

A. Vibert Douglas

Lectures and Speeches

1940s

21.

Loc 2303.9

Box #1

Ancient Science
Babylonian & Greek.

Classics Club
Queens University
1940 Dec. 4.

Early Astronomy - maps of sky
direction
Time

Babylon Assyria & Chaldea -

1. Constellations 2700 B.C. from centre of empty space.
2. Zodiac + Precession (26000 yrs) $\frac{26000}{12} = 2165 \frac{40}{12}$ per constellation.
3. Taurus until 700 B.C. Homer "The bull opens the year with his golden horns" -
Aries led 700 to 1400 A.D.
Now Pisces.

Influence on Hebrew literature 12 tribes
Their symbols -

4. Other constellations [very few not of Babylonian origin
in Canon of Alexandria 250 B.C. ? named
Coma Berenices
Myths - Cepheus, Cassiopeia - Andromeda Perseus
Orion + Taurus + Pleiades - Pegasus
see notes on H. W. Clark address -
Homer, Orion saga - the Orion
Hercules -
Mrs. Mayal (Alcidamos Siculus ?)
Mrs. Minnar read Augustus de Morgan -
Altair, Sagittarius, Milky Way.

Poem of Aratus after Callisthenes → to Greece

Inquiries about Amalgam + Great & Kids

5. Astrology in Babylon
in Greece -
+ alchemy.

Merc.	Hg.
Venus	Copper
Mars	Iron
Jup.	tin
Sat.	lead
Sun.	an.
Moon.	Ag.

{ Tycho Brahe
Kepler }

Music of the Spheres

6. Greek Speculative Astron + Cosmology.
 7. " Math + Astron.
 8. " Med P. 20 + biology P. 1192
- Great influence on later thought
Read An Whitehead
Sci + Mod. World
- e. Stanley on Lucretian P. 46.

Johns. Cooper
+ all. sphere.

Astronomy & Literature

Pictou. Tennis Club
1945 Dec 4

The influence of astronomy upon literature is a topic of vast range & it can provide unending interest to the serious student & to the vagrant reader. Lit. has been enriched tremendously by metaphors & by simile, in verse & in prose - passages inspired by the simple spectacle of the pageantry of the skies, the nightly march past of the battalions of heaven - Numbers of such passages come to mind almost unsought - passages from the Psalms of David, from the Book of Job where "the morning stars sang together"; the Book of Daniel where the writer is searching for the noblest & loftiest possible expression of acclaim for him whose life is lived in the light of wisdom & whose influence is on the side of righteousness - "They that be wise . . ."

passages in Shakespeare ~~passages~~ for whom "the flood of heaven is thick inland with patterns of bright gold"; in Shelley who backs, rolls & frolics in the starlight, piling orb on orb & world on world "till soaring fancy staggers" in its daring task of creating a fitting temple to the spirit of Nature; in Keats for whom almost every state of mind & spirit ^{every changing mood} finds its most perfect expression in the light of a star - see Sonnets 143

Byron Posters 162

SLIDES

- 2. Sunset
 - Shelley 141, 147.
 - Keats 143
 - Rht Bridge 135
 - Shakespeare 125
- 1 Night
 - Shelley 142
 - Anstey 130
 - St. Holmes 131
- 3 Dawn
 - Ruckin there is no solemnity so deep as that of dawn
 - Shelley 140, 146
 - Keats 144
 - Chapman 154
 - Rht Bridge 135
- 6 X. Dec. Sky N. Bears - Diadema Sirealis 138
 Bayens Singer arabian desert traveller guide
 4 " Koran: God hath given you
 Bayens the stars & the guides in the dark both by land & sea.
Urs minor de Morgan 138
- 9 X Dec. sky S. Gemini Orion Taurus, Pleiades 138
 Virgil & Homer
 Herod 164
 Marjorie Peckthall 151
- 10 X Pleiades ?
- 11 X " Marsden 1579 "
- 12 X " Galileo 1610 36
- 13 X " Photo Hertzsprung 1924 2616
- 14 Bayen Sky South Tennyson - Many night 122
- 15 X Orion Constellation 2 photos
- 16 X " net 6
- 17 X " Horse head net

18 Galileo 1564-1642

19 " Telescope 1610

20 Y.O. 40" 1897

21 Galileo + Milton

22 Orion neb - Milton Behold the throne
of Chaos + in dark pavilion
spread wide on the wasteful deep.
+ p 128

23 } Portrait 1642-1727

24 } Newton Trinity Col. Ch. monument - Wordsworth
25 } Westminster Abbey read inscription p 157
The marble

26 Fikson Milky Way c. of galaxy

27 " "

→ 1. Rule of law. Shelley the negative laws that
rule you rather than
the eternal order that beautify the world

→ 2. Milton distance is inexpressible by numbers
that have name

→ 3. Byron The story fable of the Milky Way
a constellation of a sweeter ray

→ 4. Keats p 35
in the abyss where sparkle
distant worlds

→ 5. Shakespeare - music of the spheres p 125
~~music of the spheres~~

→ 6. Noyle 28 M 51 ~~sub~~ at 93

29 M 81 all those cloudless throes of
glittering stars + all those glimmering

To whom
Truth
matters → 30 Eddington - where the abyss of space is powdered with
a million stars - each grain
a burning sun
31 Einstein + Tagore

Life is a constellation an unplumbed
dark stream with starry moments

Constructive
Internationalism

Granby Rotary Club
1948 March 19.

for ever strong, it flourish & conquereth
for evermore. Great is truth & mystery
above all things."
Darius said "There are found wisest"

Low views of mankind's life on
earth.

Battle of good vs evil
Goethe. Faust wisdom.

Lippman to us a fought 2 wars
to victory. but lost
the peace. no effort made
comparable

James life is a struggle in which
something is continually gained.

③ 1. Construction side of UN.

- WORRA 48
- ILO
- WHO - cholera in Egypt.
- ICAO, ITO, FAO
- monetary fund, W. Bank.
- IRO
- UNESCO.

2. ISS. I.F.U.W. Italy.

3. Tolerance at home + re people
in Poland.

④ We need a rich phalanx of life
& faith in spiritual values if our
influence is to be potent in the
world today.

Q & F.

Rotary Club, Garanoque
Dinner at the Inn 1948

① Thanks.

② Francis Bacon: Men are not
animals erect but
immortal gods.

Does mankind merit that
compliment?

Grim picture of world today
men as animals & puppets

Zoroaster ^{Do they work and} how they live + whether
fear new worship to the powers of evil

Our individual task
to be radiating centres of
constructive internationalism

1. Put truth first
Story of Darius King Persia
Isdras. "As for truth it endureth + is

Renan: J. of N infused into the
world a new spirit — the
perfect nobility of the children of God

That is how I interpret the
words of Bacon

Men are not animals erect
but immortal gods.

and this battle against
evil must go on, on, on
towards ultimate victory.

Emp. of France
1949 June 5.

Immensities of Time & Space.

1. Greetings of I.E.W. 34 nations on 5 continents
30 years of service in the
cause of univ. women of scholarship and of
international good will, helpfulness & understanding.

30 years - i.e. since 1919 - this has been the
period in which the astronomers have revealed to
us the Immensities of Space & Time.

2. Bacon men as an erect
Bacon machine in a machine for making gods.

3. Man in space - mars 10^{21} : 10^{28}

unit of length - foot
angstrom unit
astron unit - c.g.

- solar syst. galaxy - cosmos.

4. Man in time - 3 score + 10.

Kapteyn 1000 sec

Puck - girdle round the earth in 40 min

radio wave - $\frac{1}{7}$ " [ticks off 3"]
man. Callender 200 yrs man 2 million to 10⁶ yrs. any life 10⁸ earth 3.5 x 10⁹
class 3 x 10⁹
Age of the sun, of universe, 4×10^9 yrs.

The time factor in Nature

Truth is the daughter of Time.

Man's impatience - & then disillusion.

Shelley - one road to peace & what is truth
Bacon - consequent cynicism

Bacon - Sir Richard Gregory - p. 209.

Renan - a new vision - the perfect notability
of the children of God

BFDW .

Inverness 1949 June 15.

Dunree 1949 June 18.

Huddersfield June 22

Atoms & Stars

Emp. of France
1949 June 4

The interrelatedness of all knowledge has only been fully realized in relatively recent years.

There are no watertight compartments of thought.

The significance of no one fact in the whole range of physical phenomena can be known unless the fact is considered in its relation to many other facts.

This is equally true in the affairs of man - his thoughts, feelings, actions, and in the affairs of nations.

And so my title Atoms and Stars is in reality not two topics but one.

Kepler: Bow down before facts & let them speak to you.

Let me tell you a parable - the parable of two students who came to Dame Nature...
We want to give our lives to science.

Take them the atoms... Take them the stars

Perversity of human nature

Return to your laboratory, ask a few questions:

How was helium first discovered & whence its name?

How did the atoms of all the elements & all their isotopes

come into existence in the proportions which we find?

In seeking answers to these & a thousand other questions you will find that you are really studying stars.

Return to your observatory & ask How can the light of a star be explained? What message does it contain? and you will find that you are really studying atoms.

Let us answer some of these questions.

But first let us pause to notice what an international record the development of physics + astronomy present to us.

Atoms Democritus, Lucretius, J.J. Thompson
Ernest Rutherford, Niels Bohr, Greenman
Stark, ~~Antoni~~ Curie, Aston, Bethe
Chandrasekhar, Klein. 12 nationalities

stars of nuclear matter $10^{10} K$.

Survey of Universe: a typical star - mass scale $10^{27} - 10^{29}$
nebulosity

galaxies - our galaxy - sun + system

Time scale + Space scale

Atoms + radiant energy.

Spectrum analysis: Chem.
Temp
Physical state
Doppler vel
Red shift.

Geometry of Space-time

Einstein, de Sitter, Lemaitre, Eddington.

Fundamental theory linking all the constants atomic + cosmic.

and AWW p 162. $2.36 \cdot 10^{79}$ 572.36 vs 560.
" APP p. 87.

Blake: Imagination goes forth in uncurbed glory

Tragedy of human hist. is the misuse of knowledge.

all who have the ideal of world citizenship
 at heart, all who have the far vision of
 things that have been and of things that
 may be, and the realistic grasp of
 things that are, must cooperate in the
 great task of bringing into the affairs of
 mankind upon this earth some semblance
 of the order, beauty & harmony of the
 universe of atoms and stars.

The search for truth in science has brought immense potentialities for good or for ill into the hand of man.

Rab-alais : Science without conscience is damnation

It is the moral, the spiritual nature of man that is lagging behind.

all scholarship implies a primary stress on integrity - it is high faith in honesty.

Our I.F.U.W. exercises an influence in 34 countries towards this end.

Scholarship, understanding, the ideals of the truth seeker, Shelley - one road to peace & that is truth.

It is our hope that understanding kindliness and honesty may more & more become the dominating attitudes between the peoples of all nations - that the ideals of the research scholar "high faith in honesty" may become the motivating influence in our relationships one with another and nation with nation.

Insofar as I.F.U.W. helps to achieve these ends it is a constructive force in the world making for the best harmony of the world of atoms & stars in the affairs of men on this beautiful planet, the Earth.

BFW.

Glasgow 1949 June 13.

Aberdeen " 17.

Eddington's Fundamental Theory

Values of Constants 1942

1. e elem. el. ssu charge.
2. h Planck
3. M mass H atom
4. μ .
5. m_e elect.
6. m_p proton.
7. K const. grav.
8. $h c / 2 \pi e$ fine structure, 137. 137.03 Birge
9. h/c
10. m_p/m_e
11. $e/m_e c$
12. N no of ptcls in unit - $2.36 \cdot 10^{79}$
13. M_\odot mass of sun - $1.97 \cdot 10^{55}$
14. R_\odot Sun's radius - 302.38 megapsec
15. V_\odot orb. speed $572.36 \text{ k/sec/msec. } 560 \text{ H/H}$
16. K nuclear range const.
17. A nuclear energy const.

14 constants

Toast to Levana

Madam Toastmistress, Ladies,

I rise to propose a toast to a Society that has proved its value on this Campus for many years. How many years - Hush - that is a state secret! Nevertheless I shall tell you

If you take 3 score years, add 10 subtract 20 divide by 2, extract the sq. root and multiply by the cube of 1+1 - there you have the age of this Society - more or less accurately.

Arith - a very amusing subject, quite comic how hard it is to add - even $2 + 2$ It is no test of brains at all You may be able to read the Odyssey, or quote Paradise Lost or work an electrometer or dissect a star fish or analyse haemoglobin or parler Francais or sprachen Deutsch or say *se favor, si usted gusta* or discourse on the Middle ages and modern political economy - but not add 2 and 2. You look incredulous, I believe you think I am just talking nonsense - Well, let us try

add $2 + 2 + 2 + 2 + 2 + 2 + 2 + 2 + 2 + 2$

not a test of the fitness to be a member of this Society:

what are the qualifications?

Francis Bacon enumerated them years ago.

"the desire to seek, patience to doubt, fondness to meditate, slowness to assert, readiness to reconsider, carefulness to dispose and set in order . . . one that hates every kind of imposture."

Two further things - kindness - a characteristic that I know from rich experience that members of this Society possess in large measure - and an ear attuned to the lovely things, the underlying harmonies in a world when there is also much that is discordant and tragic. We want to be able to come on that which is and catch the deep pulsation of the world.

accompany music measuring out the steps of time . . . Ladies The Levana Society.

U. W. Club Montreal

1941 Feb 20.

1941 Spring

Your President wrote me that if I
came here & talked about The Stars
it would be a "tonic".

I take it that we are all so battered
upon in mind & heart & spirit by the
tragedy of the world's anguish, by the
appalling complexity of the problems
of today and tomorrow, that to
maintain our sanity we must
occasionally withdraw from the
turmoil of life ~~as it is~~ around us
and sip the nectar of the gods,
listen to the music of the spheres,
renew our faith, and our equanimity
& our courage.

"The world is too much with us..."

H. J. Wells: Short History of the World.

Read it without mentioning author.

Life on earth

struggle for existence

might is right

mastodons -

cunning > might for mastery

man, family & tribal loyalty

ideals began to be recognized

curiosity & imagination

science & philosophy

Life & teaching of a man in Palestine

not the way of might, selfishness & hate
that way leads to extinction, to animals
to jungle conditions

Substitute the way of love, unselfishness,
planned cooperation for the
best for all, kindness.

In the few centuries since then man
has been learning by bitter experience
that this is the only way. The way of
hate & intolerance leads only to war & destruction.

The astronomer's view of the Universe
and the future.

Myriad galaxies
stars + nebulosity + radiation

Our galaxy -
various kinds of stars
The Sun + system.

Looking out from Earth -

Constellations

planets.

Spring sky.

Comet of Dec-Jan
40-41.

Life on this earth in future
ages
J.H. Jeans Cleopatra's head.

Time is a factor we must
allow for.

yet work for progress towards
the ~~end~~ ^{state} we desire to see achieved.

Astronomy & Religion

1949 Feb 22

Informal noon hour
discussion group.

- ✓ The measurable
- ✓ Universe vastness
- ✓ Subatomic submicroscopic
man - geom. mean
- ✓ Facts of obsⁿ + experience
include man himself as
a truth-seeker.
- ✓ Agnosticism. Prove all things.
- ✓ [Stace: Sept. 1948. Atlantic Monthly.
Purpose in the Universe. ditto. Nov. 1948.]
- ✓ Scientific Method
- ✓ The worship of God is an adventure of The Spirit
Intuition: Weyl, Hamann, Eddington.
Archaeologists' defⁿ of Evil.
Sir R. Livingsstone: "Righteousness may be overcome
but it is not overcome" ~~the~~
→ one of the unmistakable lessons
of history is its survival -
Conviction that though evil is real, good is the
ult. reality in life and stronger than its
failures, disasters + tragedies.

"We should fit ourselves for living by the vision
of good in all its many forms and fields - in
religion, in literature, thought, art, music, and
above all in man; and in this last category
include not only the resounding heroisms
of history but also the unmarked and
unobtrusive good, of which there is so
much in ordinary beliefs about us -

Sir R. L. V.

- ✓ Schrodinger
- ✓ Eddington - Seeking
You will understand
- ✓ DEIMAN Honest religion p. 31.

Discussion: Religion of Jesus
vs. "about"

1944 Mar 7.

Vote of thanks to Prof W. Gordon.

Carlyle

Life - a little gleam
between two eternities

Wm James

Life is a struggle in
which something
is eternally gained.

Biography is the art of
making real & vivid
this little gleam ^{& perpetuating} ~~perpetuating~~
to all who read the struggle
& the achievement.
We are grateful indeed to Prof Gordon

Address at
IFOW Council Dinner
Copenhagen
1949 August.

Perspective in Time

300,000,000

Earth's box.

300,000,000

Land surface, rocks

3,000,000

life moving

towards the
appearance of
primitive man

3,000 our early

ancestors living
here, erecting
stone circles
& stone grave
mounds.

300 yrs ago + 1

the great Danish King
[?] died.

a date Dr Skjoldhorn
told us every Danish
sch. child knew.

30 years ago I did

It is significant

34.

~~the legal~~

Our Ideals.

Freedom to make friends

" to seek truth

" to express our views
& interchange our views

What do we do?

Constructive Internationalism

Newham Club Kingston
1948 Jan 11 .

St James Lit. Soc, Montreal
1948

Jesus infused into the world a new spirit:

Renan gave to man the highest conception
of the perfect nobility of the
children of God.

Zoroaster Live thy life & do thy work
and never fear nor worship the
powers of evil.

Augustine Courage, my mind &
press on mightily.

Bacon
Bergson
Renan

Internationalism
words → action

1. UNO fight deflection negotiation
& opinion.

UNRRA. Locos. Vanglam
WHO, IRO. Ch. Fund. FAO, ICAO
UNESCO.

2. Non gov. int'l bodies
Red Cross friends
I.F.U.W. wire sports - India
195 Geneva League of Nations
Can relief projects.

3. Spread international recognition of
our indebtedness

Value of Bible

Chalmers Church

Sunday 1949 Jan 30

1. Bible reading in early home life
Great passages

Be then strong & very courageous

To him that overcometh

He that dwelleth in the secret place of the ^{most high}
God is our refuge and strength
God is love - God is light and in him is no darkness
Let not your heart be troubled, ye believe in God,

God is a spirit, they that worship him
must worship him in spirit & in truth

2. The Bible emphasis on Truth Seeking - on Wisdom
+ understanding

Whosoever things are true -- think on these
The truth shall make you free.

