★ STAR DUST

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INTERSTELLAR MOLECULES CLUE TO STAR FORMATION

DR. ZUCKERMAN

Dr. Benjamin M. Zuckerman, Associate Professor of the University of Maryland, will address the April 5 meeting of National Capital Astronomers on "Interstellar Molecules and the Formation of Stars."

Within the vast hydrogen clouds from which stars are formed, the many types of molecules that are being disclosed by radio astronomy are serving as tools in the study of the star-formation process. Apparently turbulence in a cloud of perhaps 10^5 solar masses precipitates its fragmentation, aiding gravitational nucleation into protostars. The interstellar molecules within these clouds serve as tracers in the study of the motions important during this stage of the process, on a scale of a few parsecs.

Dr. Zuckerman will present observations apparently indicating such fragmentation, and although their interpretation is controversial, he will suggest several possibilities including his "own prejudices."

Dr. Benjamin M. Zuckerman was born in New York City, received his B.S. and M.S. degrees from M.I.T. in 1963, and the Ph.D. from Harvard in 1968. His background includes experience as Research Assistant, M.I.T. and Harvard; Teaching Fellow, Harvard; Physicist, Smithsonian Astrophysical Observatory; Assistant Professor, University of Maryland; Visiting Associate, California Institute of Technology; Consultant to Jet Propulsion Laboratory; Visiting Associate Research Astronomer, University of California, Berkeley; and, at present, Associate Professor, University of Maryland. He has an impressive list of publications, honors, and awards, Including the Bart J. Bok Prize from Harvard, 1974, and the Helen B. Warner Prize from the American Astronomical Society, 1975 (with Patrick Palmer).

APRIL CALENDAR — *The public is welcome.*

Friday, April 4, 11, 18, 25, 7:30 PM — Telescope-making classes at American University, McKinley Hall basement. Information: Jerry Schnall, 362-8872.

Saturday, April 5, 6:15 PM — Dinner with the speaker at Bassin's Restaurant, 14th Street and Pennsylvania Avenue, NW. Reservations not necessary.

Saturday, April 5, 8:15 PM — NCA Monthly meeting at the Department of Commerce Auditorium, 14th and E Streets, NW. Dr. Zuckerman will speak.

Monday, April 7, 14, 21, 28, 7:30 PM — Telescope-making classes at Chevy Chase Community Center, Connecticut Avenue and McKinley Street, NW. Information: Jerry Schnall, 362-8872.

Friday, April 11, 8:00 PM — Observing with the NCA 5-inch Clark refractor at the U. S. Naval Observatory. Call Larry White, 978-9681.

MARCH LECTURE

Dr. Thomas C. Van Flandern, research astronomer of the U. S. Naval Observatory, spoke on his measurement of the apparent secular decrease of the universal gravitational constant, at the March 1 meeting of NCA.

He presented remarkable new observational evidence regarding one aspect of gravitation and followed by what he called "a totally unjustified degree of speculation" on answers to the classical questions: What *is* gravity? Is it always the same? Everywhere?

His speculation is indeed provocative.

D.. Van Flandern reviewed gravitation from the Newtonian concepts to its measurement by modern lunar occultation techniques. The advent of atomic time in the 1950's and Watts' lunar limb charts in 1963 permits solution through occultation analysis for 20 unknowns, one of which is lunar acceleration along the orbit. One cause, tidal friction, is measurable otherwise; atomic time allows measurement of the total effect of tidal friction and any decrease in the gravitational constant if it exists. Analysis discloses that the effect is twice that of tidal friction, implying a rate of decrease, $\dot{G}/G = 7.5 \times 10^{-11}$ per year — quite significant over the age of the solar system, about 4×10^{9} years.

Reviewing the consequences of a continual decrease of gravitation, which we will here abbreviate, $\dot{G}/G$, Dr. Van Flandern noted that most observations support it. The only exception is radar ranging of the planet Mercury, but the results are preliminary, and are still insufficiently complete to be conclusive. General relativity, also, fails to predict $\dot{G}/G$. Tidal friction energy that is lost from the Earth should be gained by the Moon, but classical calculations fail to account fully; $\dot{G}/G$ accounts and conserves energy. Globular clusters seem older than the universe by classical calculations; $\dot{G}/G$ adjusts their age to that of the galaxy. Another classical discrepancy involves the Sun. Its present luminosity indicates an original helium abundance of 25 percent, but results of solar wind studies require an initial 15 percent. $\dot{G}/G$ accommodates 15 percent. Most gravitation theories involve Hubble's constant — the rate of expansion of the universe — as either a cause or an effect of gravitation. It seems very likely not coincidental that the rate of apparent decrease of gravitation and Hubble's constant are approximately equal.

