

A photograph of the Whipple Observatory's gamma-ray telescope, a large structure covered in thousands of small, reflective mirrors, silhouetted against a sunset sky. The telescope is mounted on a complex metal frame with various support structures and a platform on the right side. The sun is low on the horizon, creating a warm orange and yellow glow. The sky transitions from orange near the horizon to a pale blue at the top. The foreground shows dark silhouettes of trees and the ground.

The Beginning of Gamma-Ray Astronomy at the Whipple Observatory

Giovanni G. Fazio
Harvard Smithsonian Center for Astrophysics
Trevorfest 2013

High Energy Gamma-Ray Astronomy in 1958

IL NUOVO CIMENTO

VOL. VII, N. 6

16 Marzo 1958

On Gamma-Ray Astronomy.

P. MORRISON

Department of Physics, Cornell University - Ithaca, N. Y.

(ricevuto il 22 Dicembre 1957)

IL NUOVO CIMENTO

VOL. XIII, N. 1

1° Luglio 1958

The Crab and Cygnus A as Gamma Ray Sources.

M. P. SAVEDOFF

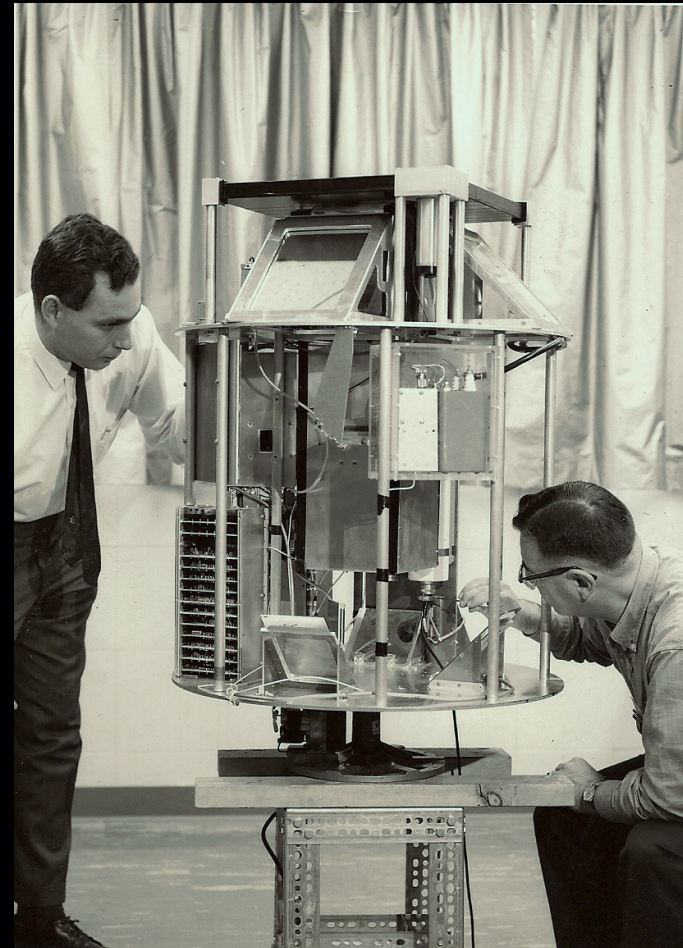
Department of Physics and Astronomy, University of Rochester - Rochester, N.Y.

(ricevuto il 30 Dicembre 1958)

High Energy Gama-Ray Astronomy at SAO (1962 - 1967)

