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NATIONAL CAPITAL ASTRONOMERS

PLANETARY DISCOVERY

Mr. Dennis Rawlins

Our speaker for December will be Mr. Dennis Rawlins, an instructor in physics at the College of Notre Dame, Baltimore. His topic will be early planetary discovery, and will largely concern the discoveries of Uranus by Sir William Herschel, Piazzi's discovery of Ceres, the discoveries of Juno, Pallas, and Vesta, together with one false alarm.

Surely the romance of discovery in astronomy is fully as exciting as that of our own world. It is not hard to understand the motivation of many a patient observer to watch the skies, nor is it surprising to find some of the greatest minds of mathematics turning their skills to the solution of orbital problems, in hopes of learning from the irregularities of an orbit the whereabouts of the yet-undiscovered perturbing body. The philosopher too had his stake in the drama, for it had once been taught that the heavens were perfect and complete; there must of course only be 7 principal heavenly bodies, — Cont'd.

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CALENDAR

DECEMBER 3 PLANETARY DISCOVERY by Mr. Dennis Rawlins at the Department of Commerce Auditorium at 8:15 P.M. Business meeting after the lecture.

3 DINNER WITH THE SPEAKER at 6:30 P.M. for reservations, Call: Jerry Hudson at 948-2809 before noon Saturday.

9 MD-DC JUNIORS MEETING at the Chevy Chase Library, 8005 Conn. Ave., Chevy Chase. 2:00 P.M. Program to be announced. Call: Leith Holloway at 362-1961 for details.

17 PRINCE GEORGES' JUNIORS MEETING at 2:00 P.M. at the home of Ted Noble. For further information, Call: 301-721-2225.

3,10,17 JUNIOR ASTRONOMY COURSE at the Takoma Park Branch of Montgomery Junior College. The course will be given by Mr. Alan L. Breitler For further information, Call: Mark Goldberg 933-0823 or Leith Holloway 362-1961.

1,15 TELESCOPE MAKING CLASS at McLean High School, McLean, Virginia From 8:30 to 10:00 P.M. with Grady Whitney.

5,12,19 TELESCOPE MAKING CLASS at the Board of Education's Material Center in Bladensburg with Ted Noble.

1,8,15,22 TELESCOPE MAKING CLASS at the Chevy Chase Community Center at 7:30 P.M. with Hoy Walls.

PLANETARY DISCOVERY - Continued from page 1.

just as there are 7 openings in the face! One can now imagine the stirrings within the philosophical community as old teachings were cast aside, and a new meaning must be found for this new organization of the heavens, with its ordering and distribution of planets.

Mr. Rawlins received his B.A. from Harvard, and his M.S. from Boston University, both in physics. From 1962 to 1965, he taught physics at Upsala College, before joining the staff at the College of Notre Dame. He is an active member of the Baltimore Astronomical Society. Recently, he has been severely bitten by the historical bug, and has done considerable research into the history of astronomy, particularly on the subject of astronomical discovery.

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NOVEMBER LECTURE - MARINER V FLY-BY

The recent fly-by of Venus by Mariner V revealed that this planet has no appreciable magnetic field and therefore no Van Allen belts like the earth's. So stated our November speaker, Mr. Oran W. Nicks, Director of Lunar and Planetary Programs of N.A.S.A. The 590-pound Mariner V was originally built as a standby vehicle for Mariner IV which flew by Mars in July 1965. It had to be modified for the journey to Venus to take into account the greater intensity of the sun on its new orbit.

Aiming of the spacecraft for its 120-day journey to Venus was very critical. It had to fly by the planet at about 2,000 miles altitude without being captured and not pass into the shadow of the planet or out of view of the guide star Canopus. Finally it had to be occulted from earth view by the planet for several hours so that the transmission of 50 and 400 megahertz radio waves and S Band radar sent from earth could pass through the planet's atmosphere (both on the bright and the dark limbs) and be measured. There measurements show that the ionosphere of the planet is strong on the sunlit side.

Mariner V indicated that Venus's thick atmosphere consists of from 72 to 87 per cent carbon dioxide on the assumption that the secondary constituent is nitrogen. The Soviet spacecraft which landed on Venus the previous day measured a 99-percent CO_2 concentration.

Study of the trajectory of the spacecraft, whose position was known within 100 meters even in the vicinity of Venus while 50 million miles distant, further refined the value of the Astronomical Unit and set an upper limit for the oblateness of the planet.

