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NASA TECH BRIEF

The Quantasyn, an Improved Quantum Detector

The advent of a wide variety of new electro-optical sensory systems for space guidance has placed increasing emphasis on the need for simple and reliable radiometric measurements. It is, for example, necessary to calibrate a number of devices which either simulate or detect stars, horizon phenomena, or man-made targets. Calibration of individual detectors and sources, as well as entire systems, requires measurements to at least 5-10% which is considered reasonably accurate for spectroradiometric results. Compounding of any individual measurement errors may result in total system calibration errors of several times this amount. Thus, if an electro-optical system is to operate successfully, accurate spectroradiometry techniques must be employed not only on components (detectors, lenses, simulated sources, and the like) but also on the entire system at each phase of its evolution.

Three detectors have been in common use for such calibration: the thermopile, the photomultiplier, and the photocell but all suffer from limiting characteristics. The thermopile suffers from relatively high noise and drift levels. Photomultiplier and photocell sensitivities are affected by applied voltage, temperature, surface irregularities, direction and wavelength of incident energy, and exhibit a dark current that requires a mechanical chopper.

In view of these limitations, a detector for measuring radiation in the range 1000 Å to 4500 Å called the Quantasyn has been developed. This device combines the high quantum of efficiency and inherent linearity of the silicon solar cell with the constant quantum response of the fluorescent organic compound liumogen. Liumogen (2, 2'-dihydroxy-l, l'-naphthal diazine) is a member of a class of fluorescent phosphors which emit a constant number of photons per incoming exciting quanta. Liumogen is more practical for use with silicon than most of the other phosphors for a number of reasons: 1) the emission spectrum of liumogen more nearly matches the highest sensitivity of the silicon, 2) the index of refraction of liumogen is reasonably well matched to that of silicon in the emission wavelength band, so that interface reflections will be small, 3) liumogen is directly subliminable so that uniform layers of any desired thickness can be readily evaporated onto the silicon.

Notes:

1. When calibrated, the Quantasyn provides absolute measurement of radiation flux below 4500 Å and into the vacuum ultraviolet with noise levels on the order of 1/100th of those of a thermopile. Additionally, it has no sensitivity to wavelengths above 12,000 Å, the cutoff of the silicon detector, and thus stray energy problems are minimized.
2. No further documentation is available.
3. Inquiries concerning this innovation may be directed to:

   Technology Utilization Officer
   Electronics Research Center
   575 Technology Square
   Cambridge, Massachusetts 02139
   Reference: B69-10443

(continued overleaf)

Patent status:

Inquiries about obtaining rights for the commercial use of this invention may be made to NASA, Code GP, Washington, D.C. 20546.

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