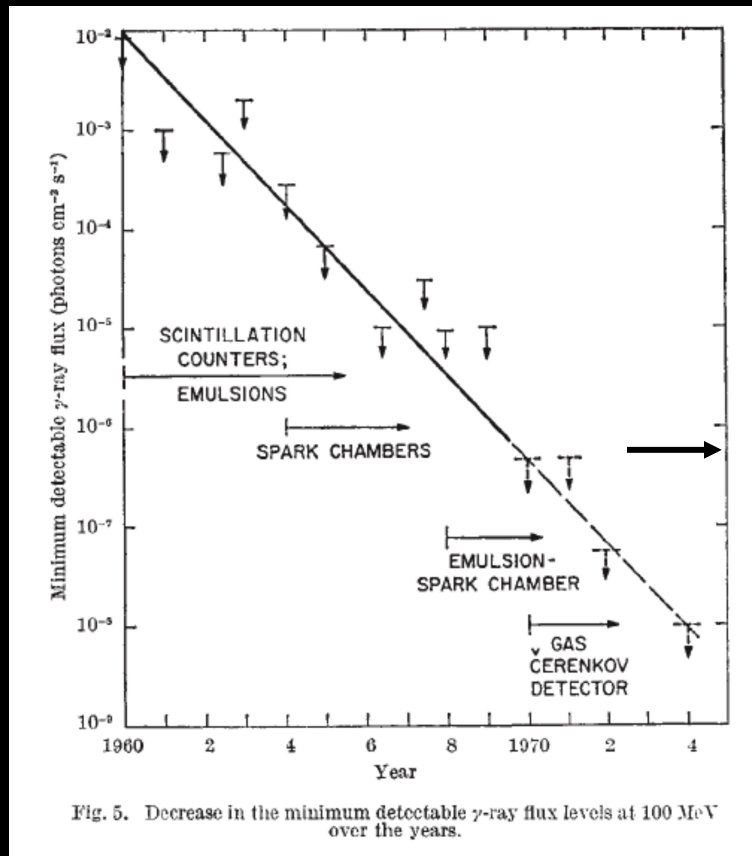


Fred Lawrence Whipple



Henry Helmken and Arnie Goldstein

Minimum Detectable Gamma-Ray Flux (> 100 MeV) For Discrete Sources



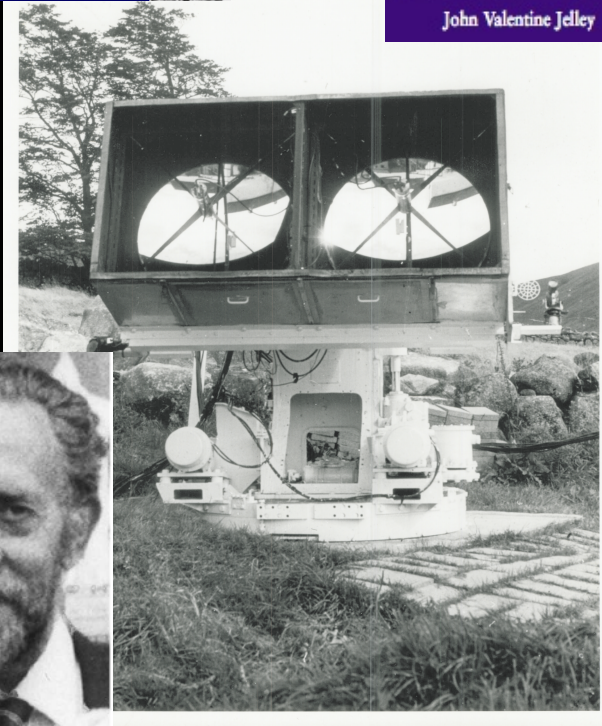
Fazio (1970)

- Upper limit to gamma-ray flux > 100 MeV decreased by an order of magnitude every ~ 2 yrs from 1960 to 1970.
- Reached an upper limit of 5×10^{-7} photons/cm²/sec by 1979.
- Crab Nebula pulsar detected in 1973 (McBreen et al. 1973)

Early Atmospheric Čerenkov Detectors



A. Chudakov
Crimea, Ukraine
1960-64



existing light receiver installation at A.E.R.E., Harwell. The bank of three-foot $f/0.5$ mirrors is mounted equatorially for drift scans.

