The New Telescope/Photometer Optical SETI Project of SETI Institute and the Lick Observatory. F. D. Drake[1], R. P. S. Stone[2], D. Werthimer[3], and S. A. Wright[4], [1] SETI Institute, 515 N. Whisman Road, Mountain View CA 94043, drake@seti.org, [2] Lick Observatory, University of California, Santa Cruz, Santa Cruz, California 95064, rem@ucolick.org [3] Space Sciences Laboratory, University of California, Berkeley, Berkeley, California, 94720, danw@ssl.berkeley.edu [4] Astronomy Department, University of California, Berkeley, Berkeley, California 94720, saw@astro.berkeley.edu.

Previously, we have conducted a search for brief, nanosecond, optical pulses produced by hypothetical technologies on the planets of some 4600 stars [1]. The rationale for the search was based on the development at the National Ignition Facility of lasers capable of producing nanosecond pulses of peak power of the order of a petawatt. Such pulses, when focused into a narrow beam by a large reflector, of the order of perhaps 10 meters diameter, would create a nanosecond light pulse which would, in the direction of the beam, be of the order of thousands of times brighter than all the starlight. Such pulses would be easily detectable with modest telescopes of the one-meter class, and we, in fact, utilized the one-meter Nickel telescope of the Lick Observatory in the search.

A special quality of the instrumentation used was the ability to discriminate against false positives created by such artifacts as photons created in the radioactive decay of an isotope in the photomultipliers used in the detection instrumentation. This was achieved by dividing the light captured by the Nickel Telescope into three photon streams, and then searching, using coincidence detectors, for the statistically anomalous arrival of bursts of photons simultaneously in the three photon streams. Such a statistical improbability would be taken as evidence for a laser pulse from the vicinity of the target star. In this search no promising candidate signals were detected.

The project described here is a follow-on to this previous project. Our goals are 1) to acquire much more observing time by constructing a dedicated telescope; 2) To use an inexpensive approach to building such a telescope, exploiting the fact that good imaging capability is not required; 3) To improve our sensitivity to statistical anomalies in the photon stream; 4) To extend our wavelength coverage; and 5) to produce a capability of recording the waveforms of any celestial pulses detected. To achieve goal (1) we will utilize an unused dome at the Lick Observatory which is available for dedicated SETI use. Goals (2) and (3) will be achieved by constructing the telescope by mounting seven commercially available 16-inch Meade Optical Telescope Assemblies on a telescope mount still in place in the dome. This will produce, at low cost, a total aperture equivalent to that of a single 42-inch telescope, which is a slightly larger aperture than used in our first project. Each OTA will have its own detector, and these will be used to achieve goal (4) by being sensitive to NIR, and perhaps longer, wavelengths not captured in our original project. Thus there will be now seven photon streams, which are advantageous because they allow more sophisticated and robust analyses of the statistics of the photon stream. Also, the photon stream at each detector will have a lower rate by about a factor of two, of photon arrival, compared to the streams in our first project, for a star of a given apparent magnitude. This will reduce incidents of "photon pile-up", which interfere with instrument performance. Goal (5) will be achieved by adding to the electronics, which, in the main, will be very similar to our original electronics, some circuitry which retains a temporary digital record of a most recent short segment of the photon stream. When a candidate pulse is detected this will cause this record of the recent segment of the stream to be read into memory for further analysis.

The instrument will be used primarily to search for SETI optical signals as before. However, it will also be used to search for very short natural optical transients, such as might be generated in the vicinity of black holes, pulsars, AGN's, and quasars, for example. This is a portion of the cosmic "phase space" which has been little explored.

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References:

[1] R.P.S. Stone, S.A. Wright, F. Drake, M. Munoz, R. Treffers, and D. Werthimer (2005) *Astrobiology, 5,* 604-611.