Amateur Astronomers Association of Princeton
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NEWSLETTER OF THE AMATEUR ASTRONOMER'S ASSOCIATION OF PRINCETON

The next meeting of the Amateur Astronomer's Association of Princeton will be held on Tuesday,December 14,1971,at 8:00 p.m. in Room A-07 of Princeton University's Jadwin Hall(in the Physics Department). Our speaker will be Mr. George Lovi,Technical Advisor of Planetariums Unlimited,Inc.,a division of Viewlex,Inc., of Holbrook,Long Island. Mr. Lovi is also the writer of the Rambling through the Skies column in Sky and Telescope magazine. His topic is to be:

"Uranology:The Mapping of the Heavens"

We are sure that his talk will be both interesting and entertaining as well as being non-technical. We plan to entertain our guest before the meeting at the Holiday Inn dining room on Route 1 in Plainsboro. If you wish to join us please call Leith Holloway at 924-2480 before the 14th to make reservations. We will meet in the lobby of the Holiday Inn promptly at 6:15 p.m.

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The next meeting of the Study Group is the Friday following the meeting,December 17,1971,at 8:00 p.m. The group will meet in Duncan Planetarium at Princeton Day School. The topic will be on Chapter 12 "The Solar System in General" presented by Mr. Barry Hancock.

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The next lecture at Princeton University's Peyton Hall is on January 21,1972,at 7:30 p.m. Hopefully the sky will be clear enough to view through the 9in. refractor they have.

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Welcome New Member: Last month Mr, Richard A. Miller joined our club. His address is: Mr. Richard A. Miller,238 Washington Rd., Princeton,N.J. Welcome to the club!

DOES THE STAR OF BETHLEHEM STILL SHINE?

by:Arthur C. Clarke
Taken from Reader's Digest

What was the Star of Nativity that blazed from the Milky Way with awesome brilliance and guided the Wise Men to Bethlehem-assuming that it was a natural phenomenon and not a miraculous apparition? The Bible gives us few clues;all we can do is consider some possibilities.

One early theory suggests that Venus was this Star,and many books have been writen to prove it. Every 19 months Venus appears in the morning sky,rising just before the Sun:one of the most beautiful sights in all the heavens,a blazing beacon, so much brighter than Sirius,the brighest of all our nighttime stars.

But to the peoples of the Eastern world the planet Venus was one of the most familiar objects,and still is. Even today she serves as a kind of warning alarm to Arab nomads to start moving before the Sun begins to blast the desert. To the Magi,who knew the movements of the planets,there could have been nothing remarkable about Venus.

Four other planets are easily visible to the naked eye(Mercury, Mars,Jupiter, and Saturn) and 2 such planets may pass very close to one another in conjunctions. Such events are rare enough to be striking and Kepler devoted much time to proving that the Star of Bethlehem was a conjunction of Jupiter and Saturn. However more accurate and correct astronomical calculations have since then shown that this conjunction was not a very close one. Furthermore the Bible said the Star was visible for many weeks while the conjunction of planets can last only hours.

Is there any other astronomical phenomenon that could have appeared at the right time? One sufficently startling to men that were familiar with planetary movements?

A comet is visible for many weeks,shining on like a search light among the stars. However many attempts that have been made to prove this were without success. Probably the most accurate theory would be the supernova. About once every 200 years a star explodes with such force and brightness it dominates the whole sky. This Star would have been 3000 years distant and although it has stopped shining here other worlds may be seeing a neww and wonderful star shining in their skies.

RECENT JOURNAL ARTICLES REVIEWED BY JOHN CHURCH

"Energy in the Universe", Scientific American, September 1971, p 51.
The different forms of energy in the universe (gravitational or "potential", heat, light, nuclear, chemical, kinetic, etc.) and their interrelationships are the subject of this article. The long-term trend is towards the conversion of the stupendous amount of high-grade gravitational energy into lower-grade forms such as heat and light, with an accompanying increase in the entropy of the entire system. (A wit once paraphrased the Second Law of Thermodynamics thusly: Things are going to get worse before they get better -- and who says things are EVER going to get better?) Given this trend, why has not the universe collapsed into one mass long ago? The answer lies in various "hangups" of the system. 1) the universe as a whole, because of its huge size and low density, has a free fall time of about 100,000,000,000 years (the "size hangup"). 2) Individual galaxies would collapse into themselves in about 100,000,000 years, except that they usually exhibit rotation relative to the rest of the universe, which preserves them (the "spin hangup"). 3) Stars would collapse rapidly if it were not for the outward energy flow caused by their nuclear reactions (the "thermonuclear hangup"). 4) Thermonuclear reactions in stars are much less catastrophic, and last much longer, than terrestrial hydrogen bomb explosions, because hydrogen bombs use deuterium (heavy hydrogen) which reacts by way of "strong" nuclear interactions, whereas stars contain almost exclusively ordinary hydrogen, which reacts by way of "weak" interactions (the "weak interaction hangup"). Whenever one of these hangups is overcome locally, cataclysmic events ensue (development of supernovae, bright spiral arms sweeping around a galaxy, formation of many massive new stars, and generation or destruction of planets.)

