SPECIAL SESSION

INTRODUCTION AND PERSPECTIVE

INTRODUCTORY ADDRESS

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This is the first symposium devoted entirely to "Radio Physics of the Sun", although as part either of Radio Astronomy or of Solar Physics, the subject has been discussed several times over the past twenty years. We are now entering a new era of solar radio research because of the recent advances in plasma and radiation theory combined with the capability for observing the Sun with a spatial resolution of less than a second of arc at cm-wavelengths and of obtaining fast, multifrequency two-dimensional pictures of the Sun at meter and decameter wavelengths. We felt that it was appropriate at this time to hold a symposium to discuss the contributions that Radio Astronomy has made to Solar Physics and to sharpen our ideas for further progress of radio astronomy in Solar Physics and Astrophysics in the next decade when new theoretical and observational techniques will be available. I would like to give a brief outline of the various stages in the development of solar radio physics.

Solar Radio Astronomy started with the discovery by Hey in 1942 of radio emission from sunspots. This was ten years after Karl Jansky discovered radio waves from the Milky Way Galaxy.

In the years following the publication of Hey's discovery, many radio techniques, receivers and antennas developed for military applications were modified and applied to solar and cosmic radio observations. Most of these instrumental developments were rather general in nature -- they were first applied to the sun and later to other cosmic radio sources. In the 1950's, the solar radio instruments were novel and powerful enough to make important contributions to solar-terrestiral research. That plasma radiation is responsible for certain radio emissions following solar flares was an important discovery made by one such instrument; the radio observation of coronal plasma that is ejected after big flares, and moves out through the interplanetary space truly revolutionized the study of solar-terrestrial relationships. In the 1960's came the realization that it was necessary to understand properly the various plasma physical processes in order to interpret the diverse and complex radio burst phenomena. The construction of a radio heliograph in Australia that could take fast two-dimensional pictures of the Sun's corona almost like

M.R. Kundu and T.E. Gergely (eds.), Radio Physics of the Sun, 3-4.

an optical telescope greatly contributed to this development in solar plasma and radio physics. I might add that at the University of Maryland's Clark Lake Radio Observatory a multifrequency radioheliograph is in the final stages of completion, and a third one is almost ready in France. In the beginning of the 1970's several important events took place; satellite observations at low radio frequencies led to the direct detection of plasma waves and the mapping of magnetic field lines in the interplanetary space; the Skylab was launched; and finally many large interferometers primarily meant for sidereal radio astronomy were completed. Solar radio astronomers challenged the myth that such large instruments should be reserved for observation of cosmic sources only and used them. Scientifically the results were rewarding. They achieved arc-second resolution, that is they could see details on the sun on scales of several hundred kilometers; most importantly, coronal magnetic fields could be measured, something the optical and x-ray astronomers, who had already achieved arc second resolution on the ground and in space could not easily do. It is at this point, many highly successful collaborative studies started, based upon Skylab x-ray and uv data, on the one hand, and high resolution radio data on the other.

What is in store for us in the 1980's? With the launch of the Solar Maximum Mission later this year we'll of course have the unique opportunity to study the solar flare in all parts of the electromagnetic spectrum with the resolution of a fraction of a second to a few minutes of arc. I personally see a much more important happening in Solar Physics, and solar radio physics in particular. This will be the decade when "Solar Physics" should receive a broad interpretation, including the heliosphere and the interaction of the solar wind with planetary magnetospheres and atmospheres. The sun will provide the laboratory for the study of the activity and the associated plasma effects that no other available situation provides. The sun, a pedestrian star in middle age, is our only experimental window into the vast and varied activities of other stars and galaxies, too distant to be resolved. Solar radio physics has a particularly important role to play in this broad scenario--a scenario that consists of the study of the energy release in explosive phenomena in the universe--from solar flares to quasars, by combining space observations in x-ray and γ-rays and groundbased radio and optical observations with theoretical studies. This broad scenario is of course "High Energy and Plasma Astrophysics" of which solar radio physics is an integral part.