The spirit of truth will guide you into truth

PS 117 O praise the Lord all ye nations, praise him
all ye people for his merciful kindness &
great toward us and the truth of the Lord endureth
for ever

3. Old T. Through eyes of a scholar who is a
modern liberal Jew. C.G. Montefiore.
Read Hobbes J. July 1932 p. 563, 566.

- 4- New T. the record of a life that was lived on
the worship of God is an adventure of the spirit ^{earth}
Renan Life of J. 1. Jesus is the one who has caused his
fellow men to make the greatest step towards the divine.
2. He has fixed forever the idea of pure worship.
3. He infused into the world a new spirit -- the
perfect nobility of the children of God.

Out of great Tribulation

At Anglican Ch.
Yamouque

1946 August 25th

11 am Sunday Service

Contd.

No bitterness or cynicism
(ex. Saccha R.)

Mrs E. Cavell

Patriotism is not enough
There must be no hatred,
no bitterness

Gen Wainwright

It is not enough to be brave
there must be goodness
& kindness.

Sir R. Livingstone - ed's for
character. We must
hold before young people
not simply that which is
great but what is
both great + good

7.14.

These are they which came
out of great tribulation,

Jean Chesneau ✓

Sacha Racine ✓

Jean Levy

Madeleine Noel ✓

Jacques Brunols ✓

Combloux

Im

Int of the CA

Er Langens Raymond de Miribel ✓

Dutch 2 Dr.
2 Gun.

4 yrs Buchen
V2 factory

Sterranbury - underground - hunted.
captured - labor camp

Theo Priss. ✓

21 - 7.13

*"Courage is not enough
There must be goodness
There must be kindness."*

RECAST
SHOWERS

The

1

MO



GEN. JONATHAN M. WAINWRIGHT

said friendship had everything to do with the furtherance of peace.

In his speech he enumerated some of the things Gyro of Canada had done toward "making Canada a friendly country to live in." He told of some \$300,000 raised by the Hamilton club for a school for the blind and of Padre Jones' Cigaret Fund that had started in Montreal and had spread from here to the United States. In closing he said: "With the help of God, we hope, in the next few years, to make a communion of nations." After which he presented the international Key of Honor to Members Jack Steeves and O. G. Sentyon.

POST OFFICE THEFT DRAWS FOUR YEARS

Sherbrooke Man Is Found Guilty of Break in Sub-postoffice

(Special to The Gazette.)

Sherbrooke, October 7. —Gaston Leger, 28 years old, of Sherbrooke, was sentenced to four years in St. Vincent de Paul Penitentiary by Judge Anatole Gaudet in magistrate's court when he pleaded guilty on Friday to breaking and theft at the sub-postoffice in Simard Darche's premises at 8 Wellington street south on July 11, 1945.

Accused was taken in custody by Cpl. R. W. Murray Smith of the local detachment of the Royal Canadian Mounted police working in

cooperation with members of the Municipal police force, detective Sgt. Pierre Arcand, Det.-Const. Gaboriault and Det.-Const. Albe Tanguay, shortly after trying to dispose of the loot taken in the robbery. Police said tonight he had endeavored to sell \$28 worth of stamps for \$19.25 and this transaction provided the clue which led to his arrest.

Cpl. Smith said tonight that about \$3,000 worth of stamps, postal notes and other valuables taken from the sub-post office and Simard Darche's store had been recovered in the home of the accused, cached in his bedroom.

He added that Leger had entered the Darche premises by a small window at the rear and in addition to stealing a small strong box from the post office, which contained \$2,448 in stamps, postal notes, war stamps and also \$252 in cash, had forced open Darche's safe and taken a tin box containing war bonds, insurance policies and other documents.

Leger elected for a speedy trial when he was arraigned before the magistrate and pleaded guilty. He will be taken to St. Vincent de Paul Penitentiary probably tomorrow.

SUCCESS FORMULA WORKS

—for Bill Morton, Winnipeg-born tenor star, guest artist tonight on the special Thanksgiving program of "Canadian Cavalcade."

"I've found," he says, "that if one works hard and doesn't say no, opportunity has a way of turning up in the right places."

Hear him. Hear trumpeter Bobb Gimby and a true, Canadian mother son story — the most-moving drama ever told on "Canadian Cavalcade."

TUNE IN TONIGHT TO

"CANADIAN CAVALCADE"

Presented by

Borden's

OLD MILL CAFE

1192A ST. CATHERINE ST. W.

One Block West of Peel

TODAY'S SPECIAL

Leek and Potato Soup

Braised Smoked Ham,

Burgundy Style 70c

Roast Young Turkey,

with dressing

Cranberry Sauce 95c



Vision + Courage.

Women's Canadian Club
Sudbury
1940 Nov. 25

HENRI ELIE
PROPRIETOR

EUROPEAN
PLAN



Mr Stephens
President
AL. BOULEAU
M. Anderson R.A. '29

Mrs K. Clarke Sec.

200 ROOMS

TUB AND SHOWER
BATHS

The Nickel Range Hotel

Sudbary, Ont.

Womens Can. Club.
1940 Nov. 25.

Vision & Courage

Value of Can. Clubs - wartime needs & cooperation
youth in our colleges - leaders of future
Vision & dreams, R.L.S. courage.
Reason. Advancing in life -
+ even NOW.

Heart softer - tolerance, no hatred.
Living peace - silence.

Vision in Community life - apathy
Democracy. Better.
Long future of mankind

Vision in international life. Challenge of present
to plan for future.

Education for world citizenship

Hotel of Astron. 15 men Babylon
to Canada.

Rathlan L. pool. Bec. he had faith
in God, he could never despair of man.

Thinking as
World Citizens

Womens Institutes Conference.

Belleville

1941 Oct. 22.

Thinking as World Citizens

A. The greatest need in the world today is for people with simple Christian principles who can think as world citizens -

- ✓ antiquity of man. self preservation.
- family loyalty
- Clan + tribal loyalty
- national + in 1479 B.C. ^{Confucius} _{Confucius}
- ✓ Bergsons 2nd loyalty
- World loyalty

✓ Efforts towards this end

Internationally minded people have begun the good work.

- ✓ Int. Red Cross
- ✓ Int. Y.M.C.A. + Y.W.C.A. + S.C.M.
- ✓ " Service + professional clubs -
e.g. Bus + Prof. Women,
Rotary, etc.
- ✓ " Trained Nurses - Miss Lindbergh
- ✓ " Chambers of Commerce
- ✓ " Student centres in many countries
- ✓ " Federation of Univ. Women ^{Pole}
- ✓ League of Nations ^{Russian}
+ Int. Labour Office ^{Swiss}
- ✓ Not all list effort ^{True news Pacific}
- ✓ W. I.'s are part of Int organization ^{Countrywomen of the World}

London 1939 -

B ✓ Why not isolationism?

Interdependence -

1. food
2. clothing + shelter
3. fuel + transportation
4. intellectual
5. ethical

Obvious in 1-3

✓ Consider 4 - Growth of knowledge in every field, an international record.

[Consider 5 - Unity of mankind *

C - need to impress mutual indebtedness on children.

✓ Our Task - personal ✓ 2 sins (selfish greed, local health, (apathy, national - political integrity, international wide vision, faith, patience)

✓ W. M. K. asked the old? of cars are we our brothers keepers?

✓ L'pool - Bec. he had faith in God he could never despair of man.

* Fatherhood of God + Brotherhood of man

✓ not sentimentalism about the urge to produce conditions where others may live as ~~free men~~ individuals of intrinsic worth.

✓ Renunciation quot Lippman.

University Women's Club
~~Queen's Alumnae~~ Dinner
Belleville
1942 Jan. 19.

A Challenge to University Women

Began with Univ. W. Club + CFUW + YFUW + Reserve Scholars
+ Krystyna Zburanska.

Today we hear two slogans repeated
over & over, echoed & re-echoed -

The one is 'Let us make a total
war effort

the other 'Let us plan our program
of reconstruction Now.'

It is the latter about which I
want to speak.

What can we do?

We are University women who
as undergraduates and afterwards
in the postgraduate school
of experience in the life of
our communities have learned
a sense of responsibility and
have assumed duties and tasks
of influence & leadership in our
various spheres. Or we are

women who have learned those same lessons of responsibility and civic duty by going straight into the post graduate school of experience in the world of everyday affairs.

2 greatest evils Selfish greed (affecting) Apathy (passive)

I think the two greatest requirements in the world today are UNSELFISHNESS and a sense of WORLD CITIZENSHIP

The problem of evil in the world is not only a local one it is a world problem.

omitted

Rip van Winkle - "I won't count this time"
"He may not... But Nature does count it."
Relentlessly, inexorably and inevitably it is counted...

So too with the ulcer of evil in the world - we may ignore it, we may, like the Levites, pass by on the other side but by all the laws of nature, it affects us

omitted

The octopus of evil - in Manchukuo, in Abyssinia, in Spain, in Muremburg, Munich and Berlin - that is an old story, that was years ago and we were apathetic and selfishly aloof and today? This evil thing has spread & spread until we have the awful spectacle of suffering and anguish, of despair and hunger, of wastage and anxiety that is world wide today.

- ✓ Wars will return & return to scourge the earth until man learns the lessons which seem self-evident while the struggle is going on.
- Selfish greed & abathy must go.
- ✓ World loyalty, a practical internationalism must rule.

Organizations like the I.F.U.W. are working to this end.

Int. Fellowships

Refugee Scholars -
a.a.w. → I.F.U.W. \$3000

Challenge to each of us to use our influence towards a practical internationalism

- ✓ Ethical argument - unity of mankind.
- ✓ Economic " - interdependence
- ✓ Historical " - indebtedness of each to all - see hist. of development of sci, art, philosophy, med. etc!

✓ International Committee on History Books.

Problem of perverted youth.

Herbert Journal 1941 October

Problem of our own youth - fight against the spirits of hatred.

Need for establishing real democracy in our own midst.

- ✓ 1. integrity in our leaders M.P. re. + mis use of party politics.
- ✓ 2. willingness to bear taxation in peace times for health, housing + employment projects.

Mr. Noyes believes that poets, along with most other people in today's world, have lost sight of the fundamental principles and truths upon which civilization has been built, and "we shall never again have a good world until we rediscover the old sun that makes the new morning," he said.

He feels that in recent years there has been a decided breakdown in the principles of poetry and all the arts. "People are losing the power to think, write, and paint beautifully," he said. "There is a substitution of ugliness, violence, and discord."

He deplores the attempt of so-called modernists to relegate everything into a scientific category. "There are things in this world which can never be brought within the forms of science," he declared. "Science must always leave something out. One cannot explain away God, conscience, the power of the spirit, and the power of beauty. A scientist might say, quite rightly, that Beethoven's Ninth Symphony was simply the scraping of catgut on catgut. He could even tell you the pedigree of the cat. But you and I know it is much more than that. Too many people are trying to explain away those things which make life of value to us."

With that, he rose, shook hands warmly, and carried his youngest out of the room on his back.

The fastest man has run is 21.76 miles an hour.

L.P. Jacks Legends of Snuckover.

One character Hooker

Solve that in affirming your own personality, you may help others to affirm theirs.

Another character Rumbelow - 3 principles

- ✓ 1. Ideal aims
- 2. Business like methods
- 3. Sportsman like principles

cf. An Whitehead.

✓ Religion is an adventure of the Spirit.

Henri Bergson

✓ Think like a man of action.
act like a man of thought.

Education in a
Democracy

YWCA.

Business & Professional Women's Group.

1941 March 19.

ix
b
J.F.U. W. 1919

Callus
Smedley McLean

Br to USA. Can
etc

38

news / USSR

- Italy
for Aust. Czechs

Ed. of Women
in Germany today

Prof. Patzelt Vienna

x. Opportunities for highest
ed. of Women in + only in
Democracies.

Buchman

J. Mass Hall YOUTH

Youth

: duty of parents -

ii international indebtedness
inculcated early
appreciate the best in
other nations
(Bergson's Loyalties)

iii internationalism can
only be taught by
democracies

3 Mrs Melvin

Democracy + Christianity

iv Love + Work

Things in the Saddle

Housing in K.

Municipal undertaking.

v We must fight APATHY

Salvo impetuous
bitter fanaticism

Example Youth movement
+ Honda

3/ Mrs Delahaye
Married woman

4/ Mrs Platt
Significance
of individual

women, influence
in home
esp.
religion
social service
health

Reference to i

5/ Mrs Harkness
Responsibility:

Woodworth & Coleridge

Mitchel
Trinity Abbey

R. of Am. Moral

17-- A.D.

Democratic party

1832 Franchise bill

viii

Relationship betw

freedom +

curtailment by

rights of society

Need for Internationalism

vi farisplay of
women single
or married

vii Buckmaster

PANEL DISCUSSION

Wednesday March 19th. 8.30 P.M.

THEME

" GO OUT AND VITALIZE DEMOCRACY "

Speakers on Panel

Dr. Douglas Mrs. H. W. Earkness
Miss Hilda Laird Mrs. G. Helvin
Mrs. J. S. Delehaye Mrs. G. Platt
Miss Margaret Hall

An informal discussion from the floor will follow.

Miss Margaret Hall, President of the W. W. C. A. will be hostess at a social hour.

Please telephone acceptance for yourself and friends. PHONE 130.

Met Mrs Paul . Co-Inspector of Public Schools for Lanark Co. Ont.

A. Lord. mother of E. Paul in Physics.

To come to dinner in BRH some time when in town.

The Ideal of World Citizenship.

To "Women of Rotary"
(To wives of Rotarians)
Cent. & N. Y. State
Blinkhornie
Guanosque
1941 May 19.

To Wives of Rotarians
Ontario + N. Y. state.

Intro:

Some Canadian poet has written these words
Beside the harsh base speech of sordid life
The murmur of the stars falls pure.

We are deafened today by the harsh base noise
and by the shriek of devilish cruelty & brutality
so widespread in Asia + Europe today.

The challenge is to every one of us individually
to use all our influence to bring the reign of
terror to an end, to put down aggressors, to
re-establish a state of things on this beautiful
& wonderful earth where honesty & decency
& kindness will once more be the ideals of
men + nations.

Conclusion

Let us never forget that each one of us is exercising
an influence that is either going to make war in
future years + centuries inevitable - or less & less
likely & finally impossible.
I beseech of you, every one, to use your influence always
never towards this great & so essential ideal of World Citizenship.

It is a pleasure & honour to address an
internationally minded group of women.

The last time - 21 months ago. There were women
from 25 countries present. Of those countries 11 are
now under German domination. + their national
restitutions of women are banned. The Peace
at that Stockholm Conference was a WORLD CITIZEN
Dear Virginia Gilderstone of Barnard Col. N. Y.

The Ideal of World Citizenship

Too much Nationalism.

Henri Bergson's 2 Loyalties.

Norman Angell's internationalism, world
Consciousness, sense of responsibility; willingness
to renounce some degree of sovereignty for
the good of the whole - for world peace
& international cooperation.

2 arguments (1) Ethical. Unity of mankind
(2) Economic.

Need for Education

A generation growing up from infancy thinking
internationally - realizing the immense debt that
every nation owes to other nations.
Records of philosophy, literature, art, all the sciences.
Treasure hunt down the centuries of Astronomy.

Introducing Dr. Sydney E. Smith
in Grant Hall
AMS Lecture

1941 Feb. 26

The students of Queen's Univ. have asked me to be their mouthpiece in welcoming Dr Sydney Earle Smith to their Campus.

In selecting him to deliver the first Alma Mater Lecture they have chosen an outstanding Canadian
A native of N.S.
~~He was born in N.S.~~

educated at King's College, Dalhousie Univ.
(and at Harvard).

He served in France 1916-18 in 9th Siege Battery
and transferred to the Roy. Flying Corps in 1918-19

He ~~returned~~ ^{became} as a lecturer in law at Dalhousie
and was called to the Bar of N.S. in 1921

In 1925-29 he lectured at Osgood Hall, Toronto
returning as Dean of Law at Dalhousie
1929-34.

Seeking other worlds to conquer he went out to
30° west of the Atlantic ocean, stopping ^{Manitoba}
30° East of the Pacific ocean at a point
about 40° from the N. Pole where he
found the relative young but potentially great
University of Manitoba. To it he has
given six fruitful years of service as President.

He came to Queen's in 1937 to receive his B.D. honoris causa.
He returns to Queen's today to give the Alma Mater Lecture
In choosing as his subject today

Education and Faith he is following

the best traditions of some of the great lectureships
established in the last 100 years

The Gifford Lectures in the Scottish Universities

The Swarthmore Lectures in London

The Lowell Lectures in Boston.

We believe that he will give us much to think about
& we hope much to argue about.

I have the honour to call upon Dr Sydney Smith to
deliver the First Alma Mater Lecture.

Vision & Courage

University Women's Club
Peterborough .
1941 Jan. 13.



Vision & Courage.

1. C.F.V.W. & I.F.V.W.

Refugee guest scholar.

2. Youth of Today

George Norlin Things in the Saddle.

Henri Bergson. Think as a man of action
act as a man of thought.

3. Our Ideals for Our Students.

personal. Vision & Courage.

integrity,

Ruskin: advancing in life

heart softer kindness tolerance

no hatred.

Edith Cavell.

living peace. silence.

community. Vision

in society. & in democracy.

Benes

internationally

world citizenship

faith in mankind

problems of today & tomorrow

long future of mankind.

Liverpool Bee. he had faith

in God he could never

despair of man.

Believe in belief.
Francis Thompson.

Address of Welcome to Queens S. Sch.

Grant Hall
1944 July 12.

Thanks to Chairman (May Mead)
for graciousness.

Ref to Dr MacClement
Dean Matheson

Their influence in Q.S.S.

Congratulations Q.S.S. on new Director.

He too will have a great influence

Influence is a wonderful thing.

Francis Thompson.

"Believe in loveliness, believe
in loving kindness, believe in belief."

These three - without which all
our knowledge + all our striving
to impart knowledge will be
fruitless.

These are given + abundant + senior days
We need the friendship + comradeship
of the Q.S.S. Good success to you
all in academic work + in all
Q.S.S. activities.

Arthur Stanley Eddington, O.M.

Memorial Lecture
Ottawa R.A.S.C.
1945. March 1.

Arthur Stanley Eddington, O.M.
1882 - 1944.

With the death of Sir Arthur Eddington on
Nov. 21, 1944 a very great man passed through
the portals into the unseen world.

Slide 1. ass. b. Kendall 1882.

Stramangate sch.
Cornwall. Read tribute to Dr Alan Brackington
Owen's College Manchester.

Slide 2. Cambridge. . . . influence of
Trinity Col. Newton
amy, Cayley,
3 } JKRS. Stokes
4 } Adams
5 } Harmon
6. Thewaldsons Geo. Darwin
Newton. J.J. Thompson.

The mother lode of a
mind forever boy of it
through shape seen
of thought done.

