lengths of the discharge to be excited by using different pairs of electrodes. The 5577 Å line was detected using a Hilger $E614$ spectrograph which had been converted for use as a monochromator using the device described by McConkey and Burns[5]. The absolute intensity of the line was determined by comparison of the detector signal with that obtained from a tungsten filament standard lamp. At the same time the density of metastable $'S_0$ atoms was determined by observing the absorption of the 1218 Å $'P^0 - 'S_0$ line within the discharge. The absorption coefficient is related to the population of the lower state ($'S_0$ in this case) through the absorption oscillator strength for this transition. The discharge itself acted as a source of the 1218 Å line and the absorption coefficient was obtained by comparing the signals obtained when different lengths of the discharge were excited. The observations in the vacuum ultraviolet were made using a McPherson 0·5 m Seya monochromator with a sodium salicylate coated photomultiplier. Full details of the technique, which has a general applicability for the measurement of state densities, will be published elsewhere. From the two sets of measurements A was obtained making use of equation (1).

The value obtained was $1{\cdot}3 \pm 0{\cdot}4$ s^{-1}. Systematic errors in the experiment may be large due primarily to an uncertainty in the 1218 Å f value which may be as high as 50 per cent[6]. Other experimental errors amounted to 25 per cent, so the value obtained cannot be considered accurate to better than a factor of two. It does, however, agree very favourably with the theoretical value of 1·28 s^{-1} given by Garstang[7] and with Omholt's measured value of 1·43 s^{-1}.

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New Integrals of Motion and the Orbital History of the Moon

GOUDAS[1] has criticized the integrals of motion that I have given[2] for the elliptic restricted three body problem. He states: "Contopoulos has given an integral equivalent to the Jacobi integral for the elliptic restricted problem as well as one additional time-independent integral for the same equations of motion. It seems, however, that the work of Contopoulos is not in harmony with a famous theorem by Poincaré" because "if two integrals, time-independent and independent of one another, exist, then there should be two zero characteristic exponents associated with each periodic solution", which is not the case.

Goudas seems to have misread my paper. In fact both my integrals depend explicitly on time; therefore the theorem of Poincaré, mentioned by Goudas, which refers to integrals not explicitly dependent on time, does not apply in this case. My integrals are formal series, of which only the zero and first order terms are given; however, even these truncated integrals are useful, as indicated by a numerical example where they are found to be approximately conserved along an orbit.

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Strains recorded on a High Magnification Interferometric Seismograph

WE report here a comparison between wavetrains recorded on seismographs of the pendulum type and on a strain seismograph with high magnification and low distortion.

Earthquakes generate elastic waves with a frequency range of tens of Hertz to zero (unrecovered strain). A seismometer of the pendulum variety is sensitive to a more restricted frequency range, however, so that several instruments must be used to cover the frequencies occurring in nature. Furthermore, it is difficult or impossible to construct a pendulum with a frequency very low in the seismic band, and the record written by a pendulum seismograph is affected by frequency-dependent phase and amplitude distortion. The Benioff gauge[1] has extended the sensitivity range of seismographs to strains of periods without limit, resulting in the discovery of phenomena previously unseen. The bandwidth and accuracy of this instrument are, however, restricted by internal resonances and by the non-infinitesimal response of vitreous quartz to ageing and to changes of temperature and humidity in its environment.

The development of the laser resulted in proposals to use light emitted by this source as the measuring element in an earth-strain interferometer, but to observe changes in the number of waves of red light standing in the gap between mirrors stationed 50 ms apart, for example, is to do no more than record strains of one part in 10^8 or greater, a sensitivity barely sufficient to detect earth tides and less than that of the Benioff gauge.

To circumvent this, a laser-actuated Fabry–Perot interferometer has been developed in which it is possible to observe changes in path length of a small fraction of a wavelength of light[2,3]. The fundamental equation of such an instrument, observing strains in a ground sample of dimension l, is

$$\Delta l/l = \Delta N/N$$

where N is the number of wavelengths, λ, of light standing in the field of measurement. N is a function of the velocity of propagation c and the emission frequency f of the source, so that

$$N = l/\lambda$$

and

$$\lambda = c/f$$

Changes in the frequency of the laser light or in the velocity of its propagation therefore appear as spurious readings of strain. In the case of a beam propagating through the atmosphere, a change in pressure of 1 mm of mercury introduces an apparent strain in excess of