

Lost in the Dark

nearly-forgotten ideas, observations

"The Greeks weren't always the first to do things, but they were nearly always the first to write about it"

L. Joyce Farmer

IRS



Feb 2016 UCLA DM

APS-SFW

OCT 2015



Virginia Trimble
4575 Physics Univ California
Irvine, CA 92697-0001

when

what

who

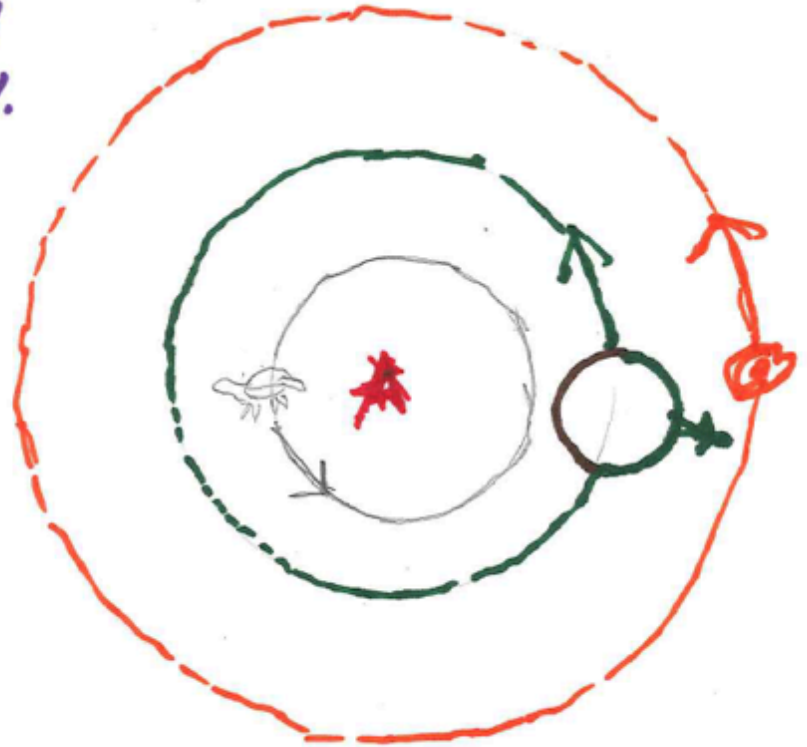
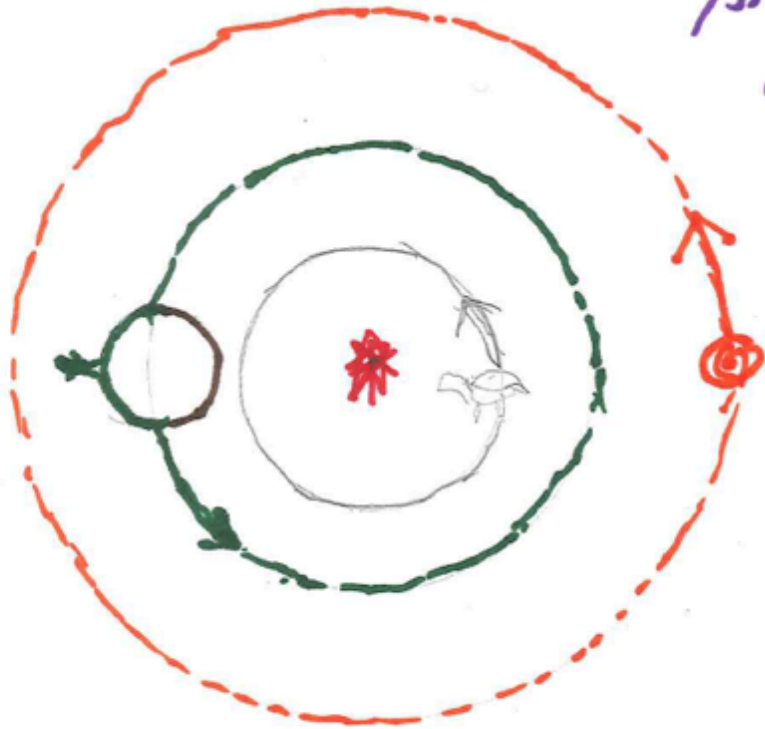
c. 460 BCE	Counterearth	Philolaus of Croton
325 CE	visibilium et invisibilium	Council of Nicea
1786	unenlightened stars	Goodricke, Pigott
1784, 1796	escape speed exceeds c	Michell, Laplace
1840+	gravity first, then light Neptune, Sirius Procyon	Bessel, Leverrier
1800	missing planets	von Zach, "Bode"
1860s 1920s	dark (dead) stars	thermodynamics Zöllner
1922	3 dark stars for each luminous	Jeans
	quantity of dark matter cannot be excessive	Kapteyn
1930	Dunkle materie in 6 galaxies	Lundmark
1933, 37	Coma (dunkle mat), Virgo cl.	Zwicky, S Smith
1937	Binary galaxies	Holmberg

2

1939/40	M31, NGC 3115 rotn. curves mass vs. $r \neq$ light vs. r	Babcock, Oort
1961	Sta. Barbara conf, large vel. dispersions in clusters CM vs other	half & half of participants
1963	G(r)	Arigo Finzi
1974	summary/graph of M/L vs R	Einasto, Kassik, Saar Ostriker, Peebles, Yahil

Philolaus 5th c. BCE
 night counterearth day

1st DM
 Cand.