Sen. Wrenner 1904

Smith's prize 1907

Fellow of Trinity 1907

Slide 7. Greenhill. Chief assistant 1906 - 1913.
Plumian Professor & Dir. Camb. Obs 1914.

Dr Alan Brookington.

To me it meant the transformation of those wearisome school hours devoted to English into a time of joy & revelation. Our class was too young to respond easily & instinctively to the appeal of the poets & the great prose writers. It was the personality & enthusiasm of the Master that illumined the field of English literature for us. He not merely opened the door; he swept us through with him.

ASBdd.

Mysticism & Poetry.
Chapman & Hall.
Foreword.

at Greenwich. 1906-13.

Stellar motions -

Slide 8. Halley 1718. Proper motions. asteroids & stars

9. Differ $\pm 200,000$ yrs

Herschel Sun's Way - distribution of velocities - ellipse.

Kapteyn - star streaming. 2 Drifts.

Edington projection method
& book Stellar Motions
& the Structure of the Universe

at Cambridge. 1913-24.

lecturing, directing work of graduate students
and engaged in long series of researches
of 1st rank fundamental importance
in physical nature & internal constitution
of the stars.

Read. S&A. p. 9.

Slide 10

Balances - 10^{27} atoms 10^{28} men

Pressures & temp S&A p. 11, 12, 14, 15, 20, 21.

Radiation pressure
& control of stellar mass S&A p. 24, 25

Interior of a star p. 26, 27, 28.

Stars a physical lab p. 83, 84

We can only mention Eddington's Theoretical calculations of the diameter of Betelgeuse and the density of Sirius' dwarf companions.

Slides 11 March sky 9.

" 12. Diagram of Betelgeuse

" 13. " " Sirius
 Bessel 1844
 Alvan Clark
 Eddington
 W.S. Adams

Researches on Mass-luminosity relation Mar. 1924
 on pulsating stars subatomic energy,
 on diffuse matter in space

" 14 } nebularly. Read. S & A p. 83-84
 15 }
 16 }

" { Nature p. 758 Dec. 16, 1944
 H. Shuman paper on Bakerian Lecture
 El. Milne p. 760
 Titanic debates.

17. J.H.J.

Read essay p. 4. R. S. Gold medal
 to J.H.J.

Read. S & A p. 41. Daedalus & Icarus.

All this is fundamental work that has laid the foundations on which many others have built & in the superstructure there is much too due to Prof. Eddington

→
Harlow Shapley's tribute

The first & greatest exponents in the English language of Relativity & Cosmology.

Slides

18 Einstein ¹⁹¹⁵ & de Sitter ¹⁹¹⁷

Eclipse May 29, 1919.

E at Principe, Comenius d. Sobras

19. de Sitter & Eddington

Read Essay. foot of p 1 - 2

Slides

20 Lemaitre

21
22
23
24
25

~~Expanding Universe~~ Expanding Universe -

Spurals

Read preface Ex. U. p. vii.

Red Shift

p 93.

111 in words.

number no. 137 114

Read essay p. 6 * 7. 7a, 17

26 ASE

Eddington's Philosophy

Read essay. foot p. 7

To end

Began with this

{ Ecclesiastical 44
part of vv. 1, 4, 5, 6, 7.

1940 Feb

The Beloved Task of Living

~~W. H. ...~~

Another academic year has just come to an end. For each of you it means the anniversary of your own graduation n years ago, where n , with that amazing good nature exhibited by some mathematical symbols, can stand for any integer between 1 to 36. Indeed for some here present $n = \text{today} - \text{yesterday} = 1 \text{ year}$.

1940
1860
56

For me, ~~n stands for n years of~~ ~~think of my own education, but~~ n stands for ^{academic} ~~in~~ my association with Queens - and a very very happy ~~and~~ session it has been - rich in opportunities & use in small ways - rich in personal contacts, rich in new experiences, rich in the kind outpouring of very genuine friendship extended to me. To say I am very grateful is pathing my feeling in a very blunt + unadorned way - but none the less sincere -

It is probably natural ~~that~~ on such occasions as Convocations & Annual meetings ~~and such like times~~ that we become a bit introspective & full of curiosity and ask ourselves all manner of ^{discovery} questions - Have we achieved anything much that is

2

worth while? Have we progressed
in our own thinking? Has our philosophy
of life mellowed & become richer, and
has it any dynamic qualities? Or
have we just been going round and
round like an animal chasing its
own tail - You have all seen a
pussy cat going round in circles
chasing its tail - and ^{it's} really or
rather futile performance. ~~It~~
~~is~~ Futility is a very bad
word and none of us would
choose to have it on our tombstone.

How best can we avoid it.

When I was thinking along these
lines and pondering what I would
say to you, my thoughts - went
back to the first time I addressed
a graduation ~~at~~ dinner at McGill.

I sat down at my desk and said to
myself - What shall I say? But no
ideas came into my head and I thought
& thought & I munter about in my mind

and still no ideas came, and after
 floundering about for a long time in
 despairation I cried What shall I say?

And then a strange thing happened
 That little imp - that mischievous
 little dare devil - that lives somewhere
~~deep~~ ~~in~~ in the subterranean
 depths of ones self, began to laugh
 at me & there was ridicule & scorn
 & mockery in its tones - and it said
 to me Don't you know yet that
 the best way to get a good idea
 is not to go worrying and searching
 & scrambling all over everything hunting
 for it, but to sit back and let me
 the imp, the Caliban, the Ariel drop
 the right idea into your mind - One
 moment you have no idea
 the next moment there it is - out
 of the blue, unheralded, falling
 as gently as a leaf wafted to the
 ground, appearing as noiselessly
 as a dew drop on the grass. It was
 a challenge & being desperate I took
 it & an unspoken agreement was suddenly

a fait accompli. I would use whatever
came first into my mind. So I sat
back and waited — and what do you
think was the first idea to come into my
head? "Silence is golden"

Silence is golden — not at first perhaps
a very promising topic for an address — and
yet suddenly it dawned upon me that
this was the very subject above all others ^{about} which
I would like to talk. And that is just how
I feel today.

Do you remember the sentence of Carlyle
Looking out on the noisy inanity of the world
words with little meaning actions with little
sense how one loves to contemplate the great
realm of silence — silence is deep as eternity!!
Noisy inanity is the world around us — in
Europe ~~on the continents~~, in Asia & the islands
of the sea. noisy inanity in neutral countries
noisy inanity in our own country, in some
of our recent political speeches — words with
little meaning, actions with little sense.
and perhaps, perhaps in our own lives there has been occasionally just a trace of it!
We are so buffeted & beaten upon by noise —
physical noise & the noise of opinions and
mass madness, ^{& of our own discordant thoughts} that we can rarely
experience that great gift of the gods — real
silence. We need to withdraw into silence
to knit up the ravelled sleeves, to heal the
bruised minds, to resensitize toughened
and calloused sensibilities.

Sometimes when we need it most it is utterly impossible to get away from ^{the} physical noise of the work-a-day world, a world of machines and rush and bustle, ^{awful} full of sound & fury — and then we need to have cultivated the habit of being able to withdraw even momentarily into the silence of our own spirits.

You remember the beautiful Greek idea of the music of the spheres — the divine melody & harmony resulting from the motions of Sun, Moon, planets and stars in the great outer universe — That was a mystical music that the crude physical ear of man could never hear, it plays in only upon the listening spirit & where it is heard it uplifts, it inspires, it heals. Keats has told us of this miracle

and music lifted up the listening spirit
 Mental it walked, exempt from mortal care
 Godlike, on the clear billows of sweet sound.

Shakespeare has told it thus

There's not the smallest orb that thou beholdest
 But in his motion like an angel sings
 Still quivering to the tune of celestial spheres
 Such melody is in immortal souls
 But whilst this muddy vesture of decay
 Doth grossly hold us in, we cannot hear it —

But the immortal soul can feel ^{it can respond to} this harmony; while to the listening spirit it brings peace and strength.

I hope you do not think that I am just talking nonsense, just trying to fill up ten minutes with words - I really do believe in what I am saying. It has been my experience that contemplation of the laws of nature resulting in the harmonious behaviour of electrons, atoms, radiations, planets and stars plays in upon my spirit like music bringing strength & courage when oppressed, bringing peace even in the midst of turmoil and perplexity. I value silence more than I can ever put in words & I feel the truth of Byron's line - "In Solitude when we are least alone".

In a book by the late Master of Magdalen College Cambridge, a book the subtitle of which is "An Experiment in Solitude", a book in which the author's mellow philosophy of life is interestingly portrayed I came across the phrase "The beloved task of living".

There is something haunting and quite definitely challenging about these words - Do we look upon life as a beloved task and if not should we be satisfied with anything less? I am not now thinking of those whose lives are

weighed down with suffering, with
desperate need and frustration, ^{with} ~~with~~ anxiety or
~~and~~ discouragement. That any such
can experience contemplative life as a
beloved task is a triumph of mind and
spirit over the physical. ~~But~~ the significance
of which can scarcely be exaggerated.

There is a story of Jowett of Balliol that ~~is~~ *D.

But for the vast number of us, average
people, with normal health and enough to
eat, with a good environment and a store
of such memories, with work to do and the
ambition to live and learn, and to play our
part in the world, there ought to be an
experience of the genuineness of this
phrase "the beloved task of living".

Life is not easy for any of us in
these days. neither for those of us who
lived and worked and suffered in
the Great War years. nor for those
who have grown up since. We have ^{at} seen
the recent years of trial and error, high
hopes of peace linger & die & a new era of
war engulf half the world.

If we are to keep high ideals before
us and wield an influence directed

The beloved task of living.

There are some people whose philosophy of life is rugged, bold and dynamic, there are others whose philosophy of life is far from being aggressive yet in no sense ^{is it} "impotent." ~~and it may perhaps be rightly described as~~ mellow. Such an one, I think, ^{was} ~~was~~ ^{at least} certainly from what I have read of his writings, and from an ~~address~~ ^{address} that I heard him give in London in 1917 I would say that here was a man who had a mellow philosophy of life.

Quite recently I read a story that Master of Magdalene College, Cambridge he wrote some years ago, the sub-title of which is "an experiment in solitude" ~~and in this book I came across~~ the

phrase "the beloved task of living." There is something haunting & quite definitely challenging about these words.

Do we look upon living as a task and is it for each of us a beloved task? and if not ~~should~~ ^{could} we be satisfied with anything less? I am not now thinking of those whose lives are

8

Towards a world of peace which
is real peace, then we must have peace
within our own spirits. This is where the
Golden moments of Silence play an
essential part in our ~~daily~~ experience
& from such moments we come forth
to hear the command of Joshua
ringing in our ears Be thou strong
and very courageous, and then ~~with~~ we
take up once again the beloved task
glowing.

*⑦

You must know as well
as I do, but it never grows
stale - How an earnest
mystically minded student
asked the Master if he
thought a ~~very~~ good man
could be happy on the
rack and how Dr. Jewett
replied Perhaps a very
good man on a very
bad rack.

Giant & Dwarf Stars.

Baconian Society

Queens University

1940 Jan. 23.

Giant & Dwarf Stars

Fundamental entity of the physical world is Energy
This may be regarded as of two classes - Bound & Unbound.

Bound energy is matter - electrons, protons etc.

Unbound " assumes various forms such as motion, radiation

Estimate of Total No. of atoms in Universe. Hubble 1926 10^{81} protons
Edd. 1930 10^{78} protons

Eddington "demonstrating beauty of quantum arithmetic" $2 \times 186 \times 2^{258} = 1.57 \times 10^{79}$] = 10^{55} gms.

Distribution in possibly 10^{12} galaxies

150 000 on H.A. Plate in 1935.
30 000 on Mt. W. "

Matter within each galaxy aggregated into stars and
nebulosity. Total mass $10^{10 \pm 1}$ stars.

mass of an average star 2×10^{33} gms.

mass range 10^{32} to 10^{35} gms.

Gravitation, gas pres. & radiation pressure.

Range in densities very great 10^{-9} gm/cc to 10^5 gm/cc.

i.e. giants & dwarf stars.

Colours indicate range in Temp. at Surface. Red to Blue.

Spectra - Newton Fraunhofer 1814 Kirck 1859 Huggin & Secchi, Planck - Temp.

Stellar distances 1838-40 { ^{Strom} Bessel ^{Henderson} } ∴ abs. mag.

Giant dwarf sequences Hertzsprung Russell.

old evolutionary picture 1924 March. Edd. Mass-Luminosity Law.

gaseous throughout. R.H.F. degenerate gas.

Sirius Bessel 1844 Alvan Clark 1862 W.S. Ad. 1914 Sp. F

Solar Atmosphere. skylarking electron

Hot giants. Pulsating stars - spectrum variations - I.P.'s
Denser Blue giants. Stark effect.

Cool giants. Betelgeuse & Antares
& Arcturus. + Neviside Caper

Slides
3 galaxies
1 M. Way

Slides
spectra

Slide

Jan 8th 5.
3 5 min

Slide

He 4471

d Orion
2 am

16 slides

MOON

MONTH

0.5

Sidereal Month

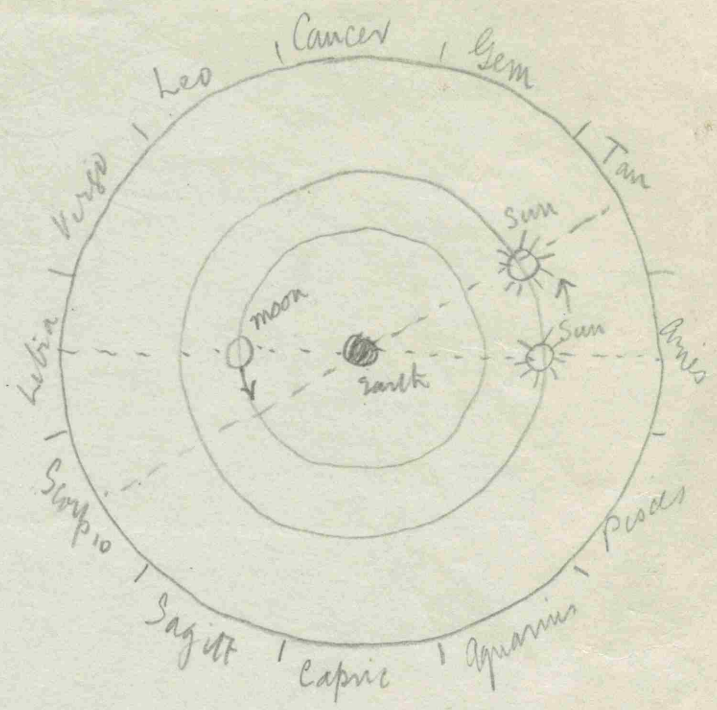
27.3 days

Moon in Libra (eg.)
returns to Libra.
MOON-EARTH-STAR.

Synodic Month

Moon opp Sun
Libra ... comes
returns to libra
but sun has
moved to Taurus.
Moon gets on
to Scorpio to
again be opposite sun.

29.5 days.



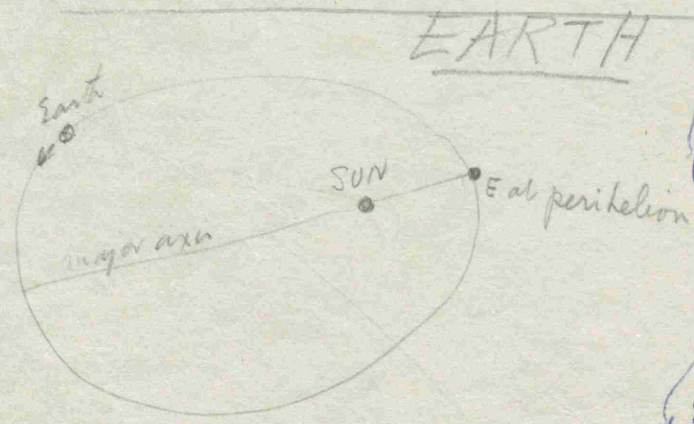
MOON-EARTH-SUN alignment

Naburiano	29.530614 days
Kidinnu	29.530594 "
Modern	29.530596 "

See Dante's Astronomy, p. 21
1936 April 21. for this diagram

STAR

p. 69



EARTH YEAR

Time to return to perihelion
(1) anomalous year 365.25964 days

But orbit is precessing ∴ perihelion pt moves eastward 11 sec. of arc per yr.

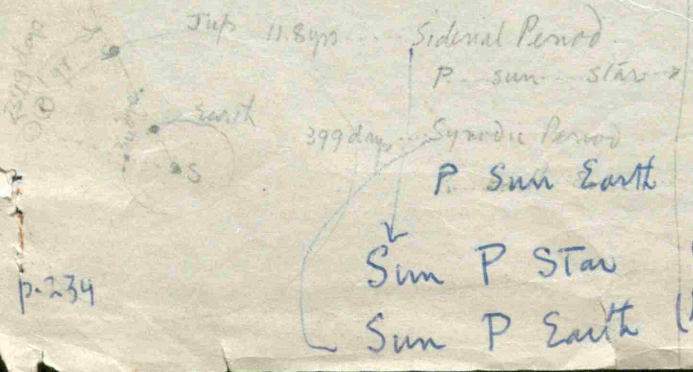
Time to return to a Sun-earth-Star position in the
(2) Sidereal year 365.25636 days

This is the true mechanical year

Time from Spring ~~Equinox~~ to Spring
(3) Tropical year 365.2422 days

Shorter than Sidereal yr by 20^m 23^s
due to earth's precession - discovered by Hipparchus
explained by Newton 1700 AD
amt of precession is 50 arc sec per yr

STAR PLANET PERIOD.



p. 234

Sidereal Period
P. Sun - Star
Synodic Period
P. Sun Earth
Sun P Star
Sun P Earth

(14) Calendar year

Astron

+ Astrophysics

1948 Summer.

1. Copenhagen - June 11. Astron - an international crowd
2. Reading - June 19. astron view the universe.
3. Birnighan. " 21 " " " "
4. Liverpool at Birkenhead " " " " " " (no slides)
5. " " " " " " " " " " (no slides)
6. Bradford. " " " " " " " " " " (no slides)
7. Leeds. " " " " " " " " " " (no slides)
8. Hull. " " " " " " " " " " (no slides)
9. Brighton. " " " " " " " " " " (no slides)

Astron - an international record.

June 1953.

It is a great pleasure, privilege and honor to address this gathering of Univ. women & their friends on an auditorium of the world famous Univ. of Copenhagen.

In one of his essays, Francis Bacon, has written men are not animals erect - but immortal gods.

not in some fields of human hist. war. etc. etc.

But in sci. in quest for truth -

in the achievements of the truth seekers

curiosity imagination
scepticism.

Bacon on man of sci. p. 153. "desire to seek, patience to doubt, fondness to meditate, slowness to assert, readiness to reconsider, carefulness to retract - a man that hates every kind of imposture."