John V. Jelley
U.K. A.E.R.E., Harwell, UK



Neil Porter
Glencullen, Ireland
1962-66

SEARCHES FOR HIGH ENERGY GAMMA-RAYS FROM PULSARS
USING A FAST NIGHT SKY ČERENKOV DETECTOR*

W. N. CHARMAN, J. H. FRUIN, J. V. JELLEY

Atomic Energy Research Establishment, Harwell, England

D. J. FEGAN, D. M. JENNINGS, E. P. O'MONGAIN, N. A. PORTER,
G. M. WHITE

University College, Dublin, Ireland

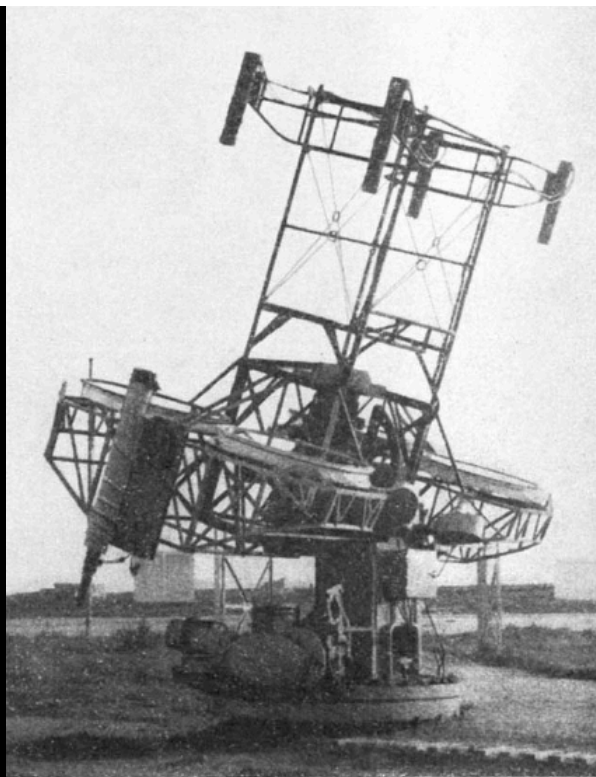


Fig. 6. The Čerenkov γ -ray installation operated jointly by the Atomic Energy Research Establishment, Harwell, and University College, Dublin. This installation consists of four 90 cm diameter $f/2$ mirrors and is sited at Qrendi, Malta.

SAO Initiates VHE Gamma-Ray Astronomy at Mt. Hopkins (1966)

- G. Fazio and H. Helmken initiate VHE gamma-ray astronomy at Mt. Hopkins in 1966.
- Trevor Weekes, UCD, joins as NAS/NRC Postdoctoral Fellow (1966).
- George Rieke (Harvard Physics Dept) and Trevor Weekes carry out early VHE gamma-ray observations from 1967-68 using two 1.5-meter searchlight mirrors at 1280-m level of Mt. Hopkins



The Early Days at the 1280-m Level of Mt. Hopkins (1967-68)