$P=24$ hr
 antichthon

central fire

$P=1$ yr
 sun

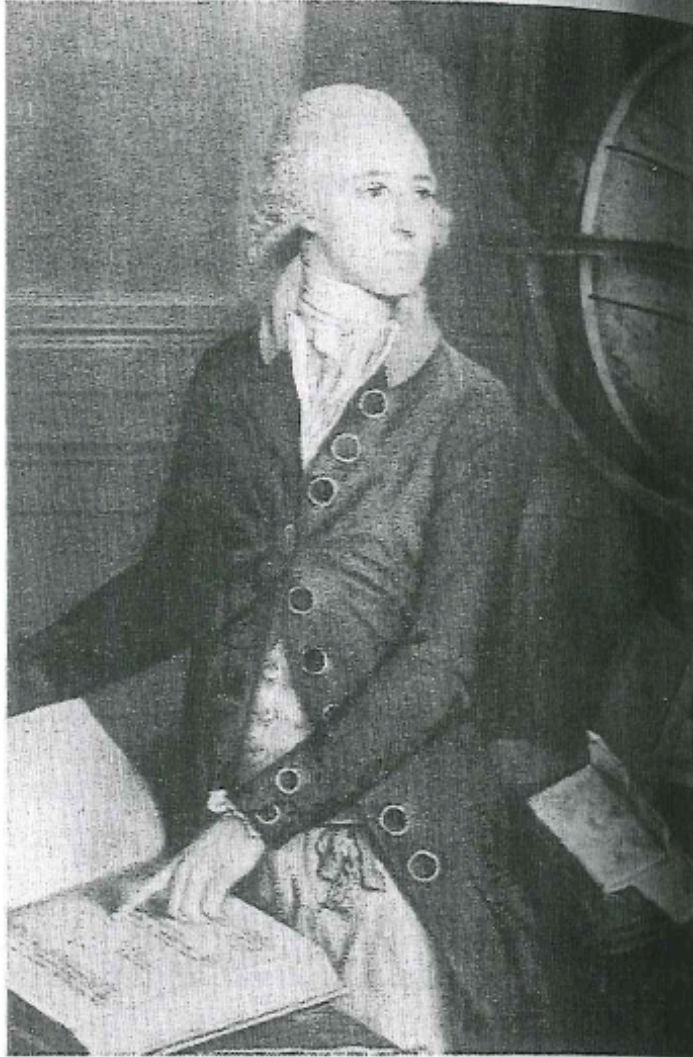
Inhabited Side
 earth $P=24$ hr
 otherside synchronous rotation

COUNCIL OF NICAEA 325 CE , 20 May - 19 June, 318 (??) bishops and higher-level clergy, mostly Eastern rites
Credo in unam Deum, Patrem omnipotentem, factorem caeli et terrae, visibilium omnium et invisibilium

GENERAL ASSEMBLY OF INTERNATIONAL ASTRONOMICAL UNION, 2 - 10 May 1922 CE, Fewer bishops, 6 (?) women
Commission 1 = Relativity (Abolished in 1925 in GA in Cambridge UK)



