Tercentennial Anniversary of LOMONOSOV

Lomonosov - 300

- Who is he
- Life
- Science
- Complexity of Science
- What makes a genius?
- Anecdotes
- Then and Now

"Ломонос" = Clematis

"Ломоносов" = breaking noses

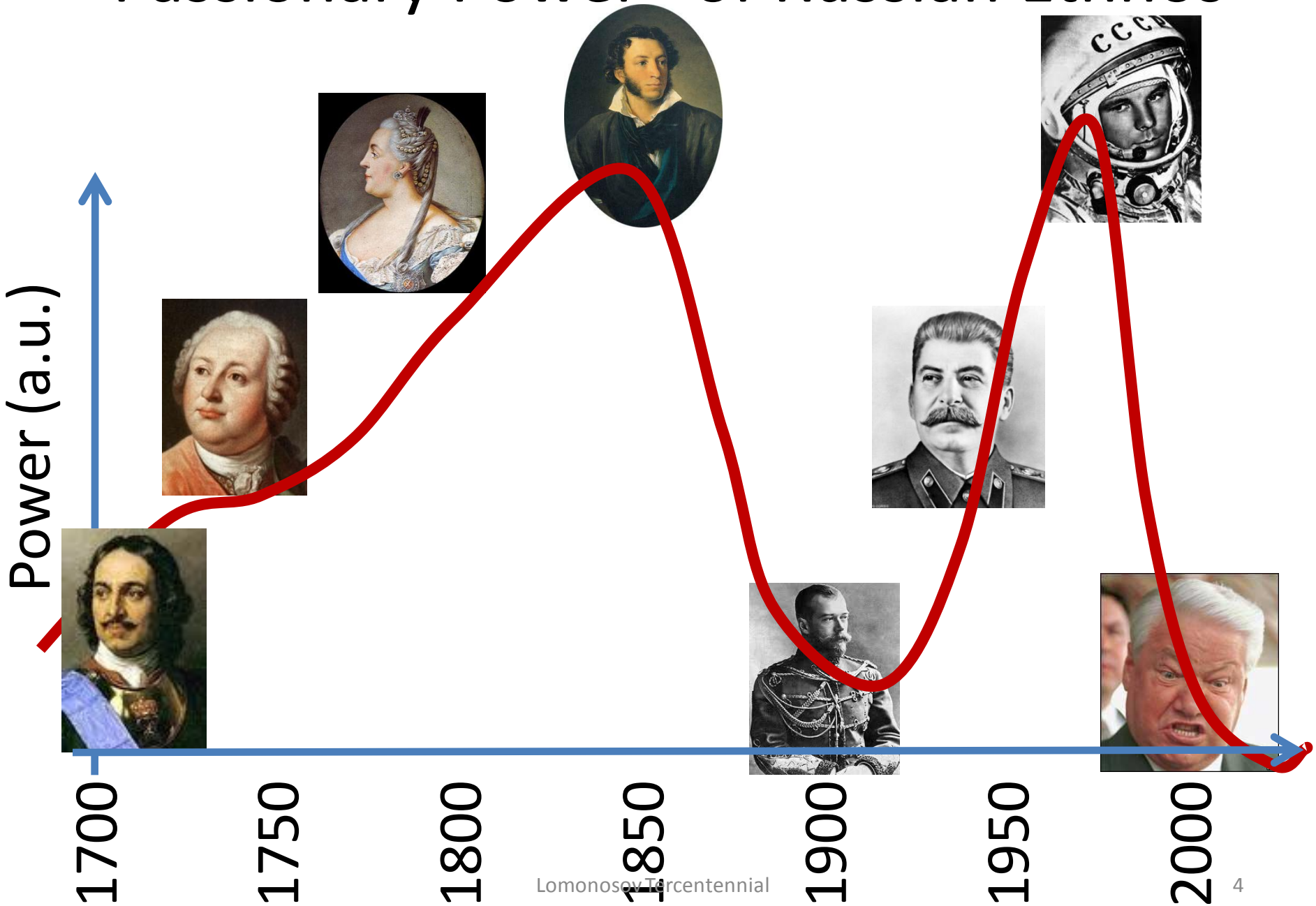
Mikhail Vasil'evich

LOMONOSOV

Nov 19, 1711 – Apr 15, 1765

- **Physicist** and **Chemist**
- Poet and **Artist**
- **Engineer and Entrepreneur**
- Courtier and Administrator
- Philologist and **Astronomer**
- Geologist and Mineralogist

“Passionary Power” of Russian Ethnos



Pushkin on Lomonosov

«…между Петром I и Екатериною II
он один является самобытным
сподвижником просвещения.
Он создал первый университет;
он, лучше сказать, сам был
первым нашим университетом”

А.С.Пушкин 1835

1755

Moscow University

“…between Peter I and Catherine II, he (Lomonosov) was the original champion of the Enlightenment. He founded the first University: better to say, he himself was our first University…”

Named After Lomonosov

- Moscow State University – Russian Top One
- Town (near St. Petersburg), home village
- Range in Arctic ocean, ocean stream, peninsula, Moon crater, mineral, crayfish species
- Three Universities
- One Theater
- Russian State China Factory
- 8 Schools
- 54 streets and squares
- Russian State-wide tricentennial celebration 2011

Roots & Early Life

Scientific Tradition

Gottfried Wilhelm von Leibniz

1646 – 1716

Christian Wolff

1679 - 1754

Mikahil Lomonosov

1711 - 1765

Lomonosov: Nature-Phylosopher

- Adjunct Professor of Physics St.Petersburg Academy 1742
- Dissertation "On origins of heat and cold" 1745
  (refereed and strongly supported by Leonard Euler)
- Academician (Professor) of St.Petersburg Academy 1745
- Formulation and experimental proof of law of 1748
  conservation of matter and movements
- Physical Chemistry 1752
- *Measurements* of atmospheric electricity and 1753
  theory of electricity (with G.Richmann)
- First working model of helicopter 1754
- Novel concept of Reflector telescope 1756
- Theoretical concept of Earthquakes' origin 1757
  of minerals, review of geological observations
- Solid mercury obtained & studied (with I.Braun) 1759
- Venus atmosphere discovery 1761
- Theoretical justification of the Arctic path expedition 1763-65

Scientific Academies

• Plato's Academy	~380's BC
• Accademia dei Lincei	1603
• Royal Society of London	1660
• German Academy of Sciences Leopoldina	1662
• French Academy of Sciences	1666
• Prussia Academy of Sciences Berlin	1700
• St-Petersburg Academy of Sciences	1725
• Royal Swedish Academy of Sciences	1739
• American Philosophical Society	1743
• Göttingen Academy of Sciences	1751
• Dutch Academy of Arts and Sciences	1806
• Academie Des Sciences Wien	1847
• National Academy of Sciences USA	1863

Lomonosov's Pattern of Thinking

- Deep insight into the Nature of things (Physical Theory, Hypothesis)
- Deduct consequence(s) – phenomena, effect
- Make experimental proof , test (… m.b. Adjust Theory)
- In case of success → Turn it into something useful

Chemical-Physical Laboratory

Выводы из модели тепла

- Correction of Boyle-Mariott law – for final molecule size (Clausius Law)