"Atoms or systems into ruin hurled,
And now a bubble bursts, and now a world." -- Pope.

"Spectral response of the Eye", Optical Spectra, September 1971, p 28.
The light-sensitive cellular elements of the human retina are the "rods" and the "cones". The cones are distributed over the entire surface of the retina; the rods are found everywhere except in the fovea, the area responsible for central and distinct vision. At normal brightnesses, cone vision predominates (photopic vision). When dark-adapted (scotoptic vision), the eye depends mainly on rod response. The spectral response of the rods is shifted towards the blue as compared with the cones; the scotoptic eye is therefore relatively more sensitive to blue light, and relatively less sensitive to red light, than the photoptic eye. Since only the cones give the sensation of color, however, the scotopic eye, although sensitive to light from 400 to 600 nm (nanometers, or millimicrons to old folks), cannot distinguish color ("at night, all cats are gray"). The very high sensitivity of the rods is well known to those of us who search for faint telescopic objects with "averted" (extra-foveal) vision, but beware of trying to ascertain the color of any such object.

"The Setting Sun", Griffith Observer, September 1971, p 190.
The oval appearance of the setting sun is familiar; it is due to greater refraction of the rays from the lower edge of the disc than from the upper edge. When the air near the horizon is strongly stratified, additional strange effects may appear. Pieces of the disc may appear to break off, hover, and collapse. Dark bands may cross the disc, and other extreme distortions map occur. Photography of these phenomena is easy with telephoto lenses of very moderate focal length.

"1971: The Era of Kepler" Griffith Observer, August 1971, p 154.
Kepler (born 400 years ago this December 27) is famous for his 3 laws of planetary motion. His 2d law states that every planet moves in such a manner that a line drawn between the sun and the planet sweeps out equal areas in equal amounts of time. This law is correct, but was arrived at by a fortuitous combination of two errors that cancelled each other out. The first error was in the assumption that the velocity of a planet is everywhere exactly inversely proportional to its distance from the sun (it is not, except at perihelion and aphelion); the second was an observational error in estimating the areas swept out by the radius vector. If Kepler had not been so (un)lucky he might have discovered the source of the error and even have come up with the mathematical statement of the law of gravity some 80 years before Newton.

"An Introduction to Observing Saturn", The Star Gazer's Journal (Willingboro Astronomical Society), August 1971, p 16.
This is a very detailed explanation of the various phenomena of Saturn which are observable with small and large apertures. Included are discussions of brightness variations on the disc and in the rings; color variations of the same; brightness variations of the satellites; determination of spot transit times across the central meridian (very important for exact determination of the rotation period of the various belts and zones); and other phenomena. Included is an extensive table of the longitude of the central meridian in System I and System II at various dates. This article should be read by those interested in careful observations of this planet, which will be near perihelion, at high north declination, and with rings opened to nearly maximum extent, at the coming opposition.

"Radio Stars", Science, 17 September 1971, p 1087.
There are 6 basic types of radio stars: red dwarf flare stars, red supergiants, a blue dwarf companion to a red supergiant, novae, pulsars, and X-Ray stars. The sun, and presumably other "normal" stars, are also radio sources, but are weak compared to the above types. Even "strong" radio stars are observationally very weak and hard to detect. Interferometers are used to pinpoint the location of a radio source and identify it, if possible, with an optical star; this procedure is accurate to about 3 arc seconds. Most radio stars are drastically variable in output. When the variation is regular, as with the pulsars, the search for new such objects is greatly facilitated.

"The Lunar Rocks" Scientific American October 1971 p 49.
Analysis of lunar rocks returned by astronauts shows that the moon's composition is sufficiently different from the earth's to show convincingly that the two bodies were were never one. The Apollo 14 rocks are the oldest yet analyzed, and approach 4,000,000,000 years in age, half a billion years older than the oldest known earth rocks. Plagioclase (a calcium sodium aluminosilicate) and pyroxene (a calcium magnesium iron silicate) each constitute more than 10% of the samples and are the most abundant minerals on the moon. There are a considerable number of titanium-containing minerals. Two new minerals unknown on earth have been found (christened pyroxferroite and armaleolite). No samples with conspicuously large crystals have been found. The composition of the rocks differs in several important respects (isotope ratios, for example) from tektites found on earth, which seems to rule out the oft-stated opinion that tektites are of lunar origin (possibly thrown out by the impact which created Tycho). Most of the volcanic activity ceased on the moon about 3,000,000,000 years ago, and since then the moon has been a passive body modified only by external influences such as the solar wind and meteorites. But volcanism was certainly an important factor in the moon's early history, as judged from the high percentage of igneous rocks found there.

