

(or gravitational time) to be compared with atomic time at two different epochs. It is of cosmological interest to know whether the ratio of these two kinds of time varies from epoch to epoch. This requires tracking of the satellite to 0''.1 or better.

3. Moon: It is desired to do high resolution mapping of the Moon in the UV, visual, and IR in various wave bands.

4. Mars: All types of observations of Mars are needed to prepare for unmanned exploration as recommended by the National Academy of Sciences. The unmanned exploration would in turn prepare for manned exploration. Most especially needed is a better knowledge of the Martian atmosphere for the design of spacecraft. Observations in the UV, visual, IR, radio wavelengths, together with the use of radar is required.

5. Venus: Needed are sub-millimeter measurement of the continuum radiation for the selection of suitable models of surface and atmosphere.

6. Jupiter and other large planets: Radio observations of the larger planets, especially on either side of the radio window, will provide information leading to an improved knowledge of their magnetic fields, Van Allen Belts, internal structure (core and upper layers). Measurements of total heat flux are needed. A determination of the abundance of D, He³, Li⁷ relative to H and He would aid in unraveling the physical processes on Jupiter, Saturn, Uranus, and Neptune.

7. Sun: In addition to high resolution photography and spectrophotometry, radio observations of the solar corona and interplanetary plasma are needed.

Stars

1. Bright Stars: Observations of luminosity and spectral energy distribution over the complete range of wavelengths for a comparison with Planck and other theories is needed for an understanding of stellar structure and stellar evaluation. The Hertzsprung-Russell relation (spectral-luminosity function), should be extended into the UV and IR (and perhaps X-ray region) for much wider range in stellar temperatures. High resolution spectrophotometry should be carried out for all wavelengths for better understanding of stellar atmosphere and ultimately the dynamic of stellar evolution and abundance analyses. This will lead into the nature of stellar chromospheres and coronas. Direct photography will result in the improvement of stellar parallaxes; if ever this can be done at great distances from the Sun, the larger base-line will produce even more improvement.

2. Faint Stars: Broad band filter photometry and low dispersion spectroscopy of fainter stars, especially those of large proper motion, will statistically augment the program outlined in the first paragraph; the sampling in this case will largely be in favor of the *cool stars*. But also to be included will be the more distant *hot stars* (blue and UV). Direct photography (including the use of filters) will ultimately result in a revised "Palomar-National Geographic Sky Survey." Accurate determination of astrometric coordinates of most stars down to a selected magnitude would then result in a new general catalogue of star positions unaffected by atmospheric refraction, and includes accurate proper motions.

3. Binary Stars: Observations from beyond the atmosphere will especially include those binary stars whose spectra are difficult to separate in the visible region. This will expand our knowledge of the masses of stars and other dynamic properties of binary systems. Search for close companions is of importance.

4. X-ray Stars: The existence of X-ray stars (i.e., point sources) is yet to be proved. The only X-ray source identified with an optical source is the Crab Nebula; it appears to be an extended X-ray source. Improved large equipment (by collimation directed equipment, and by focusing with grazing-incidence optics) needs development. Perhaps the most accurate coordinates of X-ray sources can be obtained on the lunar surface from occultations by lunar mountains. This should bring about refinements of "neutron star" theory, and perhaps the theory of *proto stars*, and wherein non-thermal effects play a role.

5. Gamma-Ray Stars: This might be considered an extension of the X-ray observations noted in the preceding paragraph. To date no isolated sources, point or extended, have been identified. Large-area spark chambers, geiger counters, and other special devices have yet to be fully developed. Longer wavelengths and cosmic rays must be eliminated by filters and anti-coincidence equipment.

6. Special Stars: Radio observations of stars at either side of the radio window for thermal and non-thermal effects are needed for *flare stars*, *variable stars*, and *peculiar stars* as well as a number of those noted above. *Incipient planetary nebulae* and *old novae* should be given attention.