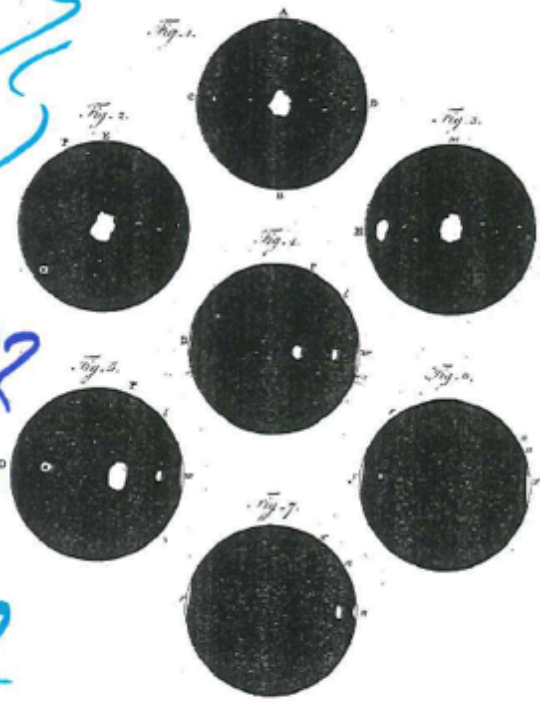
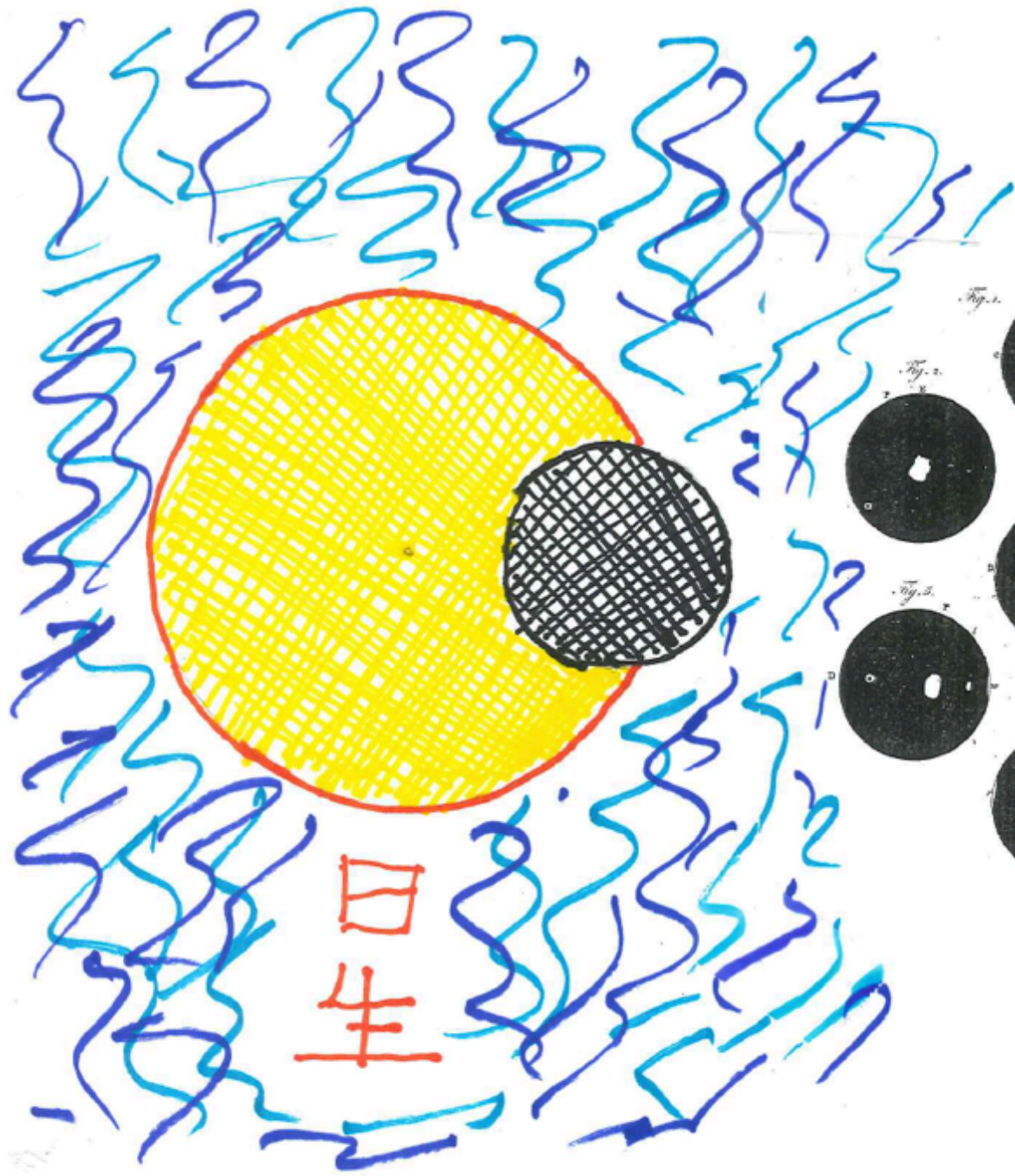
*Born Groningen, the Netherlands,
17 September 1764
Died York, England, 20 April 1786*



GA
Goodricke, John. Reproduced by permission of the Royal
Astronomical Society



Edward Pigott
1753 - 1825



7B

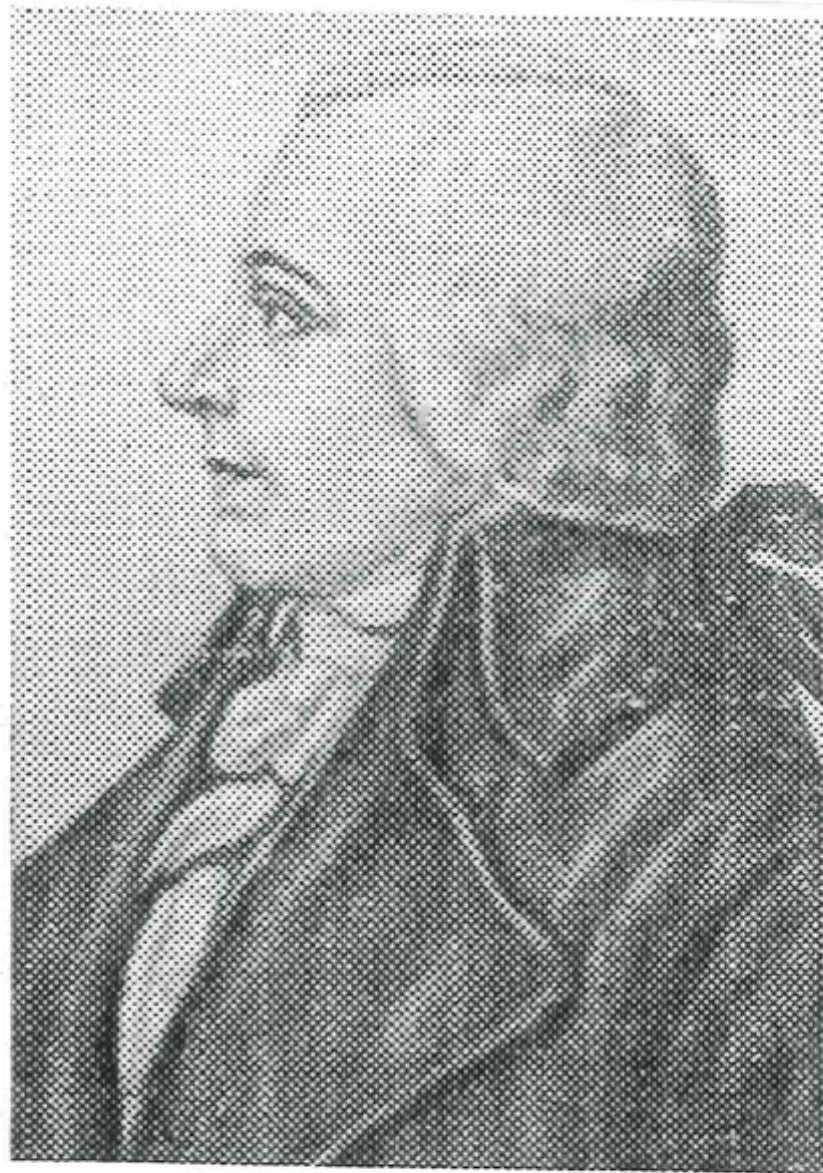
224. One of Edward Pigott's illustrations of his theory of variation in the brightness of short-term variable stars. Such stars are rotating, mostly "unenlightened," but surrounded by a medium with bright patches that are both irregular in size and in movement. From his 1805 paper, published in the *Philosophical Transactions* of the Royal Society.

