Errata for Wayne Hayes's Master's Thesis.

"But the one thing we should absolutely never do is to ignore or renounce the observational facts because we cannot explain them."
— Halton Arp

Due to a programming blunder, the gravitational potential energy computation in my shadowing program was incorrect. Thus, figures 2.2, 2.4, and 2.5 (pp. 34,36,37) of my thesis are incorrect. Here are the corrected figures. The energy of the real system should be exactly constant. The energy of the simulations is conserved to about 6 digits, so in each case a constant of about 6 digits was subtracted from the energy to more clearly show the fluctuations.

As can be seen, the actual energy fluctuations are more jagged than in the original diagram, although much smaller in magnitude (at least 4 orders of magnitude smaller!). The orbits of the first two figures (orbits 5 and 19) were unshadowable, whereas the final figure (orbit 22) was shadowable. Furthermore, I looked at all 32 energy figures and almost all of them had fluctuations similar to the ones shown here, even though most of the 32 orbits were shadowable over the 1.28 time interval used. Thus it seems that energy fluctuations may not, in themselves, be enough to detect non-shadowability.

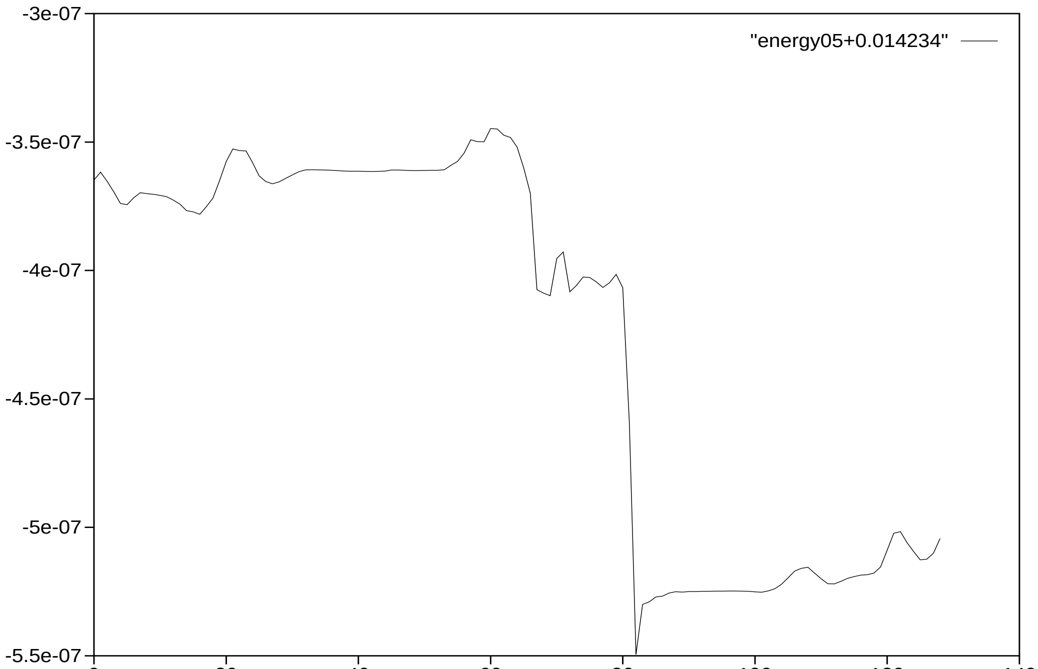

Figure 2.2: The corrected total energy (kinetic + gravitational potential, shifted +0.014234) of orbit 5 (unshadowable). The sharp decline at timestep 83 marks the close approach that caused the trouble spot. The drop is about 1.5×10^{-7}, and the total energy fluctuation is about 2×10^{-7}, or about $2 \times 10^{-7}/0.014234 = 0.0014\%$.

