# IS THE GRAVITATIONAL CONSTANT CHANGING?

T. C. Van Flandern
U. S. Naval Observatory
Washington, D. C. 20390, USA

The question posed by the title is not yet conclusively resolved. Nonetheless, determinations of the lunar tidal acceleration based on dynamical time scales are now in reasonable accord with one another, whether based on the transits of Mercury, ancient eclipse observations, ocean tide models, or artificial satellite observations; these give a purely tidal component of $-28.8 \pm 1.5$ "/cy$^2$. Lunar occultations and laser ranging now give concordant results for the total anomalous acceleration of about $-22.8 \pm 1.5$. The difference in these results gives an acceleration of possible cosmological origin of $\dot{n}/n = +3.5 \pm 1.2 \times 10^{-11}$ per year, which is also consistent with very preliminary planetary radar studies. If interpreted in the scalar covariant cosmology of Canuto and Hsieh, this implies that $\dot{G}/G = (-6.9 \pm 2.4) \times 10^{-11}$ per year, if measured in atomic time, but zero if measured in dynamical time. The implications for relativity and cosmology are discussed briefly in the paper, scheduled for the Astrophysical Journal issue of 1 September 1981.



*O. Calame (ed.), High-Precision Earth Rotation and Earth-Moon Dynamics, 207–208.*

DISCUSSION

(N.B. In the absence of T.C. van Flandern, the paper was presented by J.D. Mulholland)

*Kovalevsky : Since different time spans are used in different methods, it is not clear that one is comparing absolutely the same conditions. Would it be possible to reduce the laser ranging data or others using dynamical time ?*

Mulholland : Where do you get the dynamical time for this purpose ?

*Kovalevsky : I suppose that we could still get Ephemeris Time from its definition.*

Mulholland : Ephemeris Time is no longer an acceptable time scale. First, you would have to decide whether to use j=0, j=1, or j+2, etc. But in fact, none of them is adequate, and haven't been for over a dozen years. The definition is not good, because it is not realizable, which is why the IAU finally has abandoned it.

*King : Another approach, suggested several years ago by Slade and Williams, would be to reduce the lunar ranging data simultaneously with the planetary observations, including the Earth's orbit. That would provide a natural separation.*

Mulholland : That would probably be the best way with what we now have at our disposal.

https://doi.org/10.1017/S025292110000261X Published online by Cambridge University Press