7

No authentic
pictures of John
Michell are known



1874 Phil Trans RS
74, 35



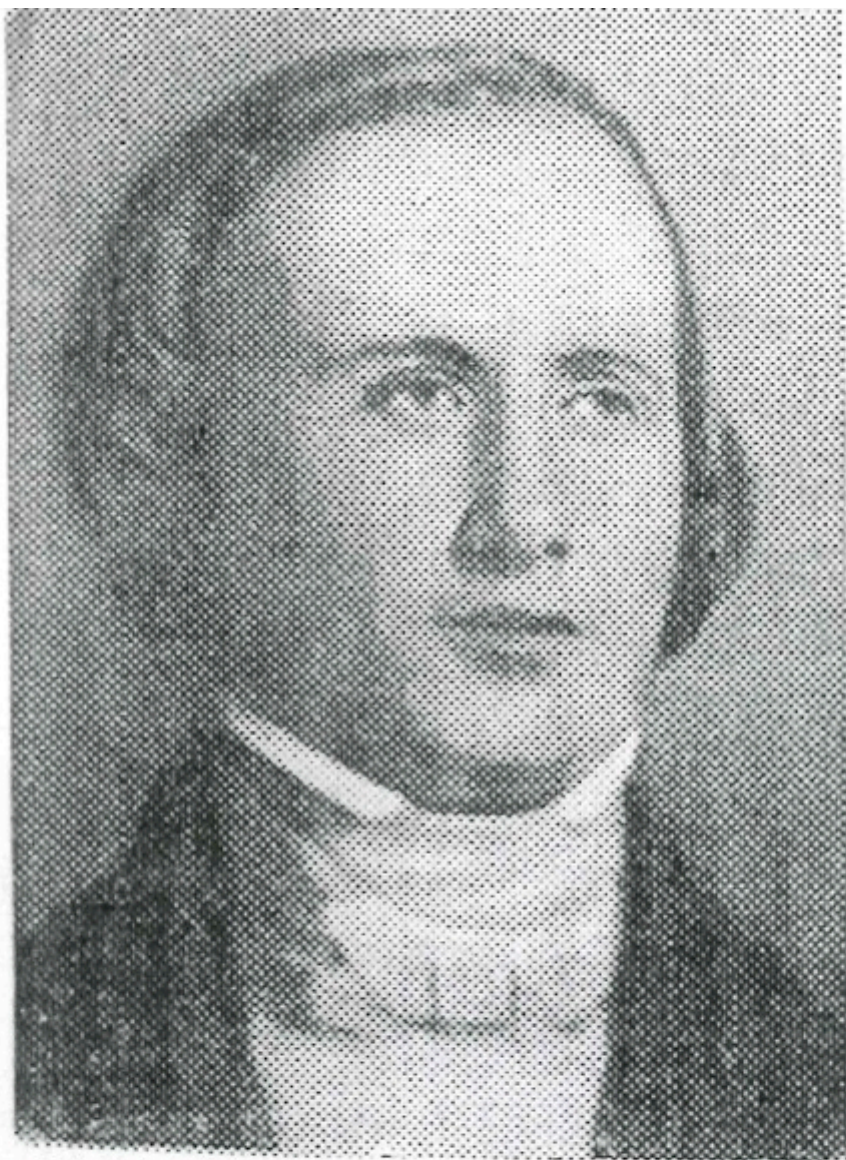
ЛАПЛАС Пьер Симон^{8B}
(28.III 1749—5.III 1827)⁸