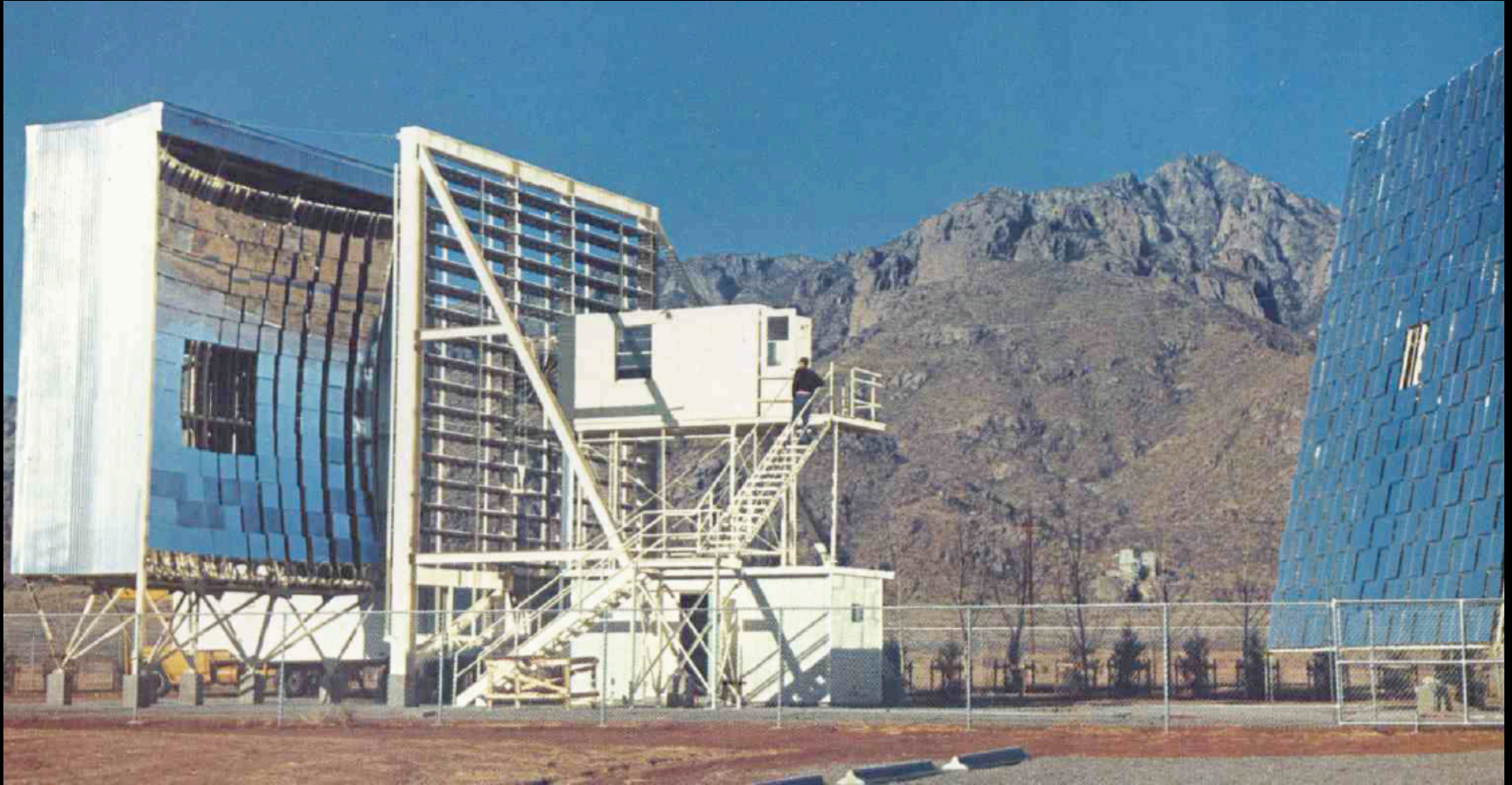
Trevor Weekes

George Rieke, Ph.D. 1969

Site of present
Whipple Observatory
Basecamp (and
VERITAS)



Precursor to the 10-meter Reflector 1965-66



Solar Furnace, U. S. Army Natick Laboratories (1952-1976), Natick, MA
In 1976 moved to White Sands Missile Range, NM

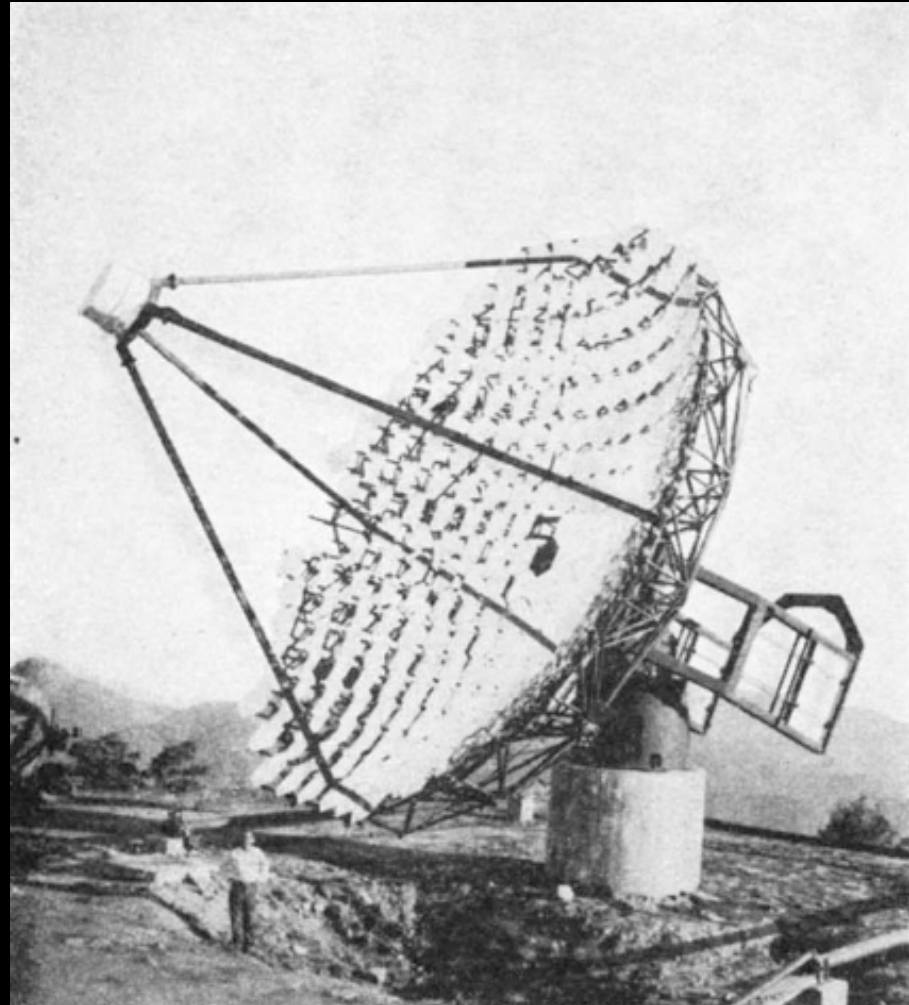
SAO Initiates 10-meter Reflector at Mt. Hopkins (1966)