In 1937 Dirac expressed all the major constants of physics in the following system of natural units: length, the diameter of the hydrogen atom; mass, that of the electron; time, that required for light to transit the hydrogen atom. He found that the constants clustered within an order of magnitude around unity, 10^{20}, 10^{40}, and 10^{80}. He speculated that hidden interrelationships unknown to us were the cause. The age of the universe, not constant, but always increasing, fell in the 10^{40} group, suggesting that these physical values must all be varying with time, those in the 10^{20} group with $T^{\frac{1}{2}}$, those of the 10^{80} group with T^{2}. The universal gravitational constant was one of the 10^{40} group, indicating that the estimated 10^{80} nucleons in the universe must be increasing with time. Many explanatory efforts, including Hoyle's steady-state theory, have failed observationally. A startling escape from the dilemma seems to be offered by the old, very unpopular, and long-discarded graviton theory with some new considerations. If 10^{80} gravitons were formed with the nucleons, the universe would disperse from the outside. In 10^{40} units of T (the present age of the universe) the volume would increase to 10^{120}, decreasing G to 10^{-40}, which is just where G is today. Furthermore, the dispersion would expose more of the inner nucleons to the graviton flux in just the way needed to place G in Dirac's 10^{40} group.

Dr. Van Flandern cautiously emphasized the speculative nature of these considerations in noting that $\dot{G}/G$ can remove objections to the graviton theory, making it consistent with most of the modern observational evidence, hence,

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NOMINATING COMMITTEE APPOINTED

A slate of nominees to be offered for election at the May 3 annual meeting of NCA will be chosen by Benson Simon, Chairman, Jim Krebs, Bob Wright, Bob Bolster, and Walter Nissen. Other nominations may be made by written petition signed by ten members and submitted to the trustees before the election.

ASTRONOMY OPEN NIGHT AT AMERICAN UNIVERSITY

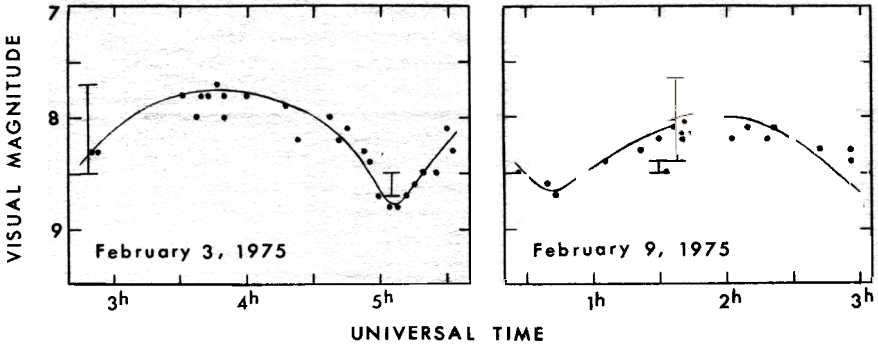
The public is invited to enjoy the evening of April 1 at American University with NCA president Dr. Henning Leidecker and others of the faculty.

At 7:30 PM — "The Cosmic Perspective," an illustrated lecture by Dr. Richard Berendzen, Dean, College of Arts and Sciences. New Lecture Hall.

From 8:45 to 10:00 PM — Telescopic observations, weather permitting, with National Capital Astronomers. University Mall.

Open House at the Physics Department, McKinley Building. Lasers, magnets, audio-visual equipment, movies, spectra, etc. Dr. Leidecker and other Physics Department faculty members.

SOME OBSERVATIONS OF THE VARIABILITY OF EROS



Daniel Costanzo of NCA submits these recent observations of the asteroid with the comment, "Eros is a challenging object to observe because of its changing magnitude and its movement, which causes one's having to use different comparison stars for each observation." Costanzo used a 6-inch reflector at 45x and 70x to estimate the visual magnitude for each point plotted. He thanks Bob Bolster for providing comparison star magnitudes.

NOTE ON CURRENT RESEARCH

Double bonds out there — Detection of vinyl cyanide (acrylonitrile) in Sgr B2 by the Parkes radiotelescope has been reported by F. F. Gardner, CSIRO, Sydney, Australia, and G. Winnewisser, Max Planck Institut für Radioastronomie, Bonn, Germany, confirming F. J. Kerr's 1974 report of "probable detection" at Parkes in 1973. Vinyl cyanide, $H_2C=CH-CN$, is the first interstellar molecule detected containing the C=C double bond. It is one of the simplest of the olefins — highly reactive, unstable, and tending to polymerization. Its detection suggests the presence also of ethylene, $H_2C=CH_2$, the simplest olefin, but ethylene is not detectable by radio astronomy techniques. (*Astrophysical Journal Letters*, February 1, 1975)

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strikingly, still viable!

In his introduction of Dr. Van Flandern, NCA president Dr. Henning Leidecker, professor of physics at American University, provided an appropriate historical survey of the concepts of gravitation from Aristotle to the symmetric tensor theory

EXTRACTS FROM THE IAU CIRCULARS

1. February 9 — Dr. Kohoutek, Hamburg Observatory, Bergdorf, Germany, discovered a 14th-magnitude comet in Taurus. Comet Kohoutek (1975c) has a period of 5.5 years, and was at perihelion in January.

2. February 27 — Dr. Kohoutek observed in Aries a comet, first thought to be 1955c. The object, also seen on February 28 by Ikemura, was apparently discovered by West on an October 15 photograph. Now known as Comet West-Kohoutek-Ikemura (1975b), this comet, also periodic, is of about 13th magnitude, and is now close to the Pleiades.

3. March 12 — Mr. W. A. Bradfield, Dernan Court, Australia, discovered a comet in Cetus. Comet Bradfield (1975d) is of 9th magnitude.

This listing furnished courtesy R. N. Bolster.

FIRST CLASS MAIL

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