If we hope ^{see} to the spirit of unselfish cooperation, which has been evident in sci., applied in the general affairs of mankind, we must educate a generation of men & women who are internationally minded - WORLD CITIZENS - recognizing the tremendous debt which any one nation owes to other nations.

from earliest childhood -

Astron not unique but typical -

Astron. had its birth when man first stood erect & looked up.
 2 essentials: 1. Direction, 2. Chronology - Time.

1. Koran
2. Units of time

SLIDES - Mapped constellations - 7 wanderers.
 Geocentric universe.

1. Babylonian Tablet - 4000 BC
 1st new moon of year near Gemini and Sun God.
 oldest record of an astron. observation.

Hipparchus
 Ptolemy
 Copernicus
 Tycho Brahe
 1546-
 Kepler

2. Galileo's 1st tel. 1610
3. Newton's " 1672
4. Yerkes 40-inch = 101 cm.
5. Mt. W. 100-inch = 508 cm.
6. Dec. sky S. Pleiades . 7
7. extra focal. "
8. Maestlin 1579. " 11 stars
9. Galileo . 1610 " 36 "
10. Hertzsprung circa 1926 - 2616 stars.
11. Mt. Palomar. 200-in diagram
12. Diagram of stellar mass. Balances
 Kepler-Newton mechanics.

How do we know
 that man is a star?

13. Newton 1642-1727 Thorwaldson - Woodsworth
 The marble index alone.
14. Solar spectrum - Chem, tempo, pres. mag + elect
 velocities.
15. Quantum Theory - diagram of runners.
16. Secchi Types.
17. Hertzsprung, Russell Giant Dwarf sequence.
18. Sirius B ^{49th m.p.} - Bessel - Alvan Clark - Eddington -
 Einstein, de Sitter, W.S. Adams.
19. Giants & Supergiants - Eddington, Rayleigh,
 Michelson, Pease.
20. E. Aurigae - Period 27 yrs, partial eclipses > 1 yr.
 infrared supergiant - v. low density but
 not transparent bc. of Heavyside effect.

SLIDES -

21. Problems of Solar photosphere, chromosphere & corona
H Prominences

22. Ca⁺ prominences

23. Corona Coronium? Eddin Fe⁺¹³ to Fe⁺⁹
max^m darkia effect Ni⁺¹⁵ to ⁺¹¹
min^m streamers Ca⁺¹² Ca⁺¹¹ etc.

Energy to produce such ionizations?

Is it lan atomic disintegration near

photosphere surface hurling neutrons outward into
corona region?

Radio noise from Sun (& other stars -

from sunspot regions & flares -

λ 20 cm to 30 metres is range observed at Canberra
by DF Martyn.

Saha: source of solar radio is atoms with spin
in a magnetic field: 100 gauss λ 4 m
660 " λ 1.36 m

several thousand " λ 0.67 m

In a large sunspot 4500 gauss is the field.

see notes (D) Martin Schwarzschild. acoustical
alfen - magneto hydrodynamic waves

High temp in
Corona

24. Proper Motion - Halley 1728
 Boss Gen. Cat. 33, 342 stars.
 Uts. Maj. $\pm 200,000$ yrs.
25. Nebulae \checkmark Lyons
26. " Orion [Milton: Behold the Throne of chaos and
 his dark pavilions spread
 wide on the
27. " Horsehead. oort formation of nebulosity
 evap. + condensation - movements and
 friction + bright edges.
- 30 28 Milky Way Sag raph + center of galaxy
 dark nebulosity - Interstellar matter
 see notes (B)
- 28 29. Plaskett's diagram of our galaxy 10" stars
 and as much interstellar matter.
- 29 30. Star chart July sky. S. C. of galaxy.
- 31 M51 Whirlpool. lanes Ven. Lord Rosse
- 32 M31 - 800,000 ly. 40 ceph. variables marked
- 33 Spectra of spirals. Red shift - de Sitter, Lemaitre
 Expanding universe. Eddington - calculations
 lens F0.6 aper. 2" focal length 1 1/16" Spec 1/8" 572 Kmp/sec/mg.psc.
- 34 M81 Uts. Maj. exp. 4 h. 15 m Mt. W 60 in.
- 35 Edd. + Dr W. de Sitter in Cambr.
- 36 de S. + Einstein 1932 Pasadena
37. Einstein + Rabindranath Tagore 1930.

(A)

Our Galaxy: $100,000 \text{ l.y.} \times 10,000 \text{ l.y.}$
Sun: Period $200,000,000 \text{ yrs.}$
Dist from centre $30,000 \text{ l.y.}$

Precession $26,000 \text{ yrs.}$
mapping of constellations circa 2700 B.C.

Col. Red λ 6438.4696 \AA.

Radar to moon 1946 Jan 10 λ 2.83 cm.
 ν 106 mega cycle.

Mass of Sun $3.3 \times 10^5 \text{ earths}$
 $= 2 \times 10^{33} \text{ gms.}$

66 elements of the 96 show lines in solar spectrum

Corona Fe^{+9} to Fe^{+13} Ca^{+11} , Ca^{+12}
 Ni^{+11} to Ni^{+15} etc

max^m - dahlia effect - min^m - streamers

Aurora mol N., atomic O.

11^x - 1838-1900 Bessel 6.145. Henderson & Cuth Sturrock

1 pc = $3.26 \text{ l.y.} = 2.06 \times 10^5 \text{ au}$

proper motion - Halley. Ross Gen. Cat 33,342 stars

nebulium O^{++} , O^+ , N^+

Cassiopeia nebula was nova of 1054 AD & is 11^x 4100 l.y.
 \therefore date of explosion of star B.C. 3100.

Nova Aquilae 1918 11^x dist 1200 l.y. \therefore 700 AD

vel. of exp. shells. 1700 km/sec + 800 km/sec
change in m 11^m to -1^m .

Average M. novae $-5^m.5$

Super 11 -14^m and $-11^m.5$

$10^8 \times$ lumin O, 10^7 lumin O^+

M31. mass $3.5 \times 10^9 \text{ } \rho$ Per. $17 \times 10^6 \text{ yrs}$ $800,000 \text{ l.y.}$
most dist spirals $500 - 700 \text{ l.yrs.}$

Interstellar lines & bands.

10 atoms: H, O⁺, O⁺⁺, N⁺
Na, Ca, Ca⁺, Ti, K, Fe
3 mols: CN, CH, CH⁺

Sizes of ptcls in interstellar clouds
10⁻³ > size of ptcl > 10⁻⁵ cm
gas & dust.

Mass of interest matter = Σ main stars
Population 1 to 10 atoms/cc.

mystery line Δ 4430.8

Radar research. Sir Sch. Appleton (Br 1907)

- i. ionosphere subject to marked solar control with sunspot cycle in ionization densities
- ii. Transient radio echoes from lower levels of ionosphere due to meteor trails.
- iii. Sunspots are powerful emitters of 5 m. waves specially enhanced at times of visual solar flares
- iv. Continuous radio noise from Milky Way whether from interstellar space or from sunspot regions of stars not yet known.

Meteor trail ionization - radio reflections

(C)

Radio λ 's from Sun

20 cm — 30 m.

Range studied at Canberra, DF McIntyre
from "quiet sun"

Coronal region emission equiv to 10^6 .

Radar λ 4 m. \equiv 72 Mc/s.

used by Lovell & Hay (46 B) on Meteors
vels. — ionization of night atmosphere
1st trail radio echo 1933 Slough

Source of solar & stellar radio waves

Saha?
atoms spin in 660 gauss λ 1.36 m. region
100 gauss λ 4 m.
very high mag. fields λ 0.68 m.

In large sunspot 4500 gauss is found

Explanations of High temps in Coronal region.
acoustical

Ap. J. Jan. 1928. Martin Schwarzschild
Princeton

The mechanism which maintains the high temp. of corona may consist of a stream of acoustical noise produced by the granulation & which transmits mechanical energy into the corona.

From particle vel + high degree ionization } chromosphere $35,000^\circ$
& from radiation intensity in 10-metre region } corona 10^6°

Energy loss from corona 6×10^{25} erg/sec.

K.E provided by rising granules over solar surface 10^{30} erg/sec.

The stream of noise produced by granules will transport its mech. energy across the photospheric layers without affecting the dynamical & thermodynamical equilibrium of that region.

Ap. J. Jan 1928 p. 106. Minkowski

Planetary Nebulae are not produced from novae though similar class of instability may cause both.

- 1. vel. of expansion 20 km/sec for Pl. neb. 1000 km/sec for nova
Lumin in spectrum of pl. neb. show diff vel of exp. \therefore not a nova shell slowed down by interaction with interstellar medium.
- 2. Mass of Pl. neb. (not central star) $0.1 \odot$, of nova shells $10^{-4} \odot$.
- Duration 30000 yrs Pl. neb. 20 yrs. nova.

ter Haar. Purdue - colleague of Oort. Summary of Solar Syph Theories in P. P. A. S.

MN - 107 - 2 - 1947

Alphei solar granulation is turbulence in photosphere; magneto hydrodynamic waves; energy is 1% of solar energy. These waves are damped mainly in inner cor. where converted into heat hence high temp of corona is produced through magneto hydrodynamic heating -

Spirit of Truth & Love
Help us to understand one another
And make one another happy.

Rabindranath Tagore.

Life is a constellation - an unplumbed
dark stream with starry moments -

Is it not the task of I.F.U.W.

to use its influence in every country to increase
recognition of mutual indebtedness to the great & the good men &
towards reverence for truth & ^{women of every nation}

truth seeking, encouragement of
scholarship, of free exchange of
knowledge, of trust in cooperation
between all people of good will

and so to increase for mankind
the number of starry moments.

2 articles on JH Jeans.

In KRAS 107. 1 - 1946 p. 53

What impressed him most in nature was its
apparent docility to the sway of mathematical
concepts.

Jeans was much criticized by professional
philosophers (The New Background of Sci.
is altogether too complacent) but in
Physics & Philos. he gave as good as
he got, and made some shrewd hits
against traditional philosophy,
accusing it of omitting all half shades
in its picture of reality and attributing its
differences from physics to differences
of idiom. I think it is a sign of
Jeans' greatness that he ended as a
philosopher; that he came inevitably
to philosophy by the path of mathematics
& physics; that he was not content
to contemplate the universe merely as a
spectacle, but that he had to seek the
inner meaning of it all.

New light on *Oed* stars.

1. 61 Cygni Bessel 1838 $\mu\alpha 0.3$ $\delta 10.8^{\circ} 7'$
K. J. mass $A \approx B = 0.45 \odot$ approx.

1943

Dr K. Aa. Strand (Pub. Astr. Soc. Pac. Feb '43)

Visual pair $P = 720$ yrs. $a = 24'' . 6$

Deviation from Keplerian motion only explained
by assuming an invisible 3rd component.

21 Potsdam plates 1914-19

26 Lick + Sprawl plates 1935-42

$P = 4.9$ yrs.

No way of knowing which component is parent.

A + B are of closely similar mass

mass C = $0.016 \odot$, highly eccentric orbit $e = 0.7$

semi-major axis 2.4 a.u.

separation at periastron 0.7 a.u.

C is $\frac{1}{60}$ mass of sun or $16 \times$ mass Jupiter

+ less than $\frac{1}{10}$ that of least massive

Star known (Kronker 60 B $0.14 \odot$)

Since luminosity must be very small

61 Cygni C may be classified as a planet

This is the first time a planetary body
belonging to a system other than
our own solar system has been detected.

2. 70 ophiuchi K.O 4^m.3 // 0".192 or 16l.y

Binary P = 88 yrs.

Derivations from binary orbit, periodic both in R.A. & Dec.

97 Herts Leander McCormick Obs 1914-42

29 " Potsdam + Johannesburg

C has P = 17 yrs.

Impos. to tell which is primary star.

70 oph A mass 1.1 \odot

then C has orbital radius 6.8 a.u.
mass 0.012 \odot

70 oph B mass 0.7 \odot

then C rad of orbit 5.9 a.u.
mass 0.008 \odot
i.e. 8x mass Jupiter

H. Russell (Pub Astr. Soc. Pac)
55-79-1943.

61 Cygni C + 70 Oph. C.

Russell deduces upper & lower limits
for radii + internal + surface temp
for such planets.

Even the hottest of such bodies can
"hardly be self-luminous though
internal constitution resembles that
of a star. Almost certainly their
light will be that reflected from
their primaries."

(From Nature 153. Jan 8. 1944 p. 59.)

Ap. J. March 1944.

Andrew McKellar p. 162 comet, 1942 g. CH₂ band at 4050 Å observed
and possibly fortuitous coincidences at λ 4228 4235 4240 4252, 4, 6
with SiO₂ 4262.9, 4274 4283

Ap. J. Jan 1943. p. 41. $\mu = 0.20$

Reigel + Holmberg. 70 oph. 3rd component P 1741. mass C = 0.010

70 oph. A 1.10 C_{mass} 0.0120

70 oph. B 0.70 C_{mass} 0.0080

Sources of Stellar Energy

Math & Physics Club.

1943 Nov. 10.

Solar output.

Giant star output.
O or B.

Helmholtz

Radio activity.

$$E = mc^2$$

Carbon Cycle.

White dwarfs - core without H.

see. Am. Scientist. Σ Ξ Oct. 1942

Hans Bethe.

↳ Chandrasekhar in AAS 1943.

approx 40 students

3 women.

Telescopes & the Universe
they reveal.

Engineering Society
Queen's University
1946 Oct. 8.

Conclusion.

not a static universe

a dynamic universe but not the
arena of haphazard change

nor of mere repetition

a dynamic universe of directed change

or as A. N. W. has written

The order of the world is no accident.

Astr. the oldest science: Time units - deriv. summarizing.

SLIDES.

1. Dec. sky 5. Pleiades . 7
2. Maestling "
3. Galileo 36
4. Hertz spring 26.6
5. Hevelius
6. Galileo 16.10
7. Newton. 1672
8. Herschel 1795 4ft mirror . 40ft focal length.
9. Yerkes 40" 100 yrs after Herschel.
Engineering achievement.
10. " spectrograph
11. Solar spec.
12. Secchi types
13. 42" discs - Sir Howard Grubb, Perseus & Co.
14. Mt W.
15. Interferometer. Theory & obs.
16. Diagram stellar diam.
17. Mt W. dome
18. DAO dome
19. DAO 72"
20. Greenwich ~~1675~~ 1675.
21. Long. 0.
22. 16th cent. woodcut.
23. Myriad stars in Milky Way. Gemini
24. Perseus Twin clus.
25. Cygni ring neb. vast filaments & wisps of
glowing gas.
26. Orion Horse head
27. Other galaxies.
28. Can Ven
29. M 31
30. M 81.

Ap J. 1942 March. Chandrasekhar. & Heinrich
Relative Abundance of Elements & isotopes.

1. Not now believed pos. to be synthesized in interiors of stars. *Ref. see proposed in latter place*

2. Pre-stellar stages (2) reqd.

(a) V. high Temp & density
 $T \sim 10^{10}, 10^{11}$

$\rho = 10^7$ gms/cc or greater.

$\frac{1}{100}$ pc = 0.0326 l.y.
= 10^{16} cm

10^{16} cm = 10^{11} km
= 10^{10} mi
= 10^{10} mi

This means total mass of universe 10^{54} gms
Confined in a sphere of rad 10^{16} cm
i.e. less than $\frac{1}{100}$ parsec.

To Pluto $3.6 \cdot 10^7$
i.e. less than
 $20 \times$ rad. of solar sys

This high temp reqd. to build up heavier nuclei like Fe etc.

As temp falls, these heavier atoms are "frozen" into the mixture

(b) $T \ 5 \cdot 10^9$ to $8 \cdot 10^9$.

$\rho \ 10^4$ to 10^7 gms/cc.

By study of relative concentrations of protons, electrons, neutrons, α -plets positions the rel. abundance of all elements O to S is obtained good diagram p. 296.

$\log N_n$ neutrons } determine ρ
 $\log N_p$ protons }

3. H & He the most abundant, as obsⁿ indicates likewise.
 $10^7 \times$ as abundant as O.

H/He = $\frac{1}{3}$ shifting at lower temp seems to H predominating though O-S are then frozen

COPY:

Observatory, Cambridge:

Dec. 6/1943.

Dear Dr. Douglas:

Many thanks for Coleman's interesting abstract.
I have written to him.

Have you examined the nature of Hubble's evidence? He gives a constant in the d^2/dt^2 law: but the value of the constant is of no interest without an investigation of the probable error, which Hubble does not give. So far as I can make out his counts agree with the Lemaitre theory within their probable errors; and I think others have pointed out the unreliability of his determination. But even if one were to accept his value without criticism, all it would mean is that the average density of nebulae within a certain moderately large distance R_1 is 30 per cent different from the average density within the largest observed distance R_0 - not a particularly suprising deviation from uniformity.

The hypothesis that the energy levels (or (more directly) the emitted frequencies increase with time has no meaning unless you define the standard of energy or time, which you take to be constant. As I have no idea where this standard is to come from, the theory you propose conveys nothing to me. So far as I can see you are just making a relativity transformation $t' = f(t)$ of the co-ordinate t : and the reason why you appear to get observable effects is that you do not carry out the transformation far enough to verify that the effects cancel. At any rate, if you do introduce a new time-reckoning t' defined by some non-atomic standard which you do not state, you will have to transform your results to the usual time-reckoning defined by quantum-specified standards before you can compare them with current physical theory. I expect that the theory (when adapted to avoid disagreement with our general knowledge of physics) will turn out to be simply the expanding universe theory referred to another system of co-ordinates.

I just don't understand this eagerness to find some other theory than the expanding universe. It arose out of difficulties (absolute rotation, lack of observational definition of ds , etc) in Einstein's theory. If you do away with it, you throw back relativity theory into the infantile diseases of 25 years ago. And why the fact that the solution then found has received remarkable confirmation by observation should lead people to seek desperately for ways to avoid it, I cannot imagine. They do not seem to have the same urge to find some explanation of light which avoids identifying it with electromagnetic waves.

We get on pretty well here though things are a bit difficult in various ways. One misses very much the stimulus of research students; even third-year students are very scarce.