- Design and construction of 10-m reflector at 2320-m level of Mt. Hopkins initiated in 1967.
- **Tom Hoffmann, SAO Engineering, provided engineering design.**
- Telescope was built by Optics for Industry, Milwaukee, WI.
- Support provided by D. Hogan, R. Carson, C. Tougas, and M. Clark,
- **J. V. Jelley, UKAERE, and N. Porter, UCD, served as consultants.**



10-meter Large Optical Reflector

- Begin operation in Spring 1968 under Trevor Weekes.
- Trevor Weekes appointed Resident Director Mt. Hopkins Observatory in 1969.
- Initial cost LOR: \$250K
 - \$140K for mount, structure, mirrors, electronics, etc.
 - \$60K building
 - \$50K to complete road
 - All SAO funds





An experiment to search for discrete sources of cosmic gamma rays in the 10^{11} to 10^{12} eV region¹

G. G. FAZIO AND H. F. HELMKEN

Smithsonian Astrophysical Observatory and Harvard College Observatory, Cambridge, Mass., U.S.A.

G. H. RIEKE²

Physics Department, Harvard University, Cambridge, Mass., U.S.A.

AND T. C. WEEKES³

Smithsonian Astrophysical Observatory, Cambridge, Mass., U.S.A.

Received June 21, 1967

A large optical reflector, designed to detect the Cerenkov radiation produced in the night sky by cosmic gamma rays, is being built for operation in the spring of 1968. The $f/0.7$ reflector will have an effective aperture of 34 ft, consisting of a mosaic of 252 2-ft hexagonal mirrors supported on a fully steerable frame. The mirrors will be front-aluminized so that by use of S-13 photocathodes the ultraviolet component of the Cerenkov radiation down to $3\,000\text{ \AA}$ can be detected. The optical efficiency of the reflector will be such that 75% of the light between $3\,000$ and $5\,000\text{ \AA}$ from a point source on the optical axis at infinity will be concentrated into a 2.5-in.-diameter disk in the focal plane. The instrument will be located on the 7\,600-ft level of Mount Hopkins, Arizona. The mount for the reflector is so constructed that an additional 34-ft reflector can be added at a later date. With the large-aperture, high-speed electronics (100 Mc s^{-1} bandwidth), and S-13 optical wave band, the present energy threshold for the detection of gamma rays by the atmospheric Cerenkov light technique will be lowered by at least an order of magnitude. Theoretical models for the Crab nebula based on the inverse Compton effect predict a gamma-ray flux 10 times greater than the minimum flux sensitivity of the instrument. Several other possible sources will also be surveyed.

10th International Cosmic Ray Conference, Calgary, Alberta, Canada (June 19-30, 1967)



Trevor Weekes, Henry Helmken, G. Fazio, John Jelley, F. Graham Smith, Neil Porter

A SEARCH FOR DISCRETE SOURCES OF COSMIC GAMMA
RAYS OF ENERGIES NEAR 2×10^{12} eV

G. G. FAZIO AND H. F. HELMKEN

Smithsonian Astrophysical Observatory and Harvard College
Observatory, Cambridge, Massachusetts

G. H. RIEKE

Mount Hopkins Observatory, Smithsonian Astrophysical Observatory, Tubac, Arizona,
and Harvard University, Cambridge, Massachusetts

AND

T. C. WEEKES*

Mount Hopkins Observatory, Smithsonian Astrophysical Observatory, Tubac, Arizona

Received September 3, 1968

ABSTRACT

By use of the atmospheric Čerenkov nightsky technique, a study has been made of the cosmic-ray air-shower distribution from the direction of thirteen astronomical objects. These include the Crab Nebula, M87, M82, quasi-stellar objects, X-ray sources, and recently exploded supernovae. An anisotropy in the direction of a source would indicate the emission of gamma rays of energy 2×10^{12} eV. No statistically significant effects were recorded. Upper limits of $3\text{--}30 \times 10^{-11}$ gamma ray $\text{cm}^{-2} \text{sec}^{-1}$ were deduced for the individual sources.

