view that the stars are divine and against the purely physical tendency of the pre-Socratic period.

In the twelfth book Plato sums up his views about the existence of the gods. He finds two proofs for this: the immortality of the soul which results from its perpetual motion, and the movement of the heavens. He asks if it is conceivable that "...those who study these objects in astronomy and the other necessary allied arts become atheists through observing, as they suppose, that all things come into being by necessary forces and not by the mental energy of the will, aiming at the fulfilment of good". His answer is that: "The position at present is exactly the opposite of what it was when those who considered these objects considered them to be soulless. Yet even then they were objects of admiration, and the conviction which is now actually held was suspected by all who studied them accurately - namely, that if they were soulless, and consequently devoid of reason, they could never have employed with such precision calculations so marvellous".

This polemic, too, is directed against Anaxagoras and the physical way of looking at the heavens, as is shown by the next passage, in which it is reiterated that "all that moves in the heavens appeared to them to be full of stones, earth and many other soulless bodies which dispense the causes of the whole cosmos". At the end there appears the Pythagorean elements in Plato's philosophy: "An in addition

to this, as we have often affirmed, he must also grasp the reason which controls what exists among the stars...and he must observe also the connection therewith of musical theory...and he must be able to give a rational explanation of all that admits of rational explanation".

We may quote at length from Plato, showing that it was his opinion that decided this important dispute. Once Aristotle had accepted it and given it a broader physical basis, the fate of Greek science was sealed and the division between heaven and earth became an integral part of ancient physics and the Greek cosmos.

This position remained unchanged till Galileo. Even Epicurus, who tried to follow in the steps of Anaxagoras and Democritus and therefore contested Plato's views about the divinity of the stars, maintained this separation, though in exactly the opposite sense. The accepted view was that the soul and intelligence of the stars was revealed in the conformity to law and absolute regularity of their movements. Epicurus therefore tried to undermine the Platonic theory by directly and indirectly raising doubts about the existence of such conformity to law in the phenomena of the heavens, while maintaining that terrestrial phenomena were strictly obeying the causal laws.

Modern science was born in the seventeenth century, when it was shown that the laws of terrestrial mechanics hold good also for the movements of the planets; in other words, with the breaking down of the barrier which separated heaven from earth.

In closing this very rapid and therefore incomplete introduction we may state that the Egyptian civilization created technology in the prescientific era. On its decline, the civilization of Greece gave birth to science without its technical application. Then, after a thousand years of paralysis, the civilization of Europe inaugurated the era of integration of science and technology. As participants in this era, we are in danger of suffering from a distorted perspective. Still, there can be no gainsaying the fundamental fact that this integration has become the main-spring of a creativeness and rapid progress, alike in the theoretical and practical spheres, which are unparalleled in earlier cultures.

The fructification of technology by science is plain for all to see; the converse effect is no less profound and many sided. Not only does technology give fresh impetus to pure science, but technical achievements have been harnessed to the service of fundamental science. In this connection, it is sufficient to mention the tremendous service rendered by the development of scientific instruments and scientific machines in extending man's knowledge of nature beyond the limits of his five senses, thus enabling him to overcome that "weakness of the senses", which Anaxagoras regarded as the chief obstacle to ascertaining the truth.

If the intellectual adventure of modern science is perhaps the greatest of all the adventures inaugurated by the modern era, this is due to the development of mathematics as the key to nature's laws. It is true that our cosmos has been drained of all the "human" content, which it contained in the Greek period; it is true that the naive world of the senses is separated from the world of science by an eye-widening chasm; it is true that understanding this world of science calls for enormous powers of abstraction and a professional and intellectual training, which is becoming ever more rigorous. But, on the other hand, this cosmos - from the nucleus of the atom to the distant galaxies- is being filled more and more with new and marvellous contents, which make the experience of those who share in this development, certainly not less rich than the cosmic experience of the first natural philosophers of Ancient Greece.

Ladies and Gentlemen:

Of particular importance is the fact that we are today gathered, scientists from all over the world, to participate in this meeting at the country where astronomy was born. The union and collaboration of all space-scientists and astronomers con-

stitutes a hopeful message and a precept how humanity must handle all its problems for the benefit of peace in the world, for the development of understanding of the various peoples, and for the abolition of poverty and misery from so many parts of our world.

Considering the wide spectrum of subjects which will be discussed and the emphasis given to various subjects of a heavy agenda, the ideas expressed and the results derived in this congress will constitute a useful knowledge of the actual status of astronomy, as well as the targets to which is aiming its future development.

I hope that the relaxing surroundings of the University of Patras will contribute to a successful meeting. Finally, I hope that you will find some time to enjoy also the country and especially the close-by site of Olympia and the temple of the Epicurian Apollo. I am sure that the University of Patras, the Local Organizing Committee and the Local Committees will do their best to make your stay both productive and pleasant."