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RESEARCH ON SOLAR PHYSICS, PULSARS,
AND COSMOLOGY

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20. ABSTRACT (Continue on reverse side if necessary and identify by block number) The contract was concerned with solar physics problems involving the solar oblateness, the precision timing of optical pulses from the Crab nebula pulsar and the polarization and isotropy of the cosmic microwave background radiation.		

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FINAL REPORT OF O.N.R. N00014-67-A-0151-0027

The solar oblateness and various solar physics problems associated with its existence and measurement were studied during the contract period. Precision timing measurements were carried out on the Crab pulsar and irregularities in its period were studied statistically. The isotropy and polarization of the microwave background radiation were studied. The various results are fully published. See publication list attached.

The principle solar physics problems investigated were the following:

- 1) the relation between the depletion of lithium and beryllium in the sun and the loss of angular momentum from the sun's interior by thermally driven turbulence,
- 2) the transport of angular momentum in the sun by Eddington-Sweet currents,
- 3) the discovery and investigation of a periodic pulse train in the solar oblateness with periodic groups of pulses (the pulses being 1-2 days in duration) and the group of pulses being separated by $25 \frac{2}{3}$ days,
- 4) the investigation of a possible relation between solar faculae and the solar oblateness signal,
- 5) the investigation of possible sources of excess brightness in equatorial regions of the sun.

The principle results obtained from research on pulsars are the following:

- 1) the discovery and investigation of a pronounced frequency jump in the periodicity of the light pulses from the Crab nebula pulsar,
- 2) the study and analysis of the noise disturbances of the pulse arrival times,

- 3) the discovery of an optical pulsar associated with an X-ray source,
- 4) a thorough search for new optical pulsars,
- 5) the development of a new noise analysis technique that allowed the noise fluctuations to be treated quantitatively and permitted the measurement of the braking index for the Crab nebula.

The principle results obtained on the microwave background (cosmic "fire-ball" radiation) are the following:

- 1) the polarization was measured at 3 cm wavelength over a very long period of time to permit noise averaging the polarization was shown to be zero with high accuracy, and

- 2) the isotropy was measured and remeasured with increasingly sophisticated techniques, a definite anisotropy not yet being found.

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Also submitted to O.N.R. during this time period were the following:

Proposal to the Office of Naval Research for a Contract Supporting Research on,

"Structure of the Solar System and Solar Terrestrial Effects" by R. H.

Dicke, March, 1970

Annual Summary Report, "Structure of the Solar System and Solar Terrestrial

Effects" by R. H. Dicke, February, 1971

Proposal to the Office of Naval Research for Renewal of a Contract Supporting

Research on, "Structure of the Solar System and Solar Terrestrial Effects"

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