Dedication of the Fred Lawrence Whipple Observatory

October 23, 1968



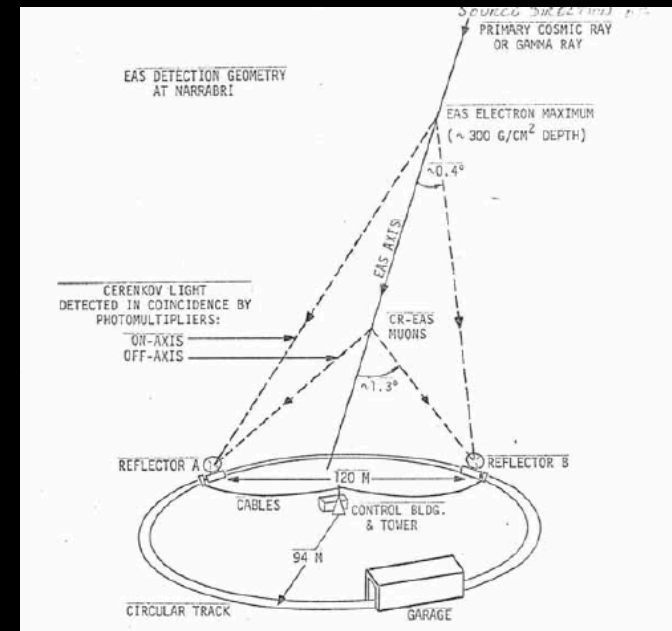
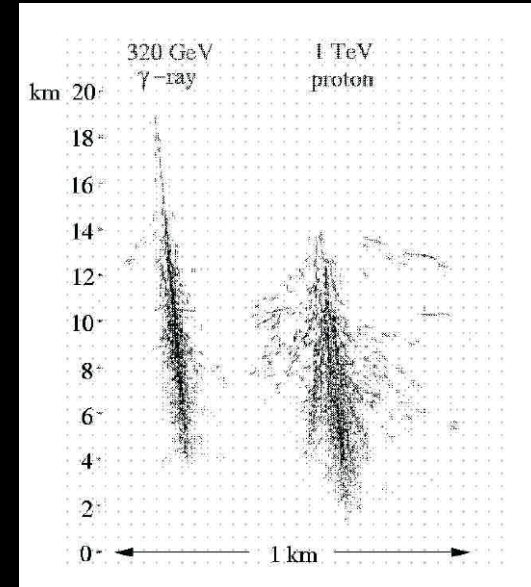
James Corbitt (Tucson Mayor), FLW,
U. S. Representative Morris Udall



Fred L. Whipple

Stereo Imaging Technique 1972-76

- Problem identifying the primary particle initiating an extensive air shower.
- Proton and gamma-ray showers should exhibit different longitudinal development.
- Josh Grindlay (Harvard Physics Ph.D.) demonstrated the value of stereo imaging with dual telescope beam technique at Mt. Hopkins and Narrabri, Australia (Hanbury Brown).



RADIO PULSES FROM EXTENSIVE COSMIC-RAY AIR SHOWERS

By DR. J. V. JELLEY and J. H. FRUIN
Atomic Energy Research Establishment, Harwell

PROF. N. A. PORTER and T. C. WEEKES
University College, Dublin

AND

PROF. F. G. SMITH and R. A. PORTER
University of Manchester, Nuffield Radio Astronomy Laboratories, Jodrell Bank

**UPPER-AIR FLUORESCENCE AS A TOOL IN
X-RAY ASTRONOMY AND SEARCHES FOR X-RAYS FROM
NP 0532 AND OTHER PULSARS**

W. N. CHARMAN, R. W. P. DREVER, J. H. FRUIN and J. V. JELLEY
Nuclear Physics Division, Atomic Energy Research Establishment, Harwell, Berkshire, England

and

J. L. ELLIOT, G. G. FAZIO, D. R. HEARN, H. F. HELMKEN,
G. H. RIEKE, and T. C. WEEKES
Smithsonian Astrophysical Observatory, and Harvard College Observatory, Cambridge, Mass., U.S.A.

