LOW COST LAGEOS RANGING SYSTEM

Peter L. Bender* and Eric C. Silverberg
Joint Institute for Laboratory Astrophysics
Boulder, Colorado 80309 USA
and
McDonald Observatory, University of Texas
Austin, Texas 78712 USA

ABSTRACT

This paper describes a Lageos laser ranging station design based on single photoelectron detection which could be used to monitor polar motion at all periods, and short-period UT1 variations with high accuracy and at moderately low cost. No comparison has been made with the costs of long baseline radio interferometry (LBI) stations, since the establishment and operation of basic international networks using both approaches seems scientifically well justified. Both LBI and lunar laser ranging results will determine intermediate and long-period UT1 variations and nutation. The LAGEOS laser ranging station design suggested here is similar to the design used in the high-mobility LAGEOS ranging station now being constructed by the University of Texas. It has been shown that 30 cm diameter transmit/receive optics with 10 arc second pointing accuracy and 50 milliwatt average laser power output are usually sufficient to give 70 signal counts in a three minute averaging time, even at 20° elevation angle. Lasers having the desired power at 530 nm wavelength with 10 pps repetition rate and 3 ns pulse length are now reported to be commercially available at moderate cost. The resulting range accuracy for normal points corresponding to the three minute averaging time is three cm, including allowances for absolute calibration of the system, atmospheric refraction correction uncertainties, and Earth tide uncertainties. Much of the pulse-timing electronics needed is commercially available, and many time and latitude stations already have good epoch determination systems. The ten arc second pointing requirement for a 30 cm diameter beam seems considerably easier to meet than the optical requirements for classical observing techniques. A simple beam director with flat mirrors appears quite feasible, with inexpensive encoders on each axis for minicomputer control if desired. A number of special features of the University of Texas high-mobility station would not be needed for a fixed station.

*Staff Member, Quantum Physics Div., National Bureau of Standards.

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DISCUSSION

Ya. S. Yatskiv: Why have you changed your plans for the construction of a mobile lunar ranging station?

E. C. Silverberg: The increased possibility of aseismic slip in non-earthquake zones favors the measurement of many locations on each continental plate. After much soul searching, it was decided to defer the development of the transportable lunar station in favor of a more mobile system optimized for Lageos. The transportable lunar station will be slowly completed over the next few years, to act ultimately as a stand-alone multipurpose replacement for the McDonald Observatory 2.7m facility.

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