Bessel, Friedrich Wilhelm

1784-1846



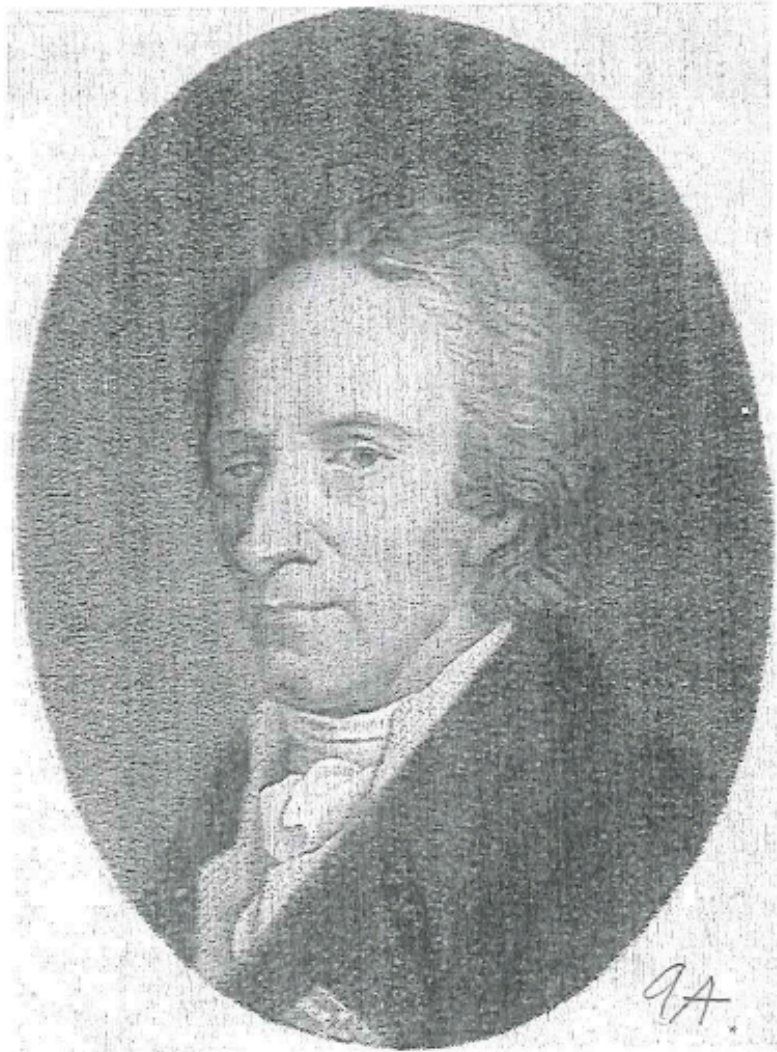
^{8/2 A}
Bessel, Friedrich Wilhelm. Courtesy of History of Science
Collections, University of Oklahoma Libraries



^{8/2 B}

ЛЕВЕРЬЕ Урбен Жан Жозеф
(11.III 1811—23.IX 1877)

Born Hamburg, (Germany), 19 January 1747
Died Berlin, (Germany), 23 November 1826



Bode, Johann Elert. Courtesy of History of Science Collections, University of Oklahoma Libraries

Born 1754
Died 1832



Franz Xaver von Zach

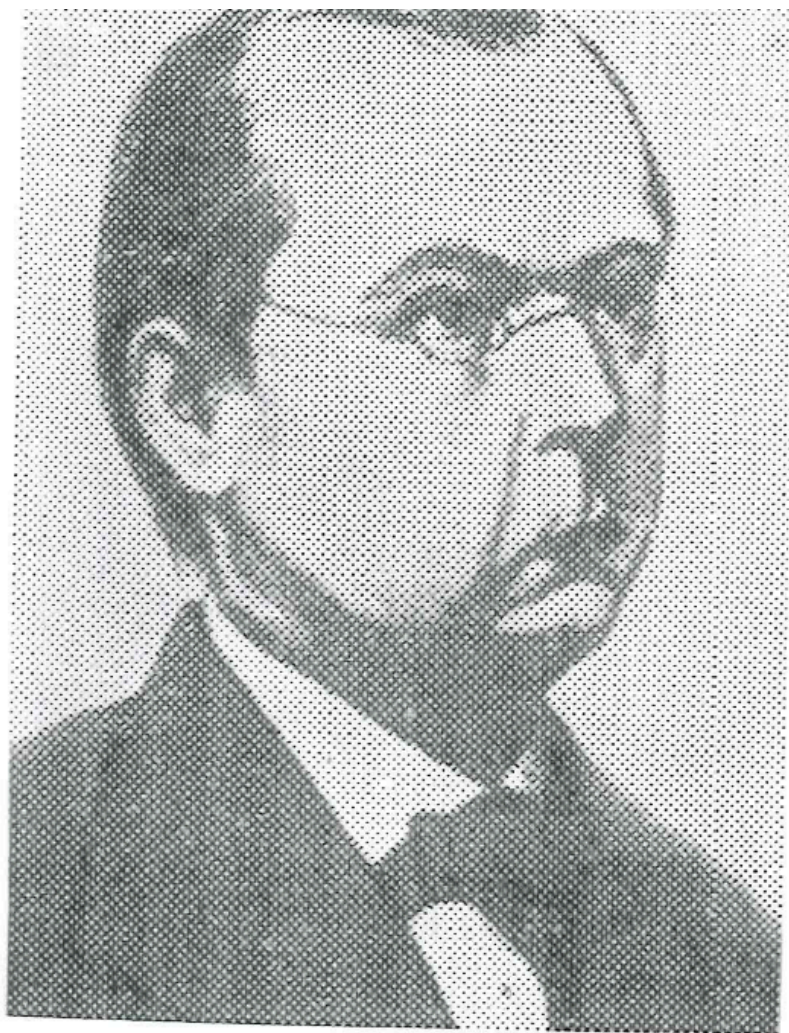
THERMODYNAMICS & DEAD STARS

$$\text{LUMINOUS LIFETIME} = \frac{\text{Energy supply}}{\text{Luminosity}}$$

A few luminosities known (distances) from 1840s
(like sun)

Energy supply (if Kelvin-Helmholtz gravitational
contraction— first discovered by others) enough for
10's to 100's of millions of years ('tension' with
biology!)