With kind regards and good wishes for Christmas,

Yours sincerely,

A.S. Eddington

COPY

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NO. 2

SPRING



NUMBER

CONTENTS

THE PROBLEM OF THE EXPANDING UNIVERSE—

Edwin Hubble

20th Annual Sigma Xi Lecture, Dallas, December, 1941

ORIENTATION OF SCIENTIFIC RESEARCH TO WAR—

Wilder Penfield

"VEGETABLE STATICKS:" Evidence concerning cell secretion, root pressure, and gas diffusion in excised plant tissues—
Philip R. White

THE LABORATORY APPROACH TO PROBLEMS OF HUMAN
MOTIVATION AND PERSONALITY—Ernest R. Hilgard

MAUPERTUIS AND THE PRINCIPLE OF LEAST ACTION—
Jerome Fee

HARVARD BOOKS ON ASTRONOMY—Reviewed by
Dirk Brouwer

OFFICIAL INFORMATION

Sigma Xi National Lectureships for 1943 (p. 115)

New National Officers

Meeting of Executive Committee, December, 1941

Recent Changes in Chapter Officers

Chapter Installations

National Officers of Sigma Xi

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<i>Secretary</i>	GEORGE A. BAITSSELL Yale University, New Haven, Conn.
<i>Treasurer</i>	GEORGE B. PEGRAM Columbia University, New York, N. Y.

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C. D. ANDERSON.....	California Institute of Technology <i>Term expires January, 1944</i>
HARVEY E. JORDAN.....	University of Virginia <i>Term expires January, 1945</i>
C. E. DAVIES.....	New York, N. Y. <i>Term expires January, 1946</i>
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EDWIN HUBBLE

An Expanding Universe
Yes or No?

Math & Physics Club.
1942 Oct. 23.

Baconian Society.
1942 Nov. 10.

Widdington's Comment on Hubble & Expanding Universe
1943 Dec 6.

SLIDES.

- 1. Earl of Rosse 1800 - 1867 3rd Earl
Father Sir Charles Parsons.
- 2. 52 ft tel. 6 ft speculum mirror (This was used
Rosse but
Herschell)
- 3. Whirlpool Neb. M 51.
- 4. M 31
- 5. 2 spirals.
- 6. Coma B
- 7. J. Plaskett model Our Galaxy.
- 8. M 33 Δ
- 9. M 64 Coma B uncondensed
- 10. groups
- 11. Leo Regen 300 in area = full moon.
- 12. M 81. Wrs. Maj
- 13. ~~simlejan~~ De Sitter.
- 14. Spitzer
- 15. Red shift - Distⁿ relation

Mean. Luminosity Spiral galaxy = 18^M .

[Rayton lens] $f = \frac{5}{16}$ " ; aperture 2" ; $F = 0.6$ Spect $\frac{1}{8}$ "
Bausch & Lomb Co. He comp. sp.

Radius doubles in $1300 \cdot 10^6$ yrs.

II Chandrasekhar
see notes on ap] March 1942

Diagram p. 296 O - S.

Expansion from radius 100 pc .
to radius $500 \cdot 10^6 \text{ l.y.}$ or $> 100 \cdot 10^6 \text{ pc}$.

If not now expanding

(1) What force brought expansion
to a standstill?

(2) How interpret observed red shift?

These last chapters of this intensely
interesting serial story do not
give us final conclusions
but they open up new questions
and show us alternative hypotheses
more clearly.

Einstein 1915 Gen. Th. Rel. - World Geometry.
amended 1916.
De Sitter 1917.
Weyl 1919. Grav. & El. Mag. theory.
Lemaître 1927 Non-static space - Expanding Universe.
1930 - 40% in England got this paper + 40% rounded it.
Hubble & Humason Statistics of Red Shift

Suppler stuff up to $250 \text{ A} \equiv \frac{c}{\lambda}$ vel.
shd be $600 \text{ A} = \frac{c}{\lambda}$? (1943)

Hubble 1942 See Σ Atty vol 30 - 2. April 1942.

D

x

x

x

- (a) .. static. observed m , One $M = -18$ plot distance
(b) x x Expanding space. correct m for dimming factor

$$M - m < \log \pi \quad \therefore \frac{1}{\pi} \text{ is smaller}$$

m is smaller numerically $\therefore \log \pi$ is larger $\therefore \frac{1}{\pi}$ is smaller
i.e. distance is smaller

If (a) linear red shift - dist law
homogeneity and sensibly ∞ universe
new principle of nature for red shift

If (b) non linear red shift - dist law
small univ. with dens. increasing outward
Hge 109 yrs see p. 111, 112

p. 115 (114 hidden syst. errors)

THE BACONIAN SOCIETY

A regular meeting of the society will be held in Room 202, Ontario Hall, on Tuesday, November 10.

4.45-5.40 - Presentation of paper

Speaker - Dr. A.V. Douglas

Subject - An Expanding Universe -- Yes or No?

5.40-6.00 - Discussion.

Annual fees (twenty-five cents) for current year may be paid at the meeting.

Roy L. Dorrance

Secretary-Treasurer

Attention of the members is drawn to the fact that smoking is not permitted in Ontario Hall.

Dr. A. V. Douglas



Bacorian Soc.

Prize address

3 outstanding contributions
in the last 2 years.

10 min for each.

1946
Feb
Oct 29

1. Corona - Edlin + Saha ✓

2. ✓ Hubble & Expanding Universe.

3. ✓ Chandrasekhar & Synthesis
of Atoms & Isotopes.

1943 4. Sources of Stellar Energy - Bethe

5. Other Planets -

PLEASE POST ON YOUR BULLETIN BOARD



Telescopes and What
They Reveal.

RCAF. Instrument Flying School. No. 1.

Deseronto

(Mohawk plain)

1944 July 10.

SLIDES

1. Herschels 1780 Dawgiz
2. Galileo 1610
3. Newton 1672
4. Yerkes 40'
5. 42" double - Sir H. G. Parson's Co. N. on T.
6. 100"
7. Paris 1667
8. Sir Wm Herschell 1795
9. 200 "
10. Greenwich - Chan. H.
11. " Transit
12. Berlin - Fraunhofer
13. Feb - sky 5. declads
14. Extra part 7
15. Macollin 1879 11
16. Galileo 1610 36
17. Hertzsprung 2676
18. Mr W. 7th Appon.
19. Skys - any - Appon at zenith
20. Spectrograph
21. Spectra - 4 by prism - tempo. pres.
22. Linc. Comindua chemistis
23. Interferometer
25. Diaphan. of stellar drams
26. & Appon
27. Colour filter on 2 Scarp
28. Van Maj. 200,000 + App.
29. Plaskett's model
30. C of G.
31. " "
32. m 31
33. 2 nets Vargo
34. m 51. Can Ven
35. Scales
36. m 81

pse, p.m

Telescopes & What they Reveal

Man kind has always been dependent upon stars for Dirⁿ of Time
 One is always amazed at how much was observed and discovered by ancient & early astronomers before the invention of telescopes.

- ✓ Mapping constellations
- ✓ 7 wanderers
- ✓ Eclipses, tides
- ✓ Precession of equinoxes
- ✓ From Ptolemaic to Copernican 1543
- ✓ Kepler's 3 laws

Synthesis of all knowledge of Truth

M.S.I. Beauty - not a static universe - Law + Order

There are 2 things I want to say

1. Progress in science is an international record of achievement by men of great faith. Faith that there is order seek, knock, ask.

Bruno, 1590 ± things have not about by accident but through the determining mind.

Ans. The order of the world is no accident - the recognition of this is the religious instinct.

2. The contrast of external world and man's world on this earth gives us food for thought. Atoms, radiation, stars, galaxies obey the laws of their natures. Man...

The task is for each of us & it won't be done when war is on - Refusing - H. Com. Agan - working citizens

working citizens

DEPARTMENT OF UNIVERSITY EXTENSION

QUEEN'S UNIVERSITY

July 5, 1944

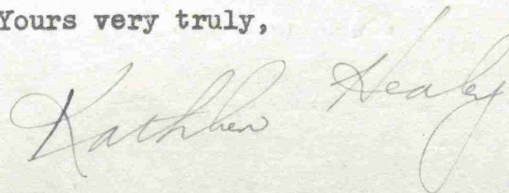
Dr. A. V. Douglas,
Queen's University.

Dear Dr. Douglas:

This is to confirm our conversation.

I have written F/L. C. S. Burchill of No. 1 I.F.S., R.C.A.F., Deseronto, stating that you will be pleased to address his unit on Monday, July 10th, and that you will be leaving on the 10.10 bus on Monday morning. I have asked him to arrange to have a lantern if at all possible and have told him that you will be bringing your own slides.

Yours very truly,

A handwritten signature in cursive script, appearing to read "Kathleen Healy". The signature is written in dark ink and is positioned to the right of the typed name.

Assistant Director

/ES

The Museum of Stars

RASC. Montreal Centre
1942 April 30.



The Universe of Stars.

SLIDES

1. Anaximander d. 545 B.C.
2. Egyptian symbology
3. Ptolemaic
4. Hildegard of Bingen 1170 AD. Job. Hart then entered into the treasuries of the snow - or seen " " " have Bay whole way in the light painted w. scattered the last wind upon the 9 or 12?
5. 16th Cent. Woodcut
6. Herschel S.W. Distrib. of stars Milky Way.
7. Centre of Galaxy
8. " " "
9. Pleiades clusters
10. Glob. clusters Shapley distances 200 - 100 ±
11. Diagram Galactic clusters 200 - 100 ±
29,000 ①
12. Plaskett's Galaxy diagram
- 13 - } Cygnus region
- 14 }
15 }
16 } Orion nebulosity
17. New Slide Androm. region + M31
18. M31
19. M51 Lord Rosse drawing Whirlpool
20. M33 Triangulum
21. M31 end portion
22. M31. Hubble Ap. J. 1929 40 ceph. variables.
900-200 l.y. now 700,000.
23. 2 nebulae
24. Coma' net. ②
25. " " ③

26. 2 hel.
 27. group of spirals.
 28. Leo region spirals.
 29. Diagram of spiral distribution. *
 30. Red shifts §
 31. M 81

* Local clustering but general large scale homo-
 - geneity
 see Hubble The Problem of Expanding Universe
Sci Quarterly Spring 1942

Observable region of space $\approx 100 \times 10^6$ l. y radius.

av. dist. between neb. 2×10^6 l. y
 " luminous flux 10^8 " 2×10^9 (p. 100)
 " mass several $\times 10^9 \odot$

our galaxy a fairly well developed open spiral

§ Red shifts, of velocity, rate of increase 100 mi/sec / 10^6 l. y
 observed & measured to 250×10^6 l. y, where the
 $v = 25,000$ mi/sec or $\frac{1}{7}$ vel. light.

Age of universe 14. time since close packed
 1800×10^6 yr = 1.8×10^9 yr.

P. 109.

Recent work Dimming factor p. 109.
 assume av. intrinsic luminosity of group App. l.
 take scale of dist. (a) assuming stationary
 (b) " recession.

(a) gives homogeneity but what causes red shifts? ?
 (b) " a slowing of expansion i.e. age of universe is reduced
 to 10^9 NOT enough
 red shift does not represent expansion
 & density of distribution increases with distance

Spirals

mass $\left(\begin{array}{c} 10^9 \\ \text{average} \end{array} \right) - 10'' \text{ stars}.$

Haward plates 1934 125 000 to $17^m.5$

Total estimated - $100 \cdot 10^6$ in $500 \cdot 10^6$ sq. radians

Cluster of Spirals.

1. Super cluster of Galaxies in Virgo.
2775 members.
av. $2 \times 10^7 \cdot 0$.
2. U.M. Major. 2 clusters
300 spirals in bowl of dipkes
3. Coma. 800
4. Leo. 300 in a full moon area.
5. Perseus 500 members.
mostly elliptical.
6. Cancer 150
7. Centaurus 300.

New Light on Old Stars

RASC Montreal Centre

1944 April 20.

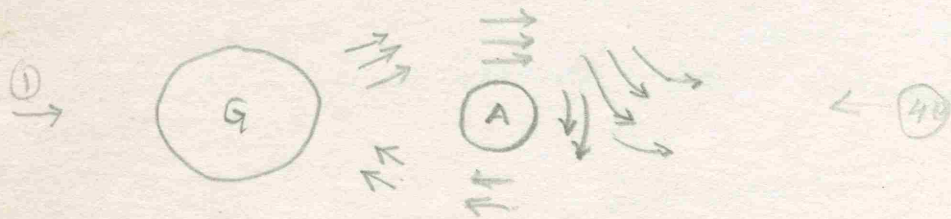
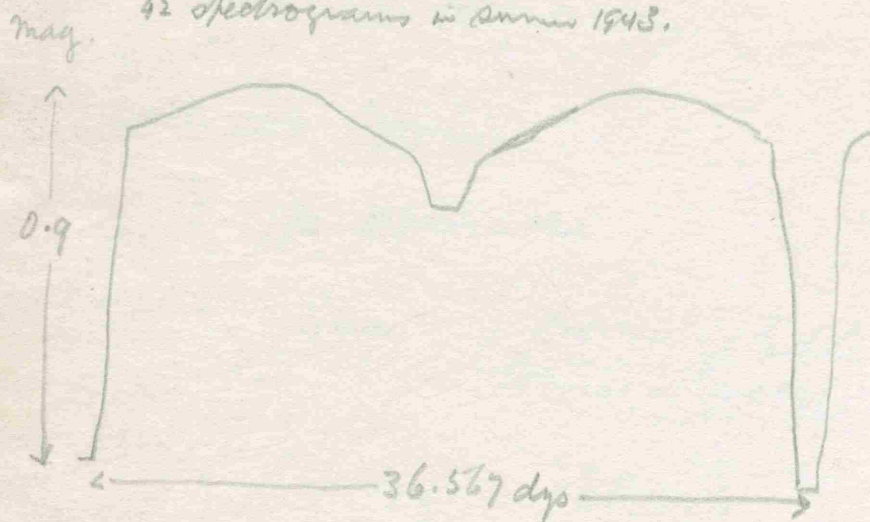
SX Cassiopeiae

Ap. J. Jan. 1944. O. Struve.

Eclipsing binary with tenuous shell of gas circulating about one component

P. 36.567 days. 9^m. G and A stars

42 spectrograms in summer 1943.



(2)

(3)

- (1) G line + r.v. emission deep minimum
- (2) G + A lines + shell
- (4) secondary min A lines + A nodes

New Light on Old Stars

Montreal May 4 Apr. 20

Introduction

Tribute to Montreal Centre
as Paris R. as C.

1. 61 Cygni

2. 70 Ophiuchi

3. Sun Corona Eddington
Source of Energy, Bethe

4. γ Peg. JST. and
Bethe + Underhill

5. SZ Cassiopeiae. Sturrock

(G. Harker Hall in Chair)

Introdu~~tion~~ Tribute to Centre
from Pres. Rasc.

1. 61. Cygni

2. 70 oph.

3. Sun i Corona Edlein
Vand
Swins

ii Energy Bethe
Chandrasekhar

mitted (4 γ Ref. JSE. AND
+ Underhill 1943
paper.

5. SZ Cassiopeae. Struve
Ap. J. Jan 1944.

(Vote of thanks by Arthur Browning)

11

Spectroscopy in Astrophysics

Math & Physics Club
1941 March 14.

Spectroscopy and Astrophysics The Chemistry of the Stars

Greek speculations 4 elements + 1
Terrestrial Chem. Atomicity
Mendeleev's Table

Galileo broke away from
Dogma of Changefulness

Newton & refraction of light
Bright line spectrum
Fraunhofer lines

Kirchhoff

Huggins Read

Line identification

Reasons for non appearance
of some elements

Spectrum classes & Temp
& lines

Si Si⁺ Si⁺⁺ Si⁺⁺⁺ series

Molecules identified

Line intensities giving Temp & pres.
Star Flash Spectrum
skyflaring electron

summary

22
Zeeman effect giving
information re mag fields

Stark effect elect. fields

H & He profiles
& fields

SLIDES.

1. D.A.O. 72" Spectrograph
2. Y.O. 40" Bina "
3. Emission lines
4. Line coincidence
5. Solar Sp. Nos. of elements
6. Secchi types.
7. M stars + also etc.
8. Planetary atmospheres. $Si Si^+ Si^{++} Si^{+++}$
9. H. Draper class. -
10. γ Lyrae.
11. Fraunhofer diagram H. Zeeman
+ Stark
effe
12. H. Bohr-Sommerfeld orbits. + series
13. Merrill Balmer. Microphotometris
1934
14. Balmer + Paschen series.
15. Paschen line trace.
16. Ancestr Solar tower. 1924
17. Mt. W. " "
18. Sclifus flash.
19. Sun's chromosphere.
20. Ionization nebulae.
planetary neb.
mag.

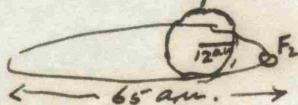
to be
retime

Telescopes and the Universe
They Reveal.


1940 March 29.
Math & Phys Club
Queen's Univ.

Telescopes & the Universe They Reveal.

1. Astron prognostication 1546
Position, app. motions of stars & 7. constellations,
periods of eclipses etc.
Of true nature of stars no knowledge.
2. Tycho Brahe 1546-1601
3. Hevelius contemp. of Halley.
4. Galileo, tel 1610
5. Newtons .. 1672.
6. Paris 1667. Louis XIV.
7. Herschel 1795. 4th. mirror. Uranus.
& Clusters & nebulae.
8. Y.O.
9. 42" diam for Rumour Tel. Sir H. Grubb, Passaic Co.
10. Mt. W. Dome
11. 100 inch
12. Winter Sky.
13. Maestlin 1577. 11 n.e.s.
14. Galileo 1610. 36. teles.
15. Hertzsprung. 2616 "
16. Orion
17. gt. orion neb.
18. Horse head neb.
19. Orion No r red filter. Lower Calif. 1939.
20. Scorpion Red & no filter, 1936 OStrom.
21. Interferometer
22. Betelgeuse diagram
23. ε Aurigae Constelⁿ.
24. " diagram. 27 yr. P. 1 yr in eclipse 1937.



diam 3000 @
T 1300 °C. infrared sp. 50% transp
P 10⁻⁹ to 10⁻¹⁰ of B.

25. Plucketh galaxy.
26. C. V. S.
27. M. W. 19. Snes.
28. 16th Cent. Woodcut.
29. Cyg.  neb. 7^h ext.
30. Pers. clusters.
31. M 31.
32. Blink phot.
33. M. 33. 2 views with variables.
34. Spirals. M 51.
35. G. O. Bruce spectrograph
36. Doppler shifts. Lens F 0.6
Aperture 2"
f 1 5/16"
length of spectrum 1/8 in.
37. M 80
38. Berlin. Babelsburg tel. 26".
a higher index of civilization than quon.
Int. cooperation in pure sci.
The immense debt we all owe to the gr.
men of science, the torchbearers, of all
countries throughout the centuries.

with Copernicus MSS.
March 1943
at Queens
Melhill
& Sharn

SLIDES

1. Copernicus, cleric & scholar, by Arthur Szyk
Refugee Polish artist in U.S.A.
2. " from steel engraving 1682
by Boulnois, Brussels.
3. Map.
4. Birth place Torun (1473)
visited by Napoleon 1807.
5. Self portrait (hilly of valley, symbolic
of medical interests ?)
digitalis substitute
5. Univ. Cracow & monument (1500)
founded 1364 - never closed its doors
until closed by German, Nov 6, 1939
"Aslame nation needs no higher edn."
"We will make of Poland a cultural
wilderness".
170 Faculty members taken to prison
camps bec. of their 'treason' in
making the Univ. 'the bastion of Polish
culture'.