F O R   A   D E P A R T M E N T   O F   D E S C R I P T I V E   A S T R O N O M Y

by Norman Sperling

Practitioners of that huge area of astronomy not included in astrophysics have for quite some time been made to feel unworthy of academic note by the uniform omission of college coursework in their field by departments called "astronomy", but actually "astrophysics". The neglected field, which here shall be called "descriptive astronomy" but which also has many other common names, is nevertheless a legitimate pursuit. Indeed, it is one of the very few remaining areas where an "amateur" can make valid contributions, and do worthwhile scientific research without elaborate equipment or extensive training.

This is not to say that descriptive astronomy cannot be taught at the college level. As will be shown, the subject matter can be categorized into several courses which are easily adaptable to the curricula of most major universities. The writer invites any comments you may have regarding this proposal, which adds up to a solid undergraduate minor.

100: The Contents of the Universe (4 credits). From prehistory to 1610: time and calendars; the celestial sphere; astronomers. The Scale of Things. The Solar System. Stars. Nebulae. Macrostellar groupings, galaxies. Cosmology. Analogous to common introductory courses for freshmen, this course should mention all the following courses. 100 should be taken or waived by all students of later courses.

200: The Celestial Sphere (3 credits). Thorough study of the constellations, their positions, shapes, important stars and other objects, and mythology. Coordinates and earthly motions; Zodiac and Solar System motions. Calendaring. Astrometry.

250: Topics Within the Solar System (4 credits). The Sun. The planets; their moons; lesser debris: asteroids, comets, meteoroids, clouds, Zodiacal light. Eclipse phenomena. The interplanetary medium.

260: Topics Beyond One Parsec (4 credits) Nature, properties, types, classification, evolution of stars. Proto- and post-stellar nebulae. Variables. Multiples. Associations. Open Clusters. Globular Clusters. The Interstellar Medium

270: The Outer Reaches (4 credits). Galaxies: their parts, types, distribution. Evolution of galaxies. Historical views of galaxies. Quasars. Black Holes. The Intergalactic Medium. Cosmogony. Cosmology.

310: With Eye and Telescope: (3 credits). Drawing all available planets, moon and sun(spots); meteor charting and counting; aurora watch; satellite timings; doubles and variables; Messier objects; timing occultations and minima. Most work to be individual, only one or two class meetings weekly.

325: Optics and Telescope Making (5 credits). The Eye. Telescope Optics. Considerations in design. Construction of a complete telescope, either Newtonian or Buchroeder, with working equatorial mount.

350: Astrophotography (5 credits). Films, filters, cameras; techniques of exposure; techniques of development and printing. Students must successfully finish photographs they take of: sunspots, the moon, a constellation, Jupiter or Saturn, meteors showing a radiant, and a Messier object or section of the Milky Way. Also, Comets when in season.

400: Preparation for an Upcoming event (1 to 6 credits). When appropriate, thorough planning for the complete observation of an occultation, eclipse or similar event. Though essentially an independent study, frequent required consultation with the instructor.

450: Research in Descriptive Astronomy (1 to 6 credits, may reenroll up to 3 terms). If entirely observational, may be results of above course, or another extensive set of observations with carefully designed technique. If historical, must include accurate reobservation with instruments similar to the originals. Results must be publishable.

Interdepartmental courses: (with History) 150: The History of Astronomy; (with Technology) 280: Machine and Man in Space; (with geology, geography, meteorology, ecology) 300: Earth as a Planet; (with biology, chemistry, astrophysics, philosophy) 375: Exobiology; (with education and audio-visuals) 465: Planetarium Work; (with education) 485: Methods of Teaching Descriptive Astronomy.

K E P L E R ' S   B I R T H D A Y   P A R T Y

For members of the Amateur Astronomers Association of Princeton, and astronomy students at Princeton Day School, a party will be held in honor of Johannes Kepler's 400th birthday, on Monday, 27 December 1971. Tentative plans call for a starting time of 7 PM, at Norm Sperling's apartment, G-7, Franklin Corner Gardens, Lawrenceville. If you would like to attend, please contact Sperling at club meetings or at home (609-896-9575) or at Duncan Planetarium (609-924-6700).

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When purchasing optical instruments for yourself or for gifts, it is important to examine the instruments carefully yourself, or to buy them from established dealers in optical goods.