Potential for many dead, dark stars (a whole chapter
of Clerke)



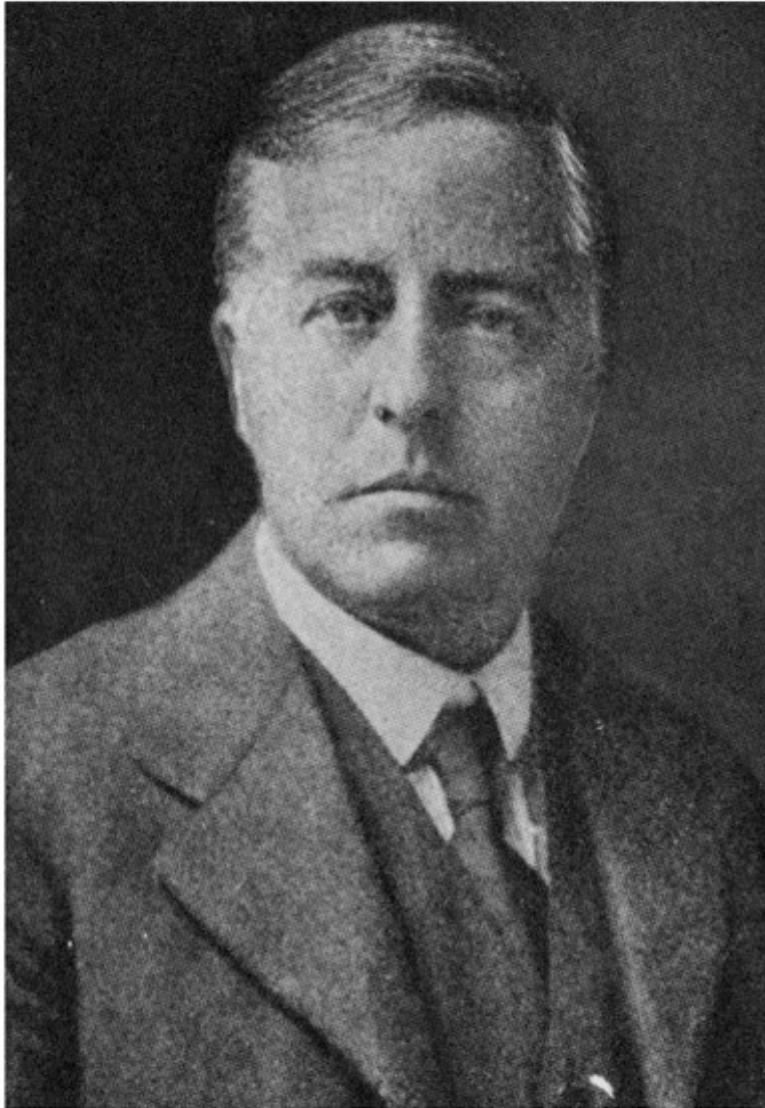
ЦЁЛЛЬНЕР ^{11A}
Иоганн Карл Фридрих
(18 VI 1821 - 05 IV 1902)

*Born Skibbereen, Co. Cork, Ireland,
10 February 1842
Died London, England, 20 January 1907*