6. Title page of De Revolutionibus Orbium Coelestium
Part VI. 1st Edⁿ 1543.

To Rev. Mr George Dunder, Canon of Warmia
from his friend Joachim Rheticus d.d.
d.d. = Donat. dedicat

Subsequently crossed out when this
book came into possession of
The Brunswick College Society of)
This Jesuit college still exist. - or
did in 1939. but this book was
taken to Sweden by Gustavus Adolphus
& is now in the library of the
Royal University of Uppsala.

The Oster library at McGill has
a copy of this 1st Edⁿ 1543.

Hefers £ 18. Only one copy
has come on market in 12 years
£ 22.

Cushman's copy is at Yale. which
also has copies of the two
summaries of Rheticus.

7. Title page of Galileo's Dialogue on Two Systems of the World.
1635 2d^{ed}.

Aristotle, Ptolemy & Copernicus.

[result of this book was that Galileo was called for 2nd time before court of Inquisition - & was put under surveillance for life]

8. Copernicus - Warsaw Monument 1830
Napoleon's suggestion, ¹⁸⁰⁷ Polish money
Thorswaldson's sculpture -
Danish artist.

WOODEN SLIDES - LONDON circa 1870.

1. Pythagoras & Aristotle Dante's Paradiso
2. Philolaus & wh. Ptolemy & epicycles etc.
3. Copernican
4. Zodiac
5. 6 Moving slides Solar System, S.-Earth-Moon System.

Rosetti

this earth "spin like a top"
midx

axial periods S. 25 d.
E. 24 h
Moon 1 month
J. 10 h

Tito Livio - Annetta

9. Galileo & Milton at Fiesole.
 Earlier than 1640
 Paradise Lost pub. 1667.
 Copernican Cos. taught
 openly in Oxford, Sorbonne
 & Yale after 1700
 Archamb. Kibhal & Ida
 masterly eversion
10. Kepler. 1571-1630 "the fragrance of ambrosia".
11. Isaac Newton 1642-1727 ~~Hamilton~~.
12. Perseus region. 5 n.e. stars.
- 13 } C. of Galaxy.
14 }
15. J.S. Plankett's model 10¹⁰ stars.
16. M 31 Androm
17. M 33 Δ
18. M 51 Can Ven.
19. M 81

Philosophy of Mod Sci

1940-41?

Philos Colloquium

Queens. Univ.

C. G. Darwin.

p. 91. electrons as waves.

p. 96. 2 $\frac{1}{2}$ worlds.
of subjectivity + objectivity

p. 102. -104. Unc. princ.
pos. + momenta

Seeing a thing to $\frac{1}{1000 \times 10^6}$ inch by

X ray mic

10. position v. acc.

but h v v. large i. high
vel of recoil

p. 112.

116.

118-119. ignorance is now
respectable.

Free will + determinism

add quote to defn.
of Determinism

Ideal of Science

Rigid laws

Kelvin's models.

Probability +
Statistical laws.

Dual nature of light
" " " matter
wave mechanics

Princ. of Uncertainty
or Indeterminacy
Unobservables.

3/ AS Eddington Nature June 12, 1937. p. 1000.

... a law of Nature has a compulsory character
conflict with the laws of Nature is impos.
bec. such conflict is unobservable.

We need to know not only the result of measurement
but the nature of the process of measurement.

An electron is not normally in a definite place but is smeared
over a probability distribution

The devastating beauty of quantum arithmetic.

$$N = 2 \times 136 \times 2^{256} \quad \text{or} \quad 10^{79}$$

Causation + Causality 297.

N.P.W. p. 293.

1928. 294 as opposed to Current Epistemology of Science
295. 428 297-8.

New P. of Sci.

1935

Burman's question of determinism p 295

Herb. Samuel - Planck 299,
Rutherford 297,
Einstein 297-8.

p. 300 last para. 302.

Free will. Planck 301

Hermann Weyl p. 72 ←

p. 74. ← det. not disproved, but phys. sci
is not even based on it.

p. 80.

p. 82

p. 85

p. 87, 88 crack of door to free will
see Philos. of Phys. Sci

Hershenberg p. 101
102
105

H. Dingle Unobservables - Nature 1937.

- (1) logically, unobs. - a square circle.
- (2) physically, unobservable - absolute motion.
- (3) practically, unobservable - back of moon.

Sci. must be based on observation fundamentally.
not on supposition or things we hope to observe in the future.

Aristotelianism vs. Galileanism. Nat. Supp. June 12 1937.
p. 1000.

Mod. Aristotelianism Dingle p. 784 May 8, 1937.

"Science is the formulation of rational relations between
sense observations"

Shall the foundation of science be observation or invention?

Harold Jeffreys - Nature 1937 June p. 1004.

pro Dingle.

... Mach, a large part of whose work was devoted to attacking
the "inherent necessity" view of causality.


C. G. Darwin - It is the sci. and the Philos. that matter.
p. 1008

Stellar Slides

Ban Rish Hall
1940 Feb. 4.

B.R.H. Sunday Feb. 4th 1940

Lantern Slides

1. Galileo's tel
2. Yerkes 40"
3. Newton's tel
4. Mt. W. 100"
5. Dec. sky. 5.
6. Maestlin Pleiades
7. Galileo's "
8. Pleiades
9. Orion neb.
10. Horse head neb.
11. Cygnus region
12. F.R. Cox Cygnus veiled neb.
13. 
14. Perseus M.W. 1.
15. C. of Salony Barnard.
16. " " Ross.
17. 16th Cent. woodcut.
18. M 31.
19. M 51.
20. NGC 7217.
21. M 33.
22. Newton.
23. Brewster & Tabor.
24. M. 81 a dynamic universe.
Universality of law of change.

Telescopes & What They Reveal.

Kingston
Miss McCullagh's Club.
1940 Feb. 20.

Telescopes & What They Reveal.

Since the dawn of intelligent life on the earth the stars have aroused the curiosity and scientific interest of mankind.

Time
Direction.

Babylonians *ca.* 4000 B.C.

SLIDES

1. Dec. Sky S.
2. Orion diagram.
3. Gr. Bear "
4. Pleiades "
5. Hildegarde of Bingen 1170 A.D.
6. Copernicus 1543.
7. Galileo's Tel. 1610.
8. Newton.
9. " Tel. 1672.
10. Paris Obs. 1667
11. Greenwich Ob. 1675-
12. " " now.
13. Herschel 4 ft mirror 40 ft focal length 1795
14. Y. O.
15. Y O 40-inch.
16. Mt. W.
17. " 100-inch.

- 18. Jan. sky 5. Pleiades . 7.
- 19. Maestlin " "
- 20. Galileo " 36.
- 21. Hertzsprung " 2616.
- 22. Perseus Clusters . 5 n.e.s. Nos.
- 23. Dipper now \pm 200,000 yrs. Motion.
- 24. Solar Spectrum Chem.
- 25. Stellar Spectra & Phys. state.
- 26. Nebulae ρ & ϕ .
- 27. " Orion
- 28. " " Horsehead.
- 29. " Cygnus.
- 30. Galactic distrib.
- 31. C. of Gal.
- 32. 16th Cent. woodcut.
- 33. M. 31.
- 34. M 33
- 35. M 51
- 36. M 81

not a static universe -
 Universal Law of Change .
 Reign of law & order - underlying harmony .
 Power & majesty of mind of man - MIND over the SPIRIT
 most wonderful entities our survey of the universe
 shows us .
 We are a part of a vast WHOLE and like the
 atoms & the stars we play our part best by living
 in harmony with the laws of our nature - phys. mental
 & spiritual

Astronomy - an International Record.

Queens Levee Soc.
Banquet Hall
1940 Jan. 17.

All Nations Are in Debt To Each Other

Too Much Nationalism at Roots of Education, Says Alice Douglas

There is too much nationalism at the roots of our education said Dr. Alice V. Douglas, dean of women of Queen's University, before a meeting of the Queen's Levana Society in Ban Righ Hall last night.

"Every nation owes an immense debt to other nations in all fields of endeavor," she declared. "It has become a virtue to instill into children such pride in the leaders of our country that later it becomes difficult for them to face international problems with unbiased minds."

With this thought in mind, Dr. Douglas outlined the contributions that countries of the world have made toward the science of astronomy. Beginning with the ancient Egyptians who mapped out the star groups and divided the heavens into constellations, she mentioned Pythagoras whose philosophy of the music of the spheres and the harmony of the universe has lived in poetic thought down to our own day; Galileo who discovered the mountains on the moon and the spots on the sun; Sir Isaac Newton whose laws of gravitation brought order out of chaos and the contemporary ideas of Einstein and the new knowledge which his vision has brought science."

Banquet Hall, Levana Soc.

1940 Jan 17.

Astronomy - an international record.

Madam President & Members of Levana Society

I want to thank your executive for inviting me to address you this evening. I am grateful for two reasons (1) because I think I have something to say to you that is worth saying (2) because it is an honour and a privilege to address a group of university women. Such a group has, potentially, the greatest influence of any group of women in any country. What we make of this potential influence is another matter.

Seriousness of present

Search for solutions - Platitude.

Explore every avenue of approach.

Spirit of nationalism - Education in international
Stress on crit. attitude towards ideas of others / pt. of view
international indebtedness.

Astron - Tagore -

THE
HAMILTON
ASSOCIATION

For the Advancement of
LITERATURE, SCIENCE and ART

FOUNDED IN

1857

Programme of
Saturday Evening
Lectures

1941 - 1942

Held at 8.15 p.m. in the
Hamilton Conservatory of Music
126 James Street South

Motion

1941 Nov. 15

PROGRAMME 1941-1942

OCT. 25—"EARTH'S UNSOLVED MYSTERIES."
THE PRESIDENT.

Some of the problems of geology that scientists have not been able to explain, and the application of this fact to our mental attitude.

NOV. 1—"THE SHAPE OF THINGS TO COME."
MR. GILBERT E. JACKSON, B.A.,
(Cambs)

Mr. Jackson's understanding of the economic and other problems that face the world to-day, assures of a fascinating story of the new and, let us hope, better world of to-morrow.

NOV. 15—"THE MYSTERY OF MOTION."
(Illustrated).

MISS A. VIBERT DOUGLAS,
M.B.E., M.Sc., Ph.D.

Dr. Douglas, who is Dean of Women of Queen's University, is the first Vice-President of the Royal Astronomical Society of Canada, and comes to us with brilliant photographs of the heavens, to tell us something about the restless universe in which we live.

DEC. 6—"APPRECIATION OF MUSIC."

MR. THOMAS J. CRAWFORD,
Mus. B., F.R.C.O., F.T.C.L. (hon.)

His half-century of experience as a musician and a teacher in Europe, in England, and in Canada, and his racy and humorous style will make Mr. Crawford's address both entertaining and instructive. It will be illustrated by selections on the piano.

JAN. 3—"DUNKIRK — A POEM."

PROF. E. J. PRATT, M.A., Ph.D., F.R.S.C.
Dr. Pratt, who is Professor of English at Victoria College, Toronto, is one of Canada's best-known poets, and has delighted the Association on previous occasions with readings from his works. This time he will read his latest, and as many think, his greatest poem.

JAN. 17—"DELPHI: ORACLE AND TREASURY
OF THE ANCIENT WORLD."
(Illustrated).

Child Memorial Lecture.

PROF. CLEMENT HODGSON STEARN,
M.A., B.D., Ph.D.

Our Second Vice-President, who can speak authoritatively on the literature, art and archaeology of Greece, will tell us something about the most fascinating of its ancient shrines.

FEB. 7—"EASTERN EUROPEAN FRONTIERS."
MR. JAMES WREFORD WATSON, M.A.

Mr. Watson, who is Assistant Professor of Geography in McMaster University, has made a study of these boundary lines at present drenched in blood, and will explain their nature and importance.

FEB. 21—SUBJECT TO BE ANNOUNCED.

DR. WILLIAM SHERWOOD FOX,
Ph.D., D. Litt., LL.D., F.R.S.C.

Dr. Fox, who is President of the University of Western Ontario, is a man of wide interests, and his address is bound to be informative and interesting.

MAR. 7—"THE CAMPAIGN OF 1942."

MR. WILLSON WOODSIDE, B.A. Sc.
We all listen to Mr. Woodside's nightly broadcasts on the progress of events. He will be here in person to explain the probable strategy of Britain and her Allies in the next phase of the conflict.

MAR. 21—"THE MEASUREMENT OF PERSON-
ALITY."

PROF. JOHN A. LONG, M.A., Ph.D.
Dr. Long, who is Associate Professor of Educational Research in the University of Toronto, is well qualified to throw some light upon a psychological problem that is of everyday importance.

APR. 11—"OUR COLD-BLOODED RELATIONS."
(Illustrated).

MISS NORMA FORD, M.A., Ph.D.
Dr. Ford is Assistant Professor of Human Biology in the University of Toronto. She is also an expert photographer, and is bringing her beautiful moving picture films in colour, to illustrate the lives of the humbler inhabitants of our fields and forests.

OFFICERS FOR 1941 - 1942

Hon. President	H. S. Alexander, Esq.
President	Prof. W. Harvey McNairn, Ph.D.
1st Vice-President	A. J. Holloway, Esq.
2nd Vice-President	Prof. C. H. Stearn, Ph.D.
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Mr. J. A. Webber	Miss Rosalynd F. Osborne
Mr. D. A. Robinson	Dr. Marian Templin

Dr. & Mrs. Cornett.

Dr. Findlay & Mrs. Findlay (v. vice)

These lectures are sponsored by the Hamilton Association for the advancement of Literature, Science and Art, a society of learning founded in our city eighty-four years ago.

Non-members are welcome to attend the meetings, but if you are in a position to support the Association, you are invited to become a member.

The annual fee is \$2.00. Application forms may be obtained from the Corresponding Secretary (15 Mapleside Avenue), or the Treasurer (119 Duke Street).

The Mystery of Motion

Hamilton Association
(1857) for advancement
of Lib, Sci + art.

1941 Nov. 15

The Mystery of Motion

Almost 6 centuries BC Anaximander postulated as the basic principles of the Universe The Infinite (an undefined primordial substance) and Eternal Motion

Daily spectacle of sun
nightly " " stars, less regular
apparent movement of planets & moon.
Motion of clouds, of winds, ^{tides} waves, of
rivers & of all growing things -
the circulation of what the Psalmist wrote
The mystery of motion & especially, in
the Greek mind of the motion of heavenly bodies

Anaxagoras asked what was the chief
object of heavy born into this world
replied "to investigate the sun, moon
and heavens"

Plato lays upon all students of earnest
purpose the task of finding "what are the
uniform and ordered movements by the assumption
of which the motions of the planets can be
explained."

Aristotle in order to satisfy the demands
of his system of logic found it necessary
to postulate God - the Prime Mover.

Natural assumption

Geocentric conceptions of Universe
Babylonians - etc - Greeks
epicycles

SLIDE.

- 1. Ptolemy's Universe
- 2. Copernicus Jacobi 1000 yrs of night.
- 3. Tycho Brahe planetary observations
- 4. Kepler. fragrance of ambrosia
3 laws. *angels pushed the planets around their orbits*
- 5. Galileo. simple harmonic motion
inertia & energy.
telescope 1610. Jupiter's moons.
Sunspots. moons surface.
- 6. Newton. Force & change of motion.
Rate of ch. of momentum.
Every action has = & opp reaction
Law of gravitation
& elliptical orbits.

READ inscription in W. Abbey.
Principia

- 7. Halley. proper motions. 1718
- 8. Bessel. & invisible astronomy. 1844
Sirius A & B
Sirius path in sky

Summary of our motion
READ ARD. M of M. p. 1.

- 9. Herschell. ~~motion of Sun~~
12 mi/sec. 1783. Sun's way

Principia 1687. q. 45.

- BK 1. 3 Laws of Motion // \log_m of forces
Theory of Orbits + disturbing forces
- " 2 Hydrodynamics waves, tides
vel of sound in air
motion of projectile in
resisting medium
- " 3. Applications to Solar System
angular rotation + polar flattening
lunar theory, tides, high + low
mass of moon
Precession of Equinoxes.

Here lies
Isaac Newton, Knight,
Who, by a Vigour of Mind almost supernatural,
First demonstrated
The Motions and Figures of the Planets,
The Paths of the Comets, and the Tides of the Ocean.
He diligently investigated
The different Refrangibilities of the Rays of Light,
And the Properties of the Colours to which they give rise.
An assiduous, sagacious, and faithful Interpreter
Of Nature, Antiquity, and the Holy Scriptures,
He asserted in his Philosophy the Majesty of God,
And exhibited in his conduct the Simplicity of the Gospel.
Let Mortals rejoice
That there has existed such and so great
AN ORNAMENT OF HUMAN NATURE.
Born 25th Dec. 1642, Died 20th March, 1727.

noslide - Kapteyn Star Streaming 1904

10. A.S. Eddington. READ STARS + ATOMS. P. 26-28.

Modern era in survey of galaxy
 Contribution of Spectroscopy

10 a. E. Curious 274M. Radial vel. 50% cells
 11. Milky Way p oph. 3 1/2 hrs. Heavide layer

12. " " ... 41 Aquilae altair 4 1/2 m 9 n.e.s.

13. " " 15- Scorpio. M 19
 M 62

Motion of Clusters.

14. Nebulae - Orion.

15. Cygnus 7th exposure

16. Centre of Galaxy. FK Ross. East

17. " " " " West.

Dist. $P = 230 \cdot 10^6$ y. $v = 275$ km/sec

18. J. S. Plaskett. diagram
 10000 l. y. diam.

19. M 31. $17 \cdot 10^6$ y.

20. M 51

21. H & K lines in Spectra.

22. M.D. slide of Runners.

23. Minister + Rabin Drakath Tagore.

24. M. 81.

Life is a Constellation, our
 unplumbed dark, strewn
 with stary moments.

omitted by lantern operator.

~~Ernestin de Sitter~~

~~23 Cosmology~~

A dynamic universe of
change.

Longfellow the perpetual round
of strange mysterious change

Mysterious change - the mystery
of change, of the flux of things.
The mystery of motion has broadened
out into a wider more all embracing
mystery as the centuries have gone by.
→ Motion only one form of energy
A. N. Whitehead not God the Prime Mover
but God the Principle of Concretion.

