PLANETARY NEBULAE SYMPOSIUM - INTRODUCTORY REMARKS

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It seems proper to start our Symposium from the very beginning. The oldest known discovery of a planetary nebula dates back to Messier who in 1764 catalogued the Dumbbell nebula, NGC 6853, as Messier 27. Only 100 years later Huggins discovered the emission line spectra of planetary nebulae and he pointed out that his discovery proves that these objects are not clusters of stars but are "enormous masses of luminous gas or vapor". In 1887, a curious suggestion was made by Lockyer who thought that the nebulae were clusters of burning meteorites when he incorrectly identified three nebular emission lines with magnesium.

The classic work on planetary nebulae appeared in 1918 in the famous Volume XIII of the Publications of the Lick Observatory where the works of Curtis, Campbell and Moore, and Wright presented extensive photographic and spectroscopic observations of the brightest nebulae.

The physical processes in gaseous nebulae began to be understood during the remarkable period beginning in 1926 and extending into the late 1930s when the works of Menzel, Zanstra, Bowen, and Ambartsumian succeeded in explaining the nature of the spectroscopic observations.

Reading through the literature of that period we can amuse ourselves by statements like "The Crab Nebula may be a complex and intricate planetary" and "The nebulae surrounding the central blue stars are totally of interstellar origin", or "Very definitely some of these nebulae have no central stars", and "there is not the slightest evidence of any dust associated with planetary nebulae".

A great deal of pioneering work on planetary nebulae has been performed during the last few decades. We have come a long way both in the observational and astrophysical studies of planetary nebulae - and yet with every new advancement we have asked new questions concerning the nature of these objects.

Planetary nebulae have recently been understood as a normal avenue of the late stages of stellar evolution for a wide range of stellar

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masses. We have adopted the hypothesis that a planetary nebula results from the expulsion of the outermost part of a star near the end of its evolution before it becomes a white dwarf star. It is very possible that the Sun, our star, will have the same fate some four billion years from now.

The first and only International Astronomical Union Symposium on Planetary Nebulae took place ten years ago in Tatransk'a Lomnica, in Czechoslovakia. That meeting set the stage for the work that has followed. Today we have achieved ultraviolet observations of planetary nebulae performed above the Earth's atmosphere. Infrared observations have demonstrated the presence of dust in planetary nebulae. Radio astronomical techniques have provided radio maps of planetary nebulae with optical resolutions. Molecular clouds of CO have been detected in young planetary nebulae and the molecules OH and CO have been detected in the direction of many objects suspected of being proto-planetary nebulae.

It is now possible to study larger, fainter and older planetary nebulae. Detections of planetary nebulae in external galaxies open up the question of the distribution of these objects among the different stellar populations, which in turn has implications on the distance scale and luminosities of these objects.

The relatively mild stellar explosions which create planetary nebulae provide an appreciable fraction of mass from evolved stars into the interstellar medium. The astrophysical implications of this evolution are very basic, particularly in relation to the chemical evolution of the galaxy, the birth of new stars, and the physical state of the interstellar medium.

In the next few days I hope we shall discuss many of the outstanding problems on planetary nebulae, and perhaps we shall emerge with some better notions on fundamental questions such as:

What is the number of planetary nebulae in the Galaxy? Is it closer to 10,000 or to half a million?

Is it possible to agree on a distance scale for planetary nebulae?

How much mass is ejected by the exploding stars?

Are all white dwarf stars preceded by planetary nebulae?

Can we put the evolutionary jigsaw puzzle together from a red giant or supergiant star to a normal planetary nebula?

What role does dust play in the evolution of planetary nebulae?

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What is the importance of magnetic fields in planetary nebulae?

Do we understand the reasons for the ejection of the stellar envelopes?

What is the origin of multiple planetary envelopes?

What is the frequency of planetary nebulae central stars in binary stellar systems?

My list of questions obviously can be very long, and it is for this reason that a meeting such as this one can serve as the answer for these and other questions to be presented and debated.

I am thrilled and feel a great joy to see all my friends here in my hometown. However, one of our distinguished colleagues is not with us today. I am proud to dedicate this Symposium to the late Professor Donald H. Menzel, who only a few months ago wrote to me as follows:

"According to my present plans I shall be able to attend the Planetary Nebulae Symposium, and I may be able to present a short paper. . . As you know the subject of planetary nebulae is one very dear to my heart. . ."

I am sure that the subject of planetary nebulae is also very dear to the hearts of all of us here today -- hence let us begin with no further delay.

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