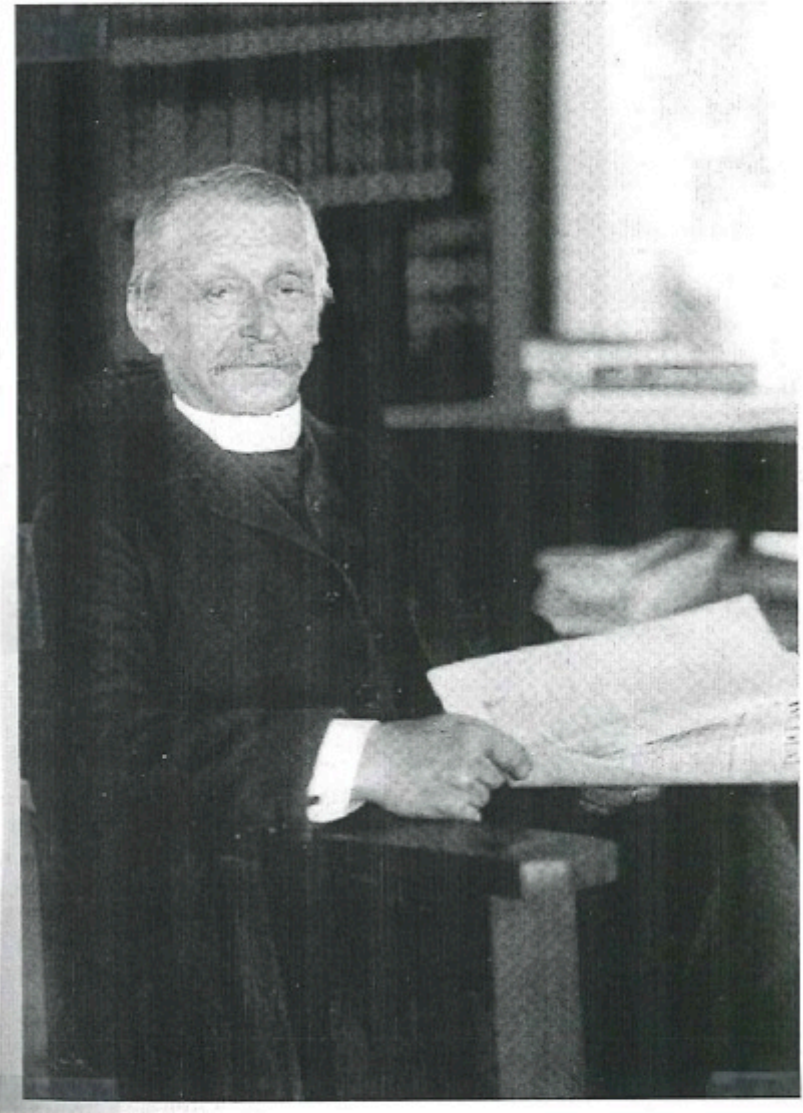


^{11B}
Clerke, Agnes Mary. Reproduced from *Astrophysical Journal* 25, no. 3 (April 1907)

James Jeans
1877 - 1946



КАРТЕУН 1851-1922



... quantity cannot be excessive. 12



ЛУНДМАРК Кнут Эмиль
(14.VI 1889—23.IV 1958)

BA

MEDDELANDE FRÅN LUNDS OBSERVATORIUM NO. 125

ÜBER DIE BESTIMMUNG DER
ENTFERNUNGEN
DIMENSIONEN, MASEN
UND DICHTIGKEITEN FÜR DIE
NÄCHSTGELEGENEN
ANAGALAKTISCHEN
STERNSYSTEME
VON
KNUT LUNDMARK

LEIPZIG 1930

SONDERABDRUCK AUS
VIERTELJAHRSSCHRIFT DER ASTRONOMISCHEN
GESELLSCHAFT · JAHRGANG 65 · HEFT 3-4

BA

Tabelle 4.

Objekt	Verhältnis: Leuchtende + dunkle Materie <hr/> Leuchtende Materie	Mittlere Zahl der Sterne für <hr/> Lichtjahre
Messier 81	100:1 (?)	0.20 (?)
N. G. C. 4594	30:1	0.042
Andromedanebel	20:1	0.006
Messier 51	10:1	0.012
Milchstraßensystem	10:1	0.08
Messier 33	6:1	0.026



13A
ЦВИККИ Фриц
(14.II 1898—8.II 1974)



Sinclair Smith
1899 - 1938



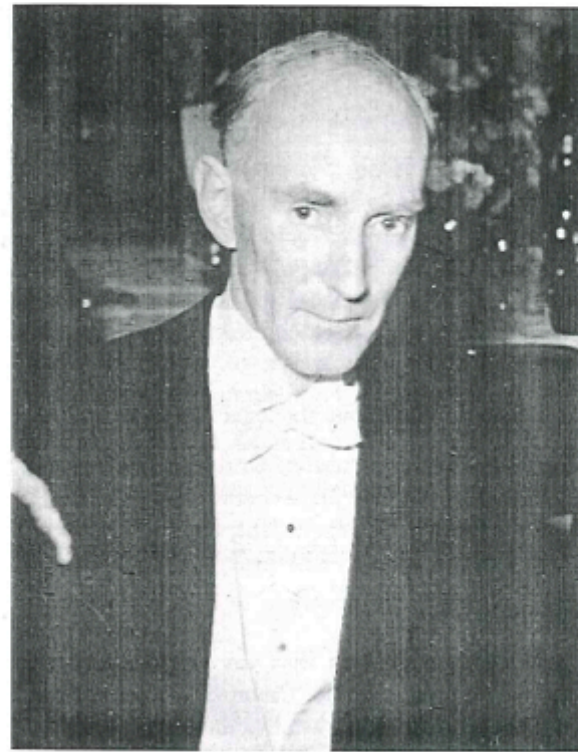
Erik Holmberg
1908 - 2000



M31

20A

БЭБКОК Хорес Уэлкам
(р. 13.IX 1912) 29/8/03



NGC 3115

20B

J.H. Oort (1900–1992), Director of Leiden Observatory from 1945, was the third General Secretary of the IAU (1935–1948) and its twelfth President (1958–1961). His General Secretariat included the years of the Second World War (1939–1945) during most of which, however, Oort was cut off from communication with other parts of the world, and W.S. Adams at Pasadena was acting General Secretary.