Particularly at Christmas, stores of all sorts stock small, poorly-made telescopes and binoculars. While some of these are American-made, most are of Japanese origin. They carry a wide variety of brand names. It is important to distinguish these from high-quality Japanese, American and European instruments. Several rules may be applied:

FIRST: if the instrument is advertised as "high-powered", avoid it. Power (magnification) is determined only by the focal length of the objective over the focal length of the eyepiece, period. Changing an eyepiece will change the power. More important characteristics of telescopes are -- aperture, or diameter of lens or mirror (this gives light-gathering power and resolving power); surface accuracy (in mirrors, given as fractions of a wavelength of light), surface coatings (on lenses, maximizes light efficiency IF properly done); focal ratio (determines power capabilities and photographic characteristics); mounting head (determines convenience of tracking with the scope); and stand (pedestal or tripod, determines stability of scope).

SECOND: Have you encountered advertisements for this brand in Sky and Telescope, or other magazines? Has anyone at the club heard of this brand? What can they tell you?

THIRD: Check the instrument over. The tripod or pedestal should be rigid -- wobble will make viewing very difficult. The mounting head should be neatly machined. Altazimuth mountings are generally \$40-\$100 cheaper than equatorials, but require turning two knobs instead of one to keep objects in view while observing. Focal ratio should be at least f/12 for conventional refractors (down to f/5 for spectally-made rich-field models); f/8 or f/10 are commonest for Newtonian reflectors. Objective lenses should be coated to look purple, not blue or yellow. Avoid uncoated lenses. Mirrors of 1/4 wave accuracy give decent images, but many companies now offer fine 1/10 and 1/20 wave accuracy. Apertures of 60mm in refractors and 4¼ inches in reflectors are minima for amateur astronomers. Maximum <u>useful</u> powers are 2X per millimeter (= 50X per inch), so 120X is maximum for the smallest useful refractor and 225X for the reflector. Barlow and other lens systems yielding higher powers spread the available light out farther than the eye can perceive it. As a general rule, long-focus refractors are somewhat preferred for Solar System objects where light is bright and magnification is needed; medium-focus Newtonians are somewhat preferred for dim and diffuse objects such as nebulae and galaxies.

No useful telescope is likely to be available for less than \$100 (refractor) or \$60 (reflector). If your budget won't stretch that far, get a good pair of binoculars following similar rules. Cheap scopes end up unused, and are thus a complete waste of money and a disappointment to those receiving them. Second-level amateurs often buy 6" Newtonians for about \$200 or 3" refractors for about \$265; the next step up is to 4" refractors and 8" reflectors in the \$400-500 range. ALWAYS consult someone who knows before spending good money on optical instruments.

--Norman Sperling

"Visual Simulators for Moon Men" -- Optical Spectra, October 1971, p 32.
A highly complex and sophisticated Lunar Module Simulator (LMS) is used to train lunar astronauts for their missions. The system includes a computer with a memory of 164,000 24-bit words to help simulate all possible instrumentation readouts and visual displays during a mission. The network of visual projectors includes a system capable of displaying several thousand simulated stars, each tinted to match its true counterpart and very accurately located. All phases of a mission are accurately simulated, and special attention is paid to all aspects of lunar orbiting and descent to landing. The success of the simulator is proved by the nearly flawless performance of the astronauts to date.

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Participate in Skylab, the first US manned space laboratory, by submitting your proposal for a space experiment.

Skylab is the first US orbiting laboratory in which long duration manned investigations in weightlessness, astronomy above the earth's atmosphere, and large-area Earth observation are possible. The National Science Teachers Association and NASA are offering to students in grades 9-12 the unique opportunity to propose space experiments to be performed aboard the Skylab space station.

Any student in US public, private, parochial, or US Overseas schools is eligible. Proposals should not exceed 1000 words. They should describe your proposed space experiment in accordance with the Skylab Student Project Rules Booklet, which will soon be available at Duncan Planetarium.

Proposals must be forwarded by first class mail, postmarked no later than 4 Feb 72.

Proposals will be submitted to NSTA regional chairmen. Up to 10% of the entrants in each region will be selected as regional winners by local committees. All regional winners will be judged by a national committee and 25 will be chosen from these as suitable for flight. NASA will make the final selection of those experiments to be flown from the 25 national winners. Flight selection will be announced in April 72.

Certificates of participation will be awarded to all entrants. Regional winners will receive a certificate and an official Skylab pin and certificates for their schools and teacher-sponsors. The 25 national winners and their teachers will be invited to attend, with expenses paid, the Skylab Educational Conference and the presentation of awards to be held at the Kennedy Space Center in Florida at the time of the launch of the Skylab. The 25 winners and their teacher-sponsors will receive special medallions, and plaques will be given to their schools.

Contact Norman Sperling at Duncan Planetarium, Princeton Day School, for details.

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