DETECTION OF HIGH-ENERGY GAMMA RAYS
FROM THE CRAB NEBULA

G. G. FAZIO, H. F. HELMKEN, E. O'MONGAIN, AND T. C. WEEKES

Smithsonian Astrophysical Observatory, Cambridge, Massachusetts

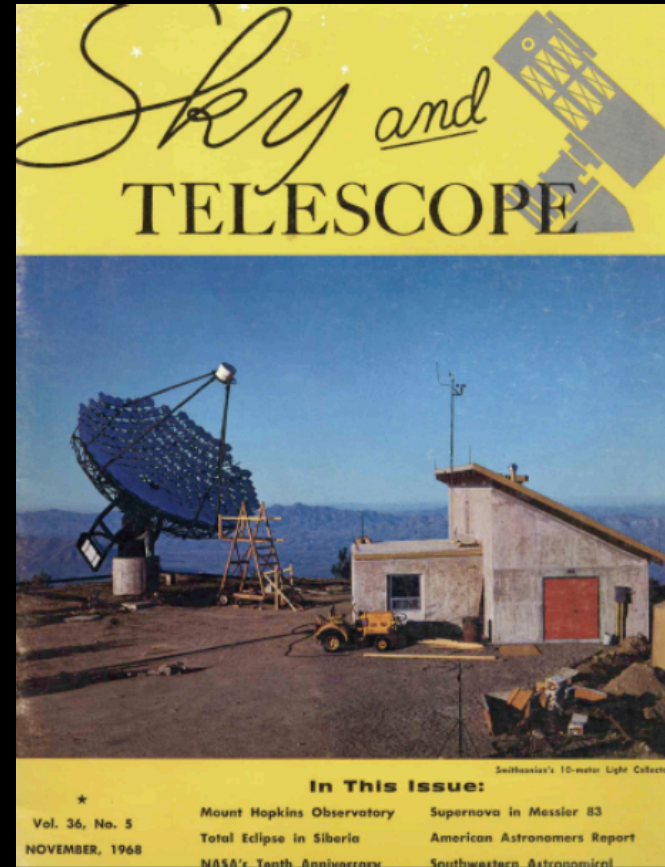
Received 1972 May 11; revised 1972 May 26

ABSTRACT

By means of the ground-based atmospheric Cerenkov technique, observations of the Crab Nebula, averaged over a 3-year period, indicate that a flux of γ -rays ($4.4 \pm 1.4 \times 10^{-11}$ photons $\text{cm}^{-2} \text{s}^{-1}$) with energy $\geq 2.5 \times 10^{11}$ eV has been detected at the 3.1σ level. This flux corresponds to an emission of 6×10^{33} ergs s^{-1} , significantly less than the continuous X-ray emission. The γ -ray flux may vary with time, with the most significant flux ($1.21 \pm 0.24 \times 10^{-10}$ photons $\text{cm}^{-2} \text{s}^{-1}$) occurring 60–120 days after a major spin-up of the pulsar NP 0532. This increase was observed on three different occasions, and if the flux in only these intervals is used, the effect is at the 5σ level. The total γ -ray energy observed on each occasion was $\sim 10^{41}$ ergs, an energy approximately equal to the energy of the pulsar spin-up.

Whipple 10-m Telescope

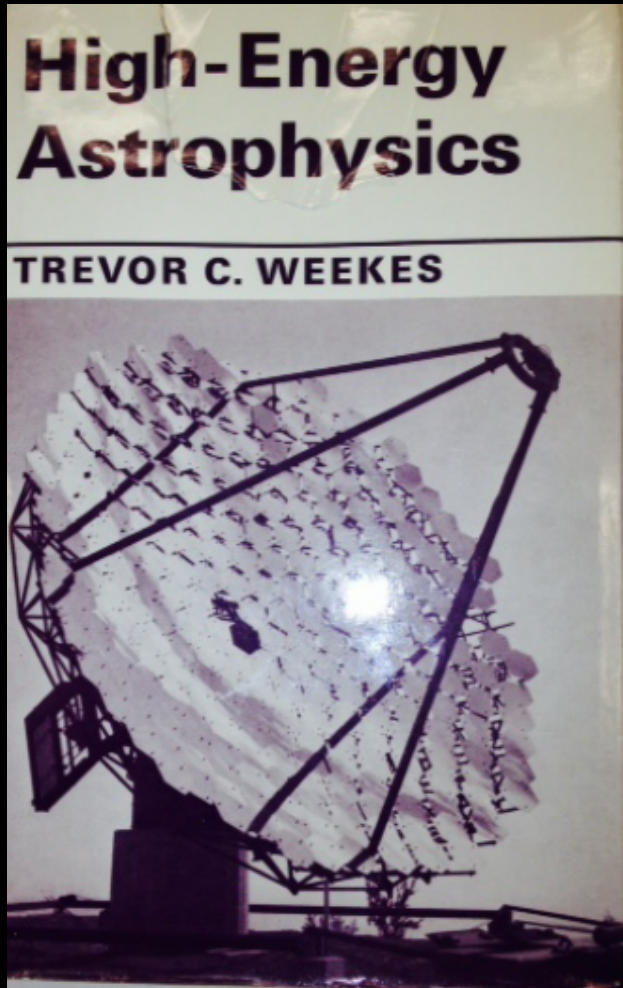
- **1968** 10-meter telescope installed.
- **1973** Only upper limits on many astronomical sources.
- **1976-82** “Dark Ages,” SAO gamma-ray program closed.
- 1977-1984 Development of the atmospheric Čerenkov imaging technique (Weekes and Turver)
- **1989** First galactic source (Crab Nebula) detected.
- **1992** First extragalactic source (Mrk 421) detected.