(Photograph taken at the 1948 Zürich Assembly, courtesy Ed. A. Müller)

20

1961 Santa Barbara conference, stability of clusters of Galaxies
THE VOTES

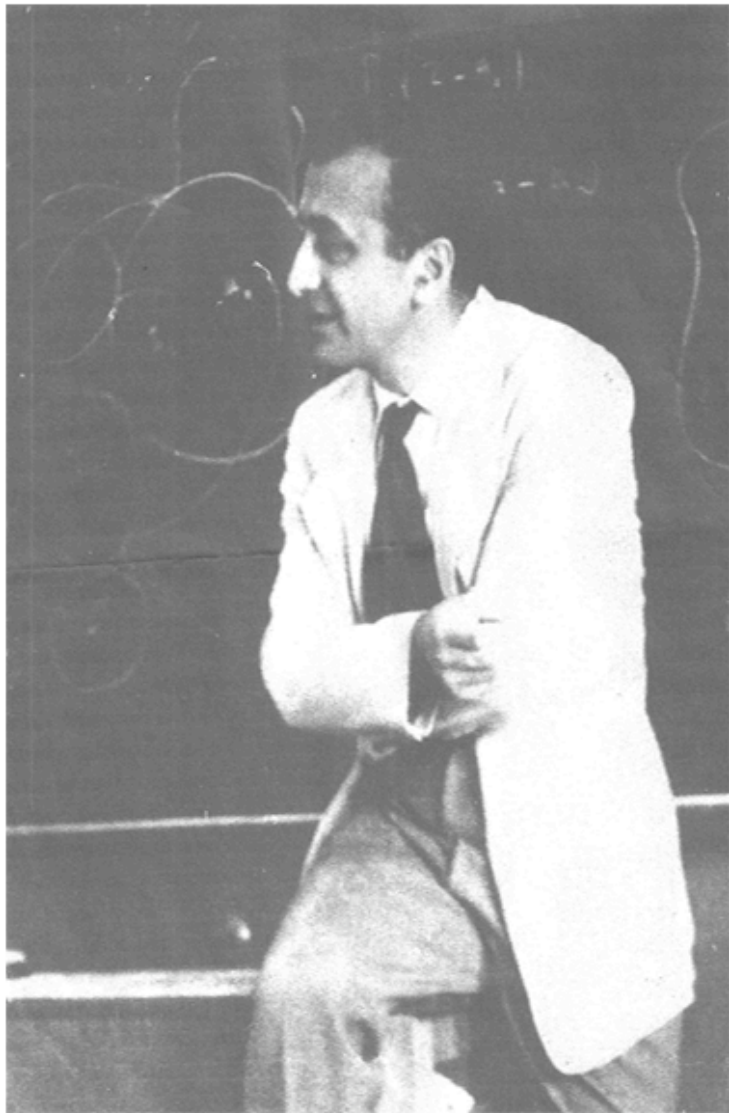
Unbound, expanding: Vorontsov-Velyaminov, Kalloghjian,
Markarian (for Ambartsumian), de Vaucouleurs, E.M. & G.R.
Burbidge (Jeans, surely)

Bound by something: Zwicky, Baum (intracluster light), Limber,
Minkowski, Abell (also superclusters); Van Albada, van
Horner (tests of Virial thm, $N = 16$ for vH)

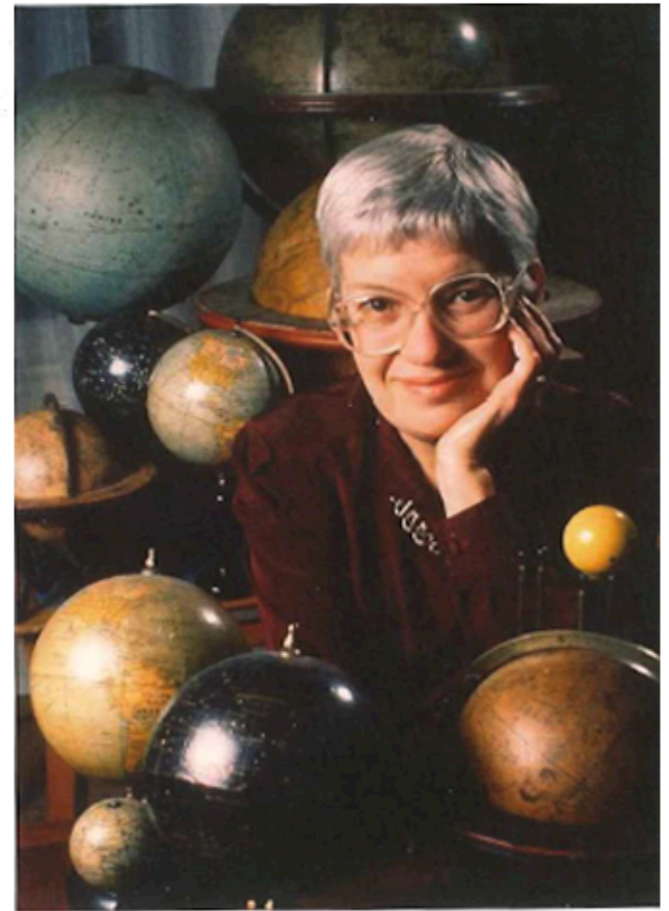
Other:

Holmberg: Observational errors, interlopers, substructure
Lemnaitre: exchange of galaxies between clusters & field

Vera Rubin was there; not yet a "voting member", mentions in
her ARA&A biography.



Arrigo Finzi
1917 - 2012



Vera C. Rubin

Vera Rubin
1928 -





J. Peebles

ЭЙНАСТО Яан Эльмаро
(р. 23.II 1929)

*Jim Peebles (1935 -), Alison Peebles
on the occasion of Dave Wilkinson's award of the
National Academy of Sciences Watson Medal.*