Within this World-as-it-is
there is room for the exercise of the
free will of man to make the
pattern of human affairs reflect
more nearly the harmony & beauty
of the universe of stars.
Great Challenge

Aristotle found it necessary to complete his metaphysics by the introduction of a Prime Mover -- God. This, for two reasons, is an important fact in the history of metaphysics. In the first place if we are to accord to anyone the position of the greatest metaphysician, having regard to genius of insight, to general equipment in knowledge, and to the stimulus of his metaphysical ancestry, we must choose Aristotle. Secondly, in his consideration of this metaphysical question he was entirely dispassionate; and he is the last European metaphysician of first rate importance for whom this claim can be made. After Aristotle, ethical and religious interests began to influence metaphysical conclusions.

The phrase, Prime Mover, warns us that Aristotle's thought was enmeshed in the details of an erroneous physics and an erroneous cosmology.

To-day we repudiate the Aristotelian physics and the Aristotelian cosmology, so that the exact form of the above argument manifestly fails. But if our general metaphysics is in any way similar to that outlined in the previous chapter, an analogous metaphysical problem arises which can be solved only in an analogous fashion. In the place of Aristotle's God as Prime Mover, we require God as the Principle of Concretion.

We conceive actuality as in essential relation to an unfathomable possibility.

*Ans. Whitehead
Sci. & the Modern World.*

Read this.

A. u. w.

" The passage of time is the
journey of the world toward
the gathering of new ideas
into actual fact . . .

The universe shows
us two aspects - - -
physically, wasting -
- -
spiritually, ascending "

Emphasized
with this

The challenge of astrophysics is
that in the universe of change, to each
human being is given the responsibility
of helping in the process of a universal
spiritual ascending -

Immensities of Time + Space.

Fac. Women's Club.
Queen's University
Grant Hall

1949. Dec 14.

Queen's Alumnae in BdH
1958 Jan -
(see back page)

The Faculty Women's Club of Queen's University

ILLUSTRATED LECTURE
THE IMMENSITIES OF TIME AND SPACE

CONVOCATION HALL

Wednesday, December 14th, at 3 p.m.

By **DR. A. VIBERT DOUGLAS**

Dean of Women and Acting Professor of Astronomy, at Queen's

Members will welcome the privilege, which few in the Club have enjoyed hitherto; of hearing Dr. Douglas speak on her own subject.

THE LECTURE IS OPEN TO THE PUBLIC

Members are invited to tea at the Club Rooms, after the lecture.

CANADA



CARD



Dr A. Vibek Douglas

Bar Righ Hall

City

Immensities of Time and Space.

Time and space are two of the elusive challenging mysteries of our consciousness. For the philosopher in one way, in another, to the poet & yet another to the scientist, and in a different way to each individual both time and space present an intrinsic relationship.

I Consider time intervals.

Would you consider 5 min a long interval of time? The question is meaningless until you relate 5 min to some other interval of time. - or to a particular situation.

5 min is a short time relative to a year approx 1 part in 100,000

But 5 min is a long time relative to the duration of a flash of lightning.

Kapitza - Cavendish $\frac{1}{100}$ sec.
Pucks - giraffe 40 min - radio wave $\frac{1}{9}$ sec.
Inverness - frames of glass 200 yd
Naim valley stone Os of lava
Stone burial mounds 2000 BC.
Age of Babylonian, assy & chaldean constellⁿ symbols.

2
man on the earth $\frac{1}{2} 10^6$ to 10^6 yrs.

Life of earlier animals
& still earlier vegetation 10^9 yrs.

Age of earth
& of meteorites $3.5 \cdot 10^9$ yrs

Age of our stellar universe $15,000 \cdot 10^6$
as upper limit.

These are the immensities of time.

Rel. to the life span of a man 3 score & 10
or if by reason of strength 4 score

The life of the race is a very long period of time
but the message of astron is that the future
of man on the earth is vastly longer
than his past. How long will his
adolescence & childish folly continue
How soon will he grow into maturity &
realize his great future in cooperation
& wisdom? with kindness

So much for man in time

II Man in Space.

Again the relativity. Is an inch a large
or small distance.

Well I have measured spectrum lines
to the $\frac{1}{10,000}$ th of an inch
and a red water spectrum line is 10^{-8} cm.
and the radius of an electron is one
million millionth of an inch.

But think of an inch relative to the distance from here to Vancouver.

We must have units suited to the job of measurement to be done.

an inch is a useful unit for measuring a chess board

But a mile is more useful for the distance to Vancouver

↳ That unit is $63,360 \times 1 \text{ inch}$

Astron. distances within solar system mile too small ∴ take $93,10^6 \text{ mi} = 1 \text{ astronomical unit}$

Sun - Earth dist

Then to Pluto is 40 a.u.

But astr unit is too small for interstellar distances - take the light year about 6×10^{12} miles or 6×10^4 astronomical units
60 thousand

Light fastest known transfer of energy
Upper limit of velocity - 186,000 mi/sec

- Earth moon 1 1/4 sec.
- " - Sun 8 1/2 min
- to α Centauri 4.4 years.

Scale of solar system

Sun	1 in.	
Earth	1/100	8 feet
Neptune		240 feet
α Centauri		300 miles

SLIDES

1. Babylonian boundary 1200 BC.
Hydra, Scorpius and Triad
2. Bab. labels 4000 BC
3. Maximander 550 BC
4. Ptolemy
5. Copernicus 1543
6. Galileo 1642
7. " tel. 1609, 10
8. Newton 1692
9. " tel.
10. Y.O. 1700
11. Ant N. 100 "
12. Winter sky S. — 150 maps + Jap + Ven.
13. Pleiades & Pleiades 7
14. Maestlin " "
15. " " "
16. Galileo 36
17. Pleiades Hertzsprung 2616
18. Balances 10^{27} atoms 10^{26} men
19. Quantum & Wave theories
20. Giants & dwarfs
21. Rel. sizes 25 nearest stars
22. Proper motion Halley
23. m. way, Perseus obs
24. " " 19. Ophiuchus

- 25. Cygnus. Look how the flood
of heaven
pines of
pure gold
- 26. Cygnus. Tenuous wisps of flowing gas
- 27. Orion Horse head
- 28. " Gc net Behold the throne
of chaos.
And Galileo show Milton this?
- 29. J Herschel & Keplerg. Gal. system
- 30. Centre of galaxy
- 31. " "
- 32. Planchette's model
- 33. M. 31 androm.
- 34. M. 51. Canes Ven. Whirlpool
- 35. M. 33 Δ Distance to 500 10⁶ ly.
" ~~expressed only as~~
~~that phrase name~~
- 36. Newton stab The marble under
(Wordsworth)
- 37. Ginnstein & Tyron
- 38. Gold
- 39. M. 81 Wn. Mag.
Bridges. Spacious as the
stony firmaments
mess. of radiant
gaze that flideth only
as if out passeth
molat right.

November 23rd, 1940

"IMMENSITIES OF TIME
AND SPACE"

Illustrated.

MISS A. VIBERT DOUGLAS, M.B.E., Ph.D.

Dean of Women, Queen's University.
Sometime Lecturer in Astrophysics, McGill
University.

*Royal Canadian Institute
Toronto
1940 Nov. 23.*

Immensities of Time & Space

In the last number of the Hibbert Journal there is an article by S. L. Allen of King's Col. Newcastle-on-Tyne in which it is argued that there can be no return to a world order based upon truth, justice and mercy until there comes a fresh recognition of the ^{principle of the} Unity of the Human Race.

The writer goes on to base his argument for belief in that principle upon ~~an~~ ^{an} event in history held most significant and sacred by Christianity.

It is my feeling that this Principle of the Unity of Mankind is too basic to be argued for in terms of an event late in time which, even 1900 years after it occurred, is known only to a fraction of the inhabitants of the earth. This principle has its roots far back in antiquity (and I would put forward the following as one argument for its validity).

All the records of history and archaeology and ethnology point to the fact that man in every age & in

every country seems to exhibit a curiosity about his environment and about himself.

The former leads to science,
the latter to religion and to philosophy.

These three, particularly the last two have varied greatly from place to place and at different epochs, yet they all spring from a common characteristic of mankind - his curiosity, and his ability, great or small, to reason things out.

Man looks out at the world - he sees himself, he sees the earth on which he stands, he looks up at the sun, the moon, the stars - and he asks

HOW? (WHY?) WHEN? WHERE?

Here are science and philosophy, twin reactions to the challenge of time & space.

Two of the greatest examples of men whose curiosity has led them far into the realms of ~~study~~ science & of mystic philosophy

1. Einstein & Tagore.

Life is a constellation
an unplumbed dark
strewn with starry moments.

Astron the oldest sci bec 2 things

Direction
Time units + chronology

3 or

4000 yrs BC ^{Babylonians, Chaldeans + Assyrians} men looked up
and marvelled at the patterns of
the starry sky. They mapped these
groups of stars, they div. them into
constellations quite arbitrarily and
associated each by some exaggerations
of fancy with birds, beasts, grubs,
dragons + so forth. They distinguished
seven bodies with individual motion
Sun moon + 5 planets

The Greeks elaborated this geocentric
scheme. Earth, 7 spheres,
8th sphere for stars
and beyond that what?

Eulerpus + his
8 spheres
concentric

3(a)

Al Biruni AD 1029 at Ghaznah - Tr. by Ramsay Wright

"In the name of God the Merciful, the Compassionate,
Him do we ask for aid."

"May God by His grace, and in the fullness of his
mercy, favour accuracy of statement in the work."

"A number of people consider that beyond the eighth sphere there is a ninth entirely quiescent, because the prime mover must not be moved, and it is on this account that they describe it as motionless. But it is possible that it is not (a body) like the other spheres, otherwise its existence could be demonstrated. Many of our ancestors considered that beyond the eight spheres there is an infinite empty space, others a boundless quiescent substance, while according to Aristotle there is neither substance nor void beyond "the revolving bodies".

500 years went by & then Copernicus...
Kepler... Galileo... Newton & the
Renaissance of Learning, the New Era
of Science on its math. foundations
& experimental methods.

W. B. Barrow & the 9th Voyage

1. Einstein & Tafel
2. 16th Century Woodcut

W. B. Barrow 1858

Mariners revealed by telescopes
& photo plates

Copernicus - Galileo & Newton
Distances measured

3. Cygnus  7 hrs

4. Horse head

5. Orion O.N.H.H.e. Ca. Na

Behold the throne of chaos
& his dark pavilion spread
wide on the boundless waste.

6. 7. Stellar spectra - colored slides

8. Dyson neb.

9. Neb. spectra

Huggins \rightarrow Bowen
1864 \rightarrow 60 years \rightarrow 1927

nebulium N_1, N_2 in green O^{++}

2 in red N^+

1 near $H\gamma$ O^{++}

1 in near U-V. O^+

Thus as H.N.R. says the mystery of nebulium
has vanished into thin air.
& as you see this is true both metaphorically
and literally.

- 10. Acc. Sky 5. Pleiades.
distance 100 parsec.
light takes over 300 years.
- 11. Extra focal. 6 or 7.
- 12. Maestlin 1579. 11
friend of Kepler who wrote to him
of Tycho Brahe's work that it
had the "fragrance of ambrosia".
modern 11th to this is Eddington's ref.
to the "devastating beauty of
quantum arithmetic".
- 13. Galileo 1610. 36.
- 14. Pleiades Hertzsprung, 2616.
- 15. Appls. of photography. Strome 1936.
Colour filter. Scorpio region. Antares region.
- 16. " Orion Lower, California
1939
- 17. Plasketh model. Read Strom to him
p. 2, 3. ✓✓
- 18 } Center of Galaxy. F. & Ross. 1954.
- 19 } Sagittarius Ophiuchus + Scorpio.

- Extra group of galaxies beyond foreground stars
20. M. 51. Earl of Rosae.
1845. Parsonstown.
21. M 31 800,000 l.y.
22. M 33
23. M 33 variables 42 Cepheids
24. Flat + edge on neb.
25. Twin neb or
26. Coma Ber.
27. Spiral spectra.

Hubble estimates
distance of faintest
spirals on his plates
 500×10^6 l.y.
& within this radius
 10^8 galaxies.

Interpretation of Red shift. 500 km/sec / megaparsec.
de Sitter, Le maître

de Milne throws the blame on our

choice of Time Scale. Elaborated

- (1) T-scale of ord. Here Now experience - atomic vibrations not
constant in time
- (2) T-scale of constant atomic vibrⁿ then laws of Nature are
functions of epoch.

28. M. 81. Was Mayor

What have been the reactions
of man to this gradually unfolding picture

7

In the ancient world with its geocentric outlook, it was natural for very great importance to be attached to man. For him the sun and moon rose and set, for him the stars shone forth, for him the rains fell and the earth produced her increase - "Thou madest him to have dominion over the works of thy hands, thou hast put all things under his feet." If to-day, man be regarded as of great intrinsic worth, it must be for intellectual reasons and for spiritual reasons; it is no longer an obvious deduction from a survey of the physical universe.

Man is a part of this vast universe & no insignificant part. He looks out on his world & recognizes some of its problems including its greatest mystery - himself. He ~~is making~~ ^{is making} progress toward solving some of these problems.

But when we look at the mind of man exploring the problems of thought, of science, of art, & when we look at the spirit of man many a sublime height of courage, endurance & service ~~and~~ ^{can} we doubt his importance, his intrinsic worth?

It is the misuse of his powers that affals us

Doppler Principle
& its Application
in Astronomy

RASC Montreal
1940 Oct. 24.

The Doppler Principle + its application in Astronomy.

[Dr. H. Barnes FRS. 1912 ... *and* *undiscovered*
1st heard of Doppler effect]

Vienna University. 1922

Memorial to Doppler 1843 Principle $\frac{d\lambda}{\lambda} = \frac{v}{c}$

Applied by Fizeau 1848

1. Line of sight vel. of stars.
2. Rotation of Sun + Convection currents in photosphere.
3. Differential rotation of Saturnus Rings.
∴ meteoric composition.
4. Spectroscopic binaries + orbits.
5. Pulsating stars. Cepheids + long period.
6. Novae
7. Moving clusters and //^x.
8. Rotation of Pleiades + other star clusters.
Hence Mass.
9. Rotation of M 31 + hence Mass.
and idea of Rotation of
our Galaxy.
10. Rotation of our Galaxy.
Charlier + Coit + J. Plaskett.
11. Recession of Galaxies.
De Sitter and Lemaitre Theories.

SLIDES

- 1. Br. line sp. & A scale Explain shift
- 2. Mizar with scale photographed on
i.e. Comp. sp. of Fe-Ti
- 3. Mizar in Ura. Maj. Constellation
Pickering 1889 double lines
- 4. 4th Catalogue of Spec. Bin 1936 1420 systems
375 orbits
periods few hours to 10 days
for 50% others up to
several years.

Mizar system 5' 5"
5' spec. Bin in 20.5 days.

- 4. One component only bright enough to
photograph - μ Orionis
- 5. Pulsating stars. δ Ceph. $\pm 6\%$ radius
Tupriue
- 6. δ Ori. Long period variables - Mira like
Mira like $330d \pm 15d.$ $\pm 30\%$ radius
draper $3.75 - 9m.0$
Irregular Variables δ Ori.
Betelgeuse $\pm 30\%$
 $5.8 \text{ yrs} \pm$

Application to γ of Ceph. P-L Relation

- 7. Nova Aquilae 1918.
- 8. Light graph.
- 9. Spectrum sequence.
- 10. N. Aqu. 1918 2 absⁿ lines.
 2300 Kmp/sec. = 46A
 1700 Kmp/sec. for yellow
 $\lambda = 6000$

Reconstruct story of cataclysm from spectrum.

F. J. M. Stratton's Atlas of Spectra of Nova Herc 1934
 1934 Dec — 1935 Apr

3181 spectra $\lambda 3600$ — H α .
 956 from 26 observations chosen

Super Novae. Read Harvard note by Shapley Aug. 1940.

11. Planetary Nebulae, rare phenomena.
 150 Known. †

Typical diam 7000 a. u.
 Central star v. hot temp 100,000
 Bowen, est from O⁺⁺⁺ lines
 yet low abs. mag. Blue dwarfs.

Doppler vel of rotation 5.3 Kmp/sec.
 Hence by bal. centrifugal force
 as grav. pull
 get mass = 22 \odot

for Ring Neb. Lyra: mass = 7 \odot

- 12 Σ Aurigae . Constellⁿ.
- 13 " " diagram .

$P = 27$ yrs.
1 yr in partial eclipse .

Large faint star Bright star .

3000 $\times \odot$	Diam	
60000 \odot	Total rad ⁿ	60000 \odot
1300 $^{\circ}\text{C}$	Temp.	8000 $^{\circ}\text{C}$.
infra red	Spectrum	F ₂
30000 $\times 10^6 \times \odot$	Vol.	
10^{-9}	density.	

Solar syst almost to Uranus
could lie within it .

Its outer atmosphere 50% transparent
to light of Σ_2 in eclipse . Yet this
degree of low dens. should be quite
transparent Hence why a 50% loss
ionization by u.v from Σ_1 produces
a stellar Heaviside layer cutting
down light to 50% .

Struve 1937
1938

14. M 31 differential rad. vel.
Per. of rot. $17 \cdot 10^6$ yrs.
mass $10^9 \odot$.
15. Plankets diagram
16. } Rot. of our Galaxy.
226 10^6 yrs.
17. } Centre of Galaxy in Sag. + Oph.
F.R. Ross.
18. } Recession of Galaxies
Red Shift.
19. } 2 spirals 51 & 81.
20. Doppler Shifts.
21. Einstein & de Sitter
22. Lemaitre
23. de Sitter & Friedmann.

International record of Coop.
Faith in mankind.

work for the time when international
Cooperation in the things of mind
& spirit that are worth while.

W.B. Yeats

all things fall & are built again
and the spirits of them who build are gone.

Not
shown.

London & Zurich when
the Sun was in Taurus
(a Scientific Miscellany)

RASC
Toronto
1947 Feb 11.

Zurich - I.F.V.W.

Adamowicz
Westerdijk
Ramar Lucas

Hannover
+ Brussels
Louvain

Zurich Univ. Bossard
Wolff Nos.

Physics + Engineering
Enrollment. 4000 →

N.S.R. + ISS. Jean Lévy ✓
Jacques Burdels
Madame Noël
Leyser ✓ + Comblou ✓

LONDON

Dr Buege ✓ - children. de Sitter ✓
Dr Oort - Leiden. Minneart.

Sir G. Darwin Lecture May 10 ✓
H. H. Plaskett - 100 mich ✓

Stratton ✓ H. J. Comrie
Dingle ✓

~~To Cambridge - Main Eddington
Plumier chair H. Jefferys
E's book +
E. T. Whittaker.~~

Plea for international coop. in all sci
full + open exchange. ✓
UNESCO. ✓

2500 students present

50 Turkish student

150 from Germany, France, Hol,
Belg + Czechoslovakia

Cyclotron isotope of 43 with
a 3 range radiactive
disintegration - Geiger counter
5 ft. distant.