Mr. Nicks gave us a preview of the specifications for the 900-pound Mariner VI scheduled for a fly-by of Mars in 1969. This spacecraft will carry 130 pounds of scientific equipment including both high and low resolution cameras. The high resolution camera will photograph detail down to one kilometer width. It will be turned on during approach to Mars as soon as the planet fills the cameras field. Pictures will be taken during several rotations of the planet. The long-focal-length camera will have a resolution of 100 meters and will photograph ten percent of the planet whereas the one Mariner IV camera had a resolution of only four kilometers and saw only one percent of the planet. - Leith Holloway

A CLOCK DRIVE WHICH CAN BE BUILT WITH SIMPLE TOOLS AND A SHORT BUDGET-Cont'd.-

pulley to the mainspring pulley. (Let's call that quantity p; that is, the polar axis pulley will be p times larger than the mainspring spool). Now, attach a spool to the mainspring, and hang a weight to the wire (be sure to wrap the wire so the clock will tend to play it out). The weight should produce a torque equal to:

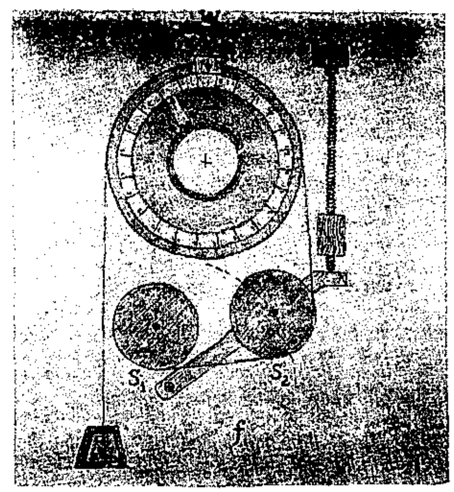
Torque on mainspring = 1/2. (spool diam.). (weight)
= (1/p). (torque on polar axle), or:

Test weight (spool) = 2. (P.A. torque) / (p. spool diam.) since the spool and pulley together have a mechanical advantage of p. Remember to convert the spool diameter to feet. Now, using this(smaller) weight, again measure the clock rate. Set the rate adjustment of the clock to a middle setting. Use the period measured to calculate the final pulley diameter required. (Some purists may want to carry the iteration through a couple of additional cycles). Possibly the diameter calculated will come close enough to a standard pulley size to take advantage of hardware store merchandise; if not, try shimming the smaller (or larger) pulley with friction tape, and also try varying the clock rate. The large pulley should be an easy job for a wood lathe; if you don't have one, do not dispair--a coping saw will do well enough, though it won't be as pretty. Fig. d shows a suggested means of attaching a wooden pulley to the polar axis.

Figs. a,b,c show some details for attaching the works to the telescope mounting, coupling the shafts together, and how the extended shaft should be supported. The coupling can be made out of key stock or a short piece of bar stock; once again, the hardware store should be able to provide the necessities. Be sure to allow plenty of stock for drilling and tapping the set screw hole. The spool (which could be a regular thread spool) can be glued with epoxy resin to the shaft. A die should be used to put a couple of threads on the end of the extension; a wing nut then provides a means of winding the clock.

Nothing has been said about provision for slow motion in R.A. Perhaps this could be done with the clock rate regulator, but a more versatile technique is suggested by Fig. f, which introduces an idler wheel, S_2, which pivots around a center near the edge of the mainspring spool, S_1. S_2 could as well move linearly, but the scheme shown is probably simpler to build. The threads for the slow motion screw can simply be made in wood (use a hardwood, such as walnut, etc.) by drilling the hole slightly undersize and forcing the screw through the wood. Lubricate with linseed oil or shoe wax. The knob can be an old radio tuning knob, or a medicine bottle cap drilled out in the center, and held with a couple of nuts and a lockwasher. Note how a setting circle could be added--it could keep sidereal time as well as indicate R.A.