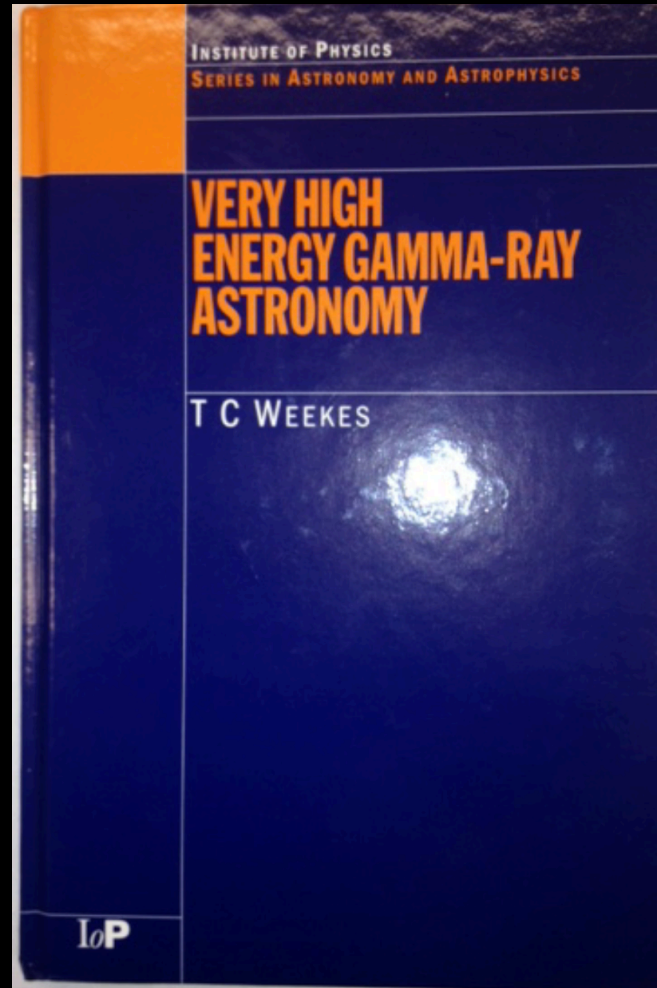
1967 - 2013



Books by Trevor Weekes



1969



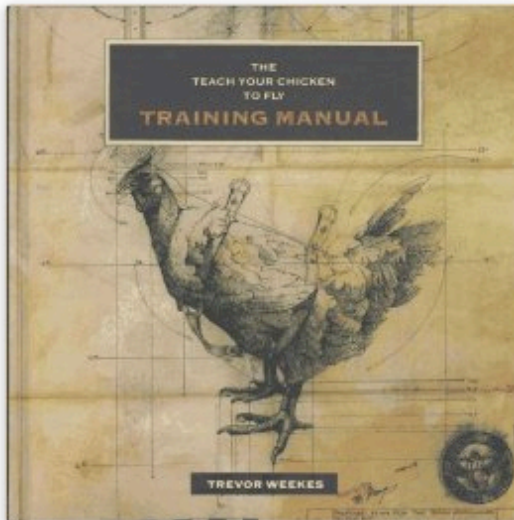
2003

Another Book by Trevor Weekes

Teach Your Chicken to Fly Paperback

by [Trevor Weekes](#) (Author)

★★★★★ 1 customer review



Paperback

20 Used from \$1.94

9 New from \$10.00

Here at last are complete and elegant instructions to train any chicken to fly. This ingenious book is based on the material developed in 1940 for the Society for the Rights of Inferior Birds. Color illustrations.

10/17/13 1:59 PM

Trevor C. Weekes

- Major Contributions to Astronomy
 - Creator of a new branch of astronomy,
 - Opened a new window on the Universe
 - Pioneered new experimental techniques
- Awards
 - Rossi Medal, HEAD, AAS, 1997
 - Honorary Membership in the Royal Irish Academy, 2002
 - Honorary Doctor of Science Degree, Univ. of Chicago, 2005
 - Yodh Prize, International Union of Pure and Applied Physics, 2007