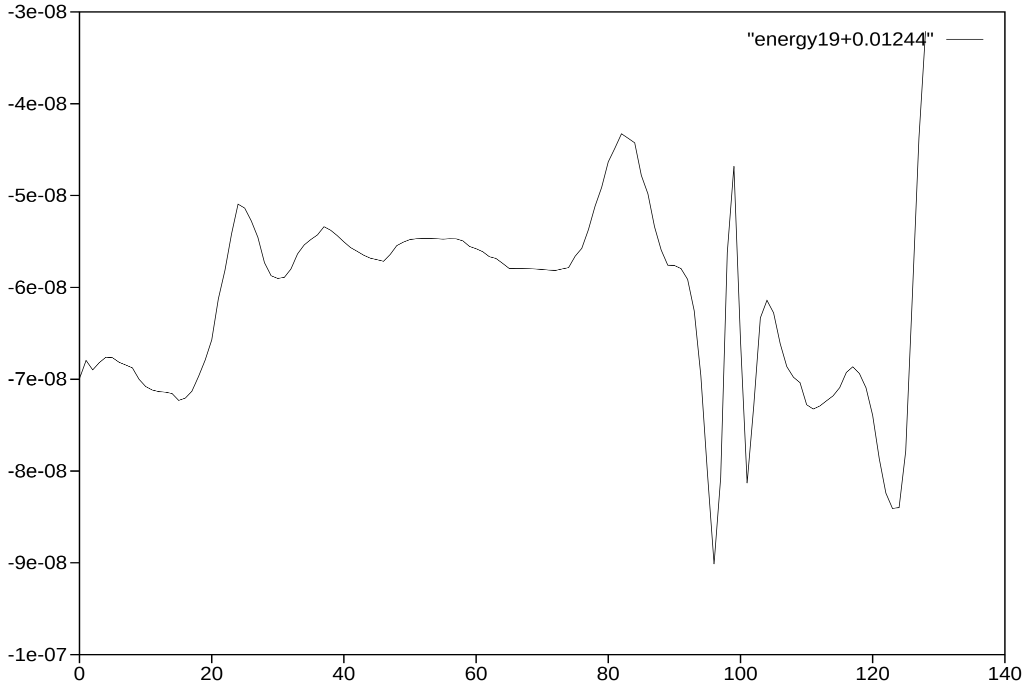

Figure 2.4: Corrected energy of orbit 19, shifted $+0.01244$ (unshadowable). The first jagged drop in the energy curve near timestep 96 is about 4×10^{-8}, while the total fluctuation is about $6 \times 10^{-8} = 0.0005\%$, about 1/3 that of orbit 5.

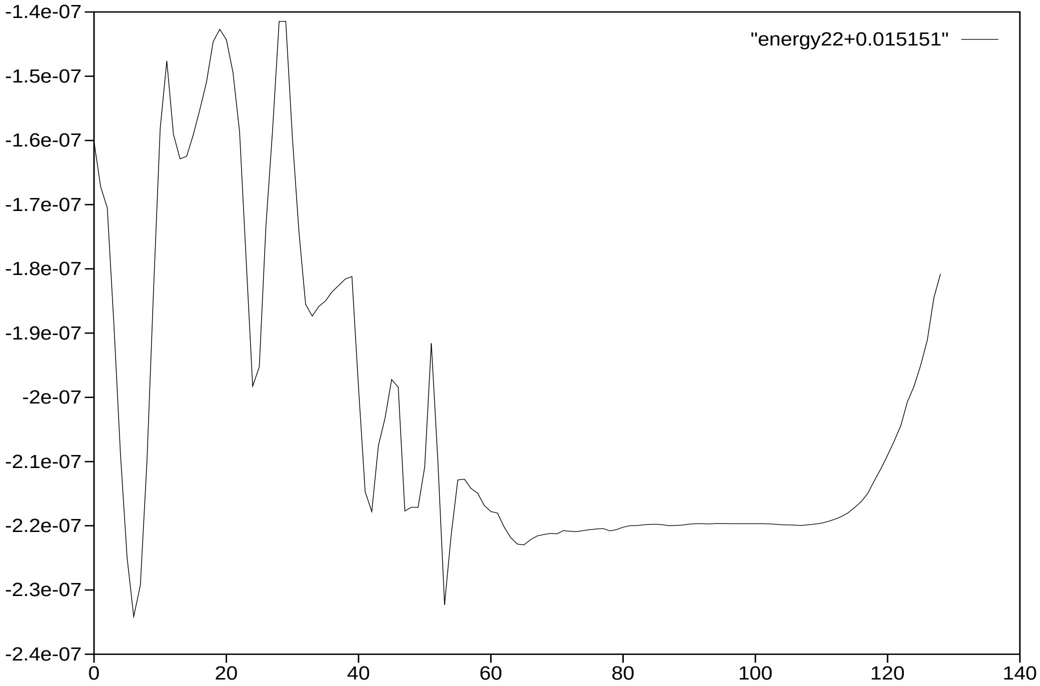

Figure 2.5: Corrected energy of orbit 22, shifted by 0.015151. This orbit *was* shadowable. The fluctuations near the beginning of the orbit are about $10^{-7} = 0.0007\%$. The energy fluctuations are slightly bigger (percentage-wise) than orbit 19, and just as jagged. Thus, it seems energy fluctuations alone cannot explain why this orbit was shadowable while 5 and 19 were not.