Here's hoping these tips will be your key to greater observing comfort and enjoyment! - Jerry Hudson

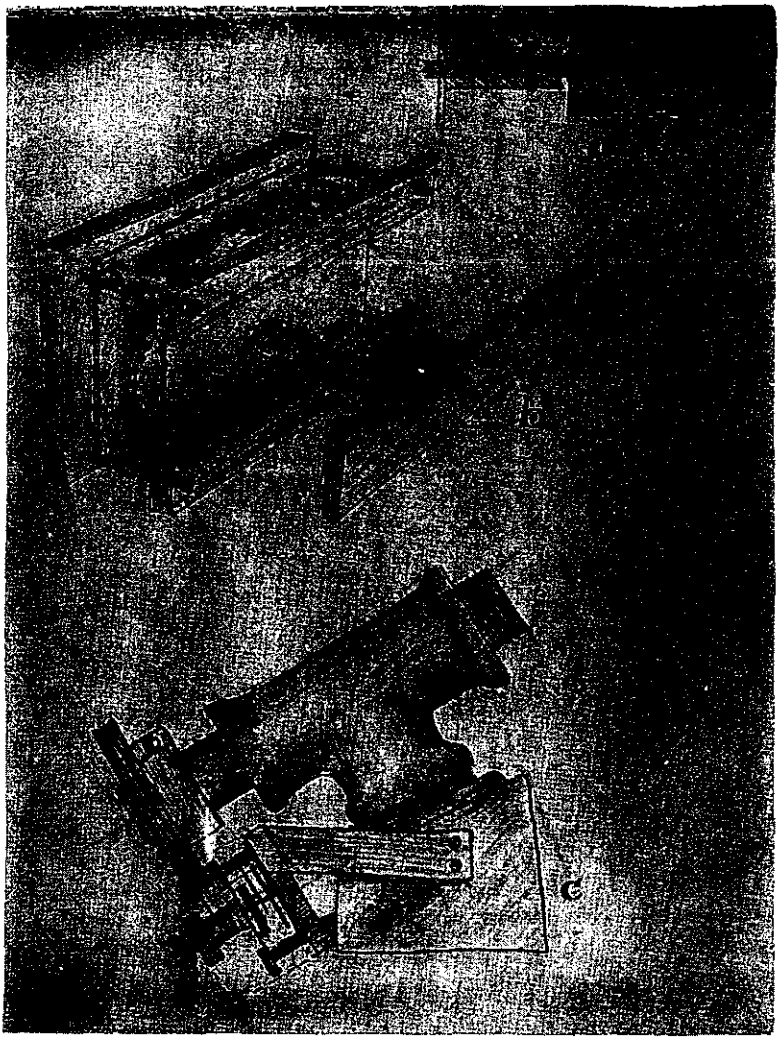


SHOP TALK ....

A CLOCK DRIVE WHICH CAN BE BUILT WITH SIMPLE TOOLS AND A SHORT BUDGET

It seems that the clock drive presents a stumbling block to most folks either building or buying a small telescope. This need not be so, as the accompanying illustrations show, for a rather simple and quite reliable drive can be made around the innards of an old alarm clock. I built two drives like this one back in my earlier days as an A.T.M., and can say they both worked, although not as well as the one I have now, which boasts a motor and worm gear. They did work sufficiently well for long exposures to be made with a small camera fastened to the side of the telescope.

The principle of this design is to let gravity do the work; the clock only serves to regulate the rate of fall of a weight. The clockwork still needs to be quite husky and able to stand some punishment. I recommend the Big Ben alarm clock, since it has large and fairly sturdy parts. The shaft driven by the mainspring is used for the output; the wind-up key is removed and a longer shaft attached, which carries a spool on which several turns of fine picture wire are wound. The picture wire goes around a larger pulley on the polar axle, and thence to the driving weight (see figure d).-(Cont'd.-)



A CLOCK DRIVE WHICH CAN BE BUILT WITH SIMPLE TOOLS AND A SHORT BUDGET-Cont'd.

Since the clock will be running under heavier than normal load, it will run somewhat faster, and will need to be tested under load before the size of the driving pulley is determined. In order to do this, set up your telescope indoors, with the polar axis horizontal. Attach all accessories to the telescope, so that you will be operating under full load. Attach a board to the polar axis, which has a thumb screw in one end, and which can be weighted in order to obtain any desired driving torque (see Fig. e). Make sure the telescope is well balanced in R.A. beforehand. Now, while using the highest magnification with the telescope pointed out the window at some distant object, turn the thumb screw back and forth. Keep adding weights until the movement is as smooth as possible. When you are satisfied with this, calculate the torque, being careful to allow for the weight of the clamp:

Torque (foot-lbs.) $= R_1W_1 - R_2W_2$ (R's in feet, W's in lbs.)

Next, attach a pointer to the wind-up key and measure the period of the mainspring shaft of the clock (without load). Divide this time into 24 hours to get a preliminary value for the ratio of the size of the polar axis-(Cont'd)