Piezo crystals Rochelle salt
grown to 5" x 3" x 1"
also potassium phosphate
crystals

Origin of Solar System

Miller Geol. Club, Queen's Univ.
1948 Nov. 9.

$$\frac{\text{Mass of Planets}}{\text{Mass of Sun}} = \frac{448.7}{331,950} = \frac{1}{748}$$

Distribution of angular momentum
 Mw^2

Jup, Sat, Uranus & Nept 98%
 of ang. mom. of Solar System

$$\frac{\text{Their masses}}{\text{Sun's mass}} = \frac{448.7}{331,950} = \frac{1}{748}$$

1. Laplace: Nebular Hypothesis 1796
 enunciated "with that diffidence which
 ought always to attach to whatever is
 not the result of observation or of calculation"

Large hot globe of gas in slow rotation
 Contraction + more rapid rotation
 + consequent equatorial bulge
 Critical stage when ring of gas
 thrown off by centrifugal force > grav. attr.
 Each ring formed a planet
 Repeat for satellites - obvious in Saturn's ring.

see Baker p. 172-173 + Jeffreys p. 36

Velocities V in orbit ellipse or \odot
or parabola

Energy eqn

$$V^2 = G(m_1 + m_2) \left(\frac{2}{r} - \frac{1}{a} \right)$$

r = radius vector

a = semi major axis

hence low V when r great + v.v.

+ critical V for a circle

When $r = a = \text{const} = \text{radius of } \odot$

$$V^2 = G(m_1 + m_2) \frac{1}{a}$$

any other vel. requires departure
from circular orbit

If a vel is increased to

$$V^2 = G(m_1 + m_2) \frac{2}{a} \text{ then}$$

planet or satellite would
escape from its ell. orbit +

travel off on a parabola

+ perhaps be captured by another
planet. i.e. moon by earth?

2. Planetesimal Theory
Chamberlain + Moulton 1900

Criticism hot tidal gases, wd diffuse, wd condense
Spitzer - Yale

Mech. difficulties - passing star producing
this req'd tide could not impart
the high ang. mom. H.N. Russell

3. Tidal theories

J.H. Jeans

Harold Jeffreys. The Earth

4. Collision Theory - H Jeffreys

5. Double Star - Collision - Lyttleton

6. Pean-shaped fission Cartan, Liapounoff + Lyttleton

7. Triple Star - Lyttleton

Novae. normal. peak mag. $-5^{M.5}$

Supernovae " " $-11^{M.5}$

8. Hoyle. Supernova $T_0 - 14^M$
i.e. $10^8 \times \text{luminosity of sun}$

9. Weizsäcker
Disc like nebula about sun + turbulence

10. Rotating disc nebula Edgeworth
+ shear + condensations

see H. Jeffreys MNRAS. 108, 1. 1948 Report
to Council

SLIDES:

1. Elliptical orb.
2. Spiral types.
3. M 81
4. M 51
5. M 33
6. M 31
7. our galaxy J.S.P.
8. C.G. 7 & R
9. " "
10. ~~Cygnus~~ Sun & planets size magn.
11. Jacobi figures & Roche series
12. J.H.P. Cygnus-shaped tube
13. Double star paths, Sirius
14. " " orbit (relative) Sir. B.
15. nova Aquilae 1918.
16. nova magnitude graph.

Solar System Scale.

Sun 1 inch.

Mer. 3 ft

Ven 5 " $\frac{1}{100}$ " diam

Earth 8 " "

Astronomy's Debt
to The Engineer

Women's Committee
Joint conference of
Am. Assoc. of Civil Engineers
& Engineering Institute of Canada.

Niagara Falls.

1942 Oct. 15.

Astronomy's Debt to the Engineer.

Mankind has turned his face upward toward the stars in all ages not only because of the aesthetic beauty of the heavens and to satisfy his natural curiosity, but bec. of 2 chief essentials, TIME + DIRECTION

Units of Time & Chronology.

Sundials.

Egyptian water clocks.

Sand glass

Early mechanical clocks.

Chronometers 450 years ago Oct 12
Columbus made landfall
on San Salvador.

Harrison's Sea Watch 1764

awarded £ 20 000 for Gov.
of 1713.

Marine Chronometers

Shortt Clocks.

Crystal Oscillators.

Direction - By sea + desert

Ulysses steering is course by the stars
Koran God has given you the
sun + stars for light by day
+ as guides in the night.

Survey - Civil engineers.

Mapping the heavens.

primitive eye only.
line of sight.

SLIDES.

1. Hevelius Danzig. 1650.
graduated arc.
2. Galileo's Tel 1610.
3. Newton " 1672
4. Newton.
5. Y.O. 40" 62ft = f. tube 6 tons
morning pts 20 tons.
6. Mt W. 100" \$500,000
7. Dao vic B.C. 72"
8. Stellar magnitudes, positions movements,
binary orbits, clusters etc.
+ Spectroscopic studies
8. Solar sp.
9. Stellar types Secchi
10. Stellar sequences.
11. Interferometer. aa mic. USA.
12. In contrast Herschel 4 ft mirror 1785
13. Paris Obj. 1667 Louis XIV
14. Y.O.
15. Mt W.
16. Greenwich.
17. Metcalf Tel Harvard.
18. Berlin Siemens erecting 47" tel reflector
19. " 26 inch reflector. NOT a common spectr.

20. Sir Howard Grubb, Parsons & Co.
N. Castle - on - Tyne
42" glass for Russian Tel.

21. Dec. Sky S. see Orion Pleiades.
Bible.

22. Orion Neb.

23. " horse head neb.

24. Pleiades
Tennyson Many a night from
the pleads rising thro' the
mellow shade
Glowing like a swarm of
fire flies tangled in a
silver track.

25. Maestlin 1579 11 stars.

26. Galileo 1610 36. "

27. Hertzsprung 1925? ~~2616~~ 2616 "

28. March Sky. N.

29. Cassius ~ 7^h exposure.

30. Earl of Rosse. d. 1867.
Father of Parsons turbine

31. Whirlpool neb.

32. M 31.

33. J.S. Plaskett's Universe

34. Centre of Galaxy. F.E. Ross. Sag. & Scorp.

35. Scales 10²⁷ atoms 10²⁸ men.

36. M. 81.

4

A dynamic universe of ordered change,
in which atoms & stars obey
the laws of their natures producing
beauty & harmony in the universe

Contrast the behaviour of mankind
The challenge of astronomy to
each of us is to play our part
faithfully & truly in obedience
to the laws of our natures
Law physical & laws spiritual.
Thus only will mankind progress
from selfish nationalism towards
an internationalism of mutual
helpfulness & trust, -
a harmony in human affairs
comparable to the Cosmic
harmony which astronomy, with
the help of physicist, chemist, mathematician
and engineer, has revealed.

Mrs. Keeler

Mrs. Land

" " Mrs.

Mrs. B. B. B.

Phyl. Jones

Con. Brown

Greek Astronomical
& Mathematical
Contributions

Notes
1944 2 good summaries

9

AWD.

The Legacy of Greece

by Livingston, Cleveon Press
1922

in Mathematics, Astronomy & Nat. Philosophy
Sir T. L. Heath, F.R.S.

Thales about 600 B.C. brought Geometry from Egypt.

& developed many of propositions of Euclid Book I, etc.

Similar triangles - hence heights of pyramids of Egypt by shadows

Predicted solar eclipses based on Babylonian discovery of recurrence of eclipses after 223 lunations

Pythagoras about 550 B.C. Theory of Numbers. Proportion of commensurable magnitudes. Ratios of musical intervals. Geom.: Euc. I. 47, etc., incommensurability of diagonal of a square. Astron.: Earth spheroidal in shape. Sun, moon & planets have indept. motions opp. to that of daily rotation - still geocentric, but thus no longer concentric spheres idea. "music of the spheres"

Hippocrates squaring planes etc. proportion

Democritus wrote treatises on irrational lines & solids

Plato 400 B.C.: encouraged his pupils in Math & Astron.

Eudoxus 350 B.C. "an original genius second only to Archimedes" in this subject

1. He extended Pythagorean proportion as in Euc. Bk. V. to all magnitudes commensurable or incommensurable. Borrowing this is "nothing in the whole body of the elements of a more subtle invention, nothing more solidly established". Keystone is Bk. V. Bk. VI.

2. He discovered the method of exhaustion for measuring curvilinear areas and solids i.e. inscribing polygons of many sides

Astron.: theory of concentric spheres to account for motions stationary for retrogradations of planets. 4 spheres for each planet. "a marvel of geometric ingenuity".

Menaechmus 350. discovered conic sections - parabola & hyperbola

Euclid 300 B.C. "The Elements" in 13 Books. collected all previous work, arranged & grouped & added many new propositions. "The Conics" in 4 books. "The Phaenomena" on Spher. Astron. "Optics" on perspective or "Elements of Music".

Aristarchus of Samos 250 B.C. anticipated Copernicus & stated Sun at rest & Earth, Mercury & Venus revolve about it in circles. Found arithmetical limits to trig. ratios of small angles.

Archimedes 250 B.C. invented a tubular screw still used for pumping water, mechanical engines of defense for Syracuse against Roman invasion.
Math: Ratio of cylinder circumscribing sphere to sphere is 3:2; Conoids, spheroids, spirals, plane equilibrium
Quadrature of Parabola. The Lever
"On Floating Bodies" I + II. Centres of Gravity
Studied Eudoxus' method for curvilinear areas + volumes by taking limits of circumscribed as well as inscribed polygons - equivalent to integration.

Eratostratus 250 B.C. Librarian at Alexandria.
Measured Earth's radius by length of shadows at Syene + at Alexandria 5000 stades distant. Hence
Circumference = 252,000 stades, i.e. 7850 miles, according to best authority, of length of stade - i.e. only 50 miles less than true polar diameter.

Apollonius of Perga 250 B.C. The "Great Geometer".
8 books on "Conics" going far beyond Euclid's knowledge of ellipses, hyperbolas, parabolas. - Evolutes, Tangencies, Plane Loci, cylindrical helix, Irrationals. Closest value of π .

For 5 centuries fewer & fewer lesser geometers kept alive the subject, extending proofs or forming alternatives - until

Pappus about 300 A.D. gathered all the fragments & works of the early Greeks in the "Collection". Together with several original theorems.

32.1 stades
= 1 mile

Italy's Poster Campaign

Two weeks before Italy's
momentous election day,
which is set for April 18th,
I crossed the Swiss-Italian
frontier at Chiasso near
the southern end of beautiful
Lake Como. At once the
the mighty conflict of political
opinions became evident ~~to~~
~~through~~ from the barrage
of posters that met the eye
on railway station notice
boards, on walls and fences, at
street corners and in frames ^{erected}
strategic public places ^{everywhere} in villages,
towns, and in the great cities, this

form of

2

political struggle was being waged, a battle of brain and wit and caricature, of proclamation and appeal, of pen and crayon and paint brush — attack and counterattack, blast and counterblast; sledge hammer blows and skillful rapier thrusts.

The multiplicity of political parties was reflected in the ~~large~~ ^{large} number of ~~soon~~ ^{soon} apparent and also the fact that three or four groups have the greatest financial ~~money~~ ^{backing}, — The communists, The Christian Democrats, The very leftist Popular Democratic ^{front} and the moderate socialists. ~~Poster~~ ^{was} pasted upon poster. Each morning new ones ~~are~~ ^{are} are

added. ~~There seemed to be~~ ^{seems to exist}
 a code of honour regarding
 opponents' posters, for very few
 were defaced in any way. ^{Only by other hand}
 Some of the most striking, ^{specially framed} posters would
 disappear overnight, ~~from their special~~
~~frames at a busy corner though~~
 whether this was sabotage or because
 they were purposely transferred to
 another vantage point, I could
 not ascertain.

The anti-clerical posters ~~were~~ ^{are}
 many and varied - some bitter
 and vindictive, some cruelly clever
 in their ridicule. In Milan
 I saw several which made use of
 reproductions of some of the
 great religious art of Italy: the
 crucifixion scene of a 14th century
 Florentine master with a harsh
 caricature of priests at the feet
 of the cross; The Last Supper
 by Leonardo, with a diatribe

against the "false apostles" of 1948. One large poster seen frequently in Milan, Bologna, Florence and Siena, consists of the pictures of Mussolini, Hitler, Franco and of the Cardinal of Milan blessing the Fascist troops before they set off on the war of aggression in Abyssinia.

In Florence one morning by the busy Straw Market where the vendors were putting out their gay baskets, hats, mats and other wares, a brightly coloured poster depicted first a heavily laden donkey (Italy) led on by a caricatured priest holding out a carrot, second the weary donkey drinking water in the heat of midday while the priest sat in the shade eating grapes, and lastly the donkey in the act

of delivering a mighty hand
kick to the priest on April 18, 1948.
This theme of an awakened Italy
throwing off the oppressive
domination of ecclesiasticism
appeared in many forms.

The Christian Democrats have
put out many dignified proclamations
and appeals. Some of these show
the faces of leading church
dignitaries; all of them, so far as
my observation went, display
a plain cross, never a crucifix.
In Siena ~~particularly~~ did these
posters appear to outnumber those
of any other party.

Early in the campaign, the
communists and pro-communist
socialists adopted the head of
Garibaldi against the background
of a 6-pointed star, and
effective use has been made
of this in many ways. The
descendants of Garibaldi who

(6)

are ~~not~~ active politically in
Italy ^{to date} are not pro-communist.
~~and no doubt~~

The anti-communists have shown ~~great~~ imagination and ingenuity in their retaliation. Posters show a voting box surmounted by a Janus-like head, one face is that of Garibaldi, the other Stalin, and a vote cast for the former ~~increases~~ ~~adds~~ up the count for the latter. In others the face of Garibaldi is seen to be merely a mask behind which is that of Stalin, or a death head, or a wasted prisoner behind bars and barbed wire.

An effective leftist design shows a youth escaping from the blackness of a prison with its adjacent graveyard & advancing with upstretched arms toward an arch beyond which is sunlight and the word Libertas.

The long nose of De Gasperi gives the cartoonist great scope for exaggerated caricature, and ~~his opponents~~ the opponents of his party are making full and humorous use of this. In many posters, he is depicted as awaking in nightmare horror on April 18, or suffering rude and violent ejection from office. The not unusual ~~election~~ ^{method of political attack} campaign by contrasting pre-election promises with post-election compromise or inactivity is exploited with vigour

Trieste is featured by both sides. The western powers would see ~~that~~ that justice was done to Italy, therefore vote anti-communist. Vote Communist because then Yugoslavia will hand ~~over~~ ^{over} Trieste to Italy as a gesture of brotherly good will.

There are many anti-American posters depicting Uncle Sam as a sinister figure insinuating friendship, ~~himself as~~ playing the part of gracious benefactor, actually robbing Italy and planning to dominate ~~over~~ her and reduce her to a puppet state. On a notice board in Bologna station was a ~~cartoon~~ cartoon clipped from a newspaper and coloured with crayons showing (1492) ~~empty~~ ^{bribes} promises of food and ^{empty promises of} gold to the Indians (1948) ~~empty~~ bribes of

corned beef and tinned milk ⁽⁸⁾
to the Italians and equally empty
promises of ~~wealthy factories~~ ^{industrial wealth} and
prosperity. The Marshall plan
is ridiculed in many ways.

One small cartoon ~~shows~~ warns
against haste in accepting it,
and shows groups of unemployed
workers outside a closed factory —
"chiusi; piano marshalla".

The counteroffensive to these
includes posters listing ~~some~~
~~of~~ UNRRA benefits to Italy and
amounts of food and other
necessities shipped over from
the U.S.A. One sequence of
cartoons ~~is~~ called "A day in the
life of an Italian" and shows
his ^{indebtedness to} ~~that of~~ American ^{aid} ~~products~~
from his morning ablutions, his
~~second~~ breakfast and his bicycle

ride to work, to the close of the day. Another poster displays a crane ^{ashore} ~~swimming~~ a crate of produce on which the stars and stripes are evident. Yet another portrays the bow of a U.S.A. freighter laden with food and machinery for Italy. A teacher in one city said to me that he felt confident that the Italian people realize that they would have starved without American wheat and rice.

Two grimly sinister cartoons are almost omnipresent. In one a hideous black spider, ~~with~~ symbolical of American imperialism, is sprawled across North America with its hairy legs spread over South America, southern Asia

(10)

and western Europe. In the other ~~a~~ red octopus on the map of U.S.S.R. has great red tentacles reaching out over Scandinavia, over China, over ~~the~~ ~~Greece~~ Balkans, ~~and Greece~~ over Germany and Austria, over Greece and one tentacle across the Adriatic to fasten upon the peninsula of Italy. Variations upon this theme include in one case a gun, in another an axe, both weapons labelled "Your Vote" severing the red tentacle threatening ~~the~~ Italy.

One striking feature of the campaign is the

effort to make every one
 exercise his franchise.
 They are fighting apathy and
 fighting timidity. The
 non-voter is ridiculed
 in poster after poster -
 he is represented as a
 headless man in a frock
 coat, a fat man in
 petticoats, a sleepy rabbit
 with its nose on its paws,
 an imbecile in a ~~frame~~
 perambulator. The non-
 voter ^{is pictured} as ipso facto voting
 for Stalin. ^{He is shown as waking up} ~~He sees a skeleton~~
~~behind barbed wire.~~
 He sees with horror ~~that~~
~~freedom and freedom~~
~~has~~ → that freedom has
 departed from his country, and a
 skeleton behind barbed wire points

after April 18 1950
 To an engraver Stalin

an accusing finger at him.

Italy in all the beauty of Spring, wisteria blossoms hanging like draperies, the purple pink of Judas trees, lilacs, bridal wreath, fruit trees in full bloom, ~~and~~ tulips and great peonies and multi-coloured anemones in profusion!

Loud speakers booming out election speeches in the public squares; Basso, eloquent leader of the left wing socialists, pouring forth oratory from the Loggia del Signoria

^{in Florence} to a standing crowd of perhaps three or four thousand on Sunday morning April 4; Students of Milan and other

Cities allying themselves
with the moderate socialists;
Sermons in every church
demanding a vote in
opposition to a materialistic
philosophy of life and government,
bells pealing from ancient
towers and marble cathedral
belfreys; and everywhere,
everywhere, these campaign
posters catching the attention,
awakening the curiosity,
stirring the minds of
the citizens of this beautiful
and ancient land whose
poets, artists, sculptors,
~~and~~ musicians, scientists
and philosophers have
enriched the whole world.

The whole world will be looking
at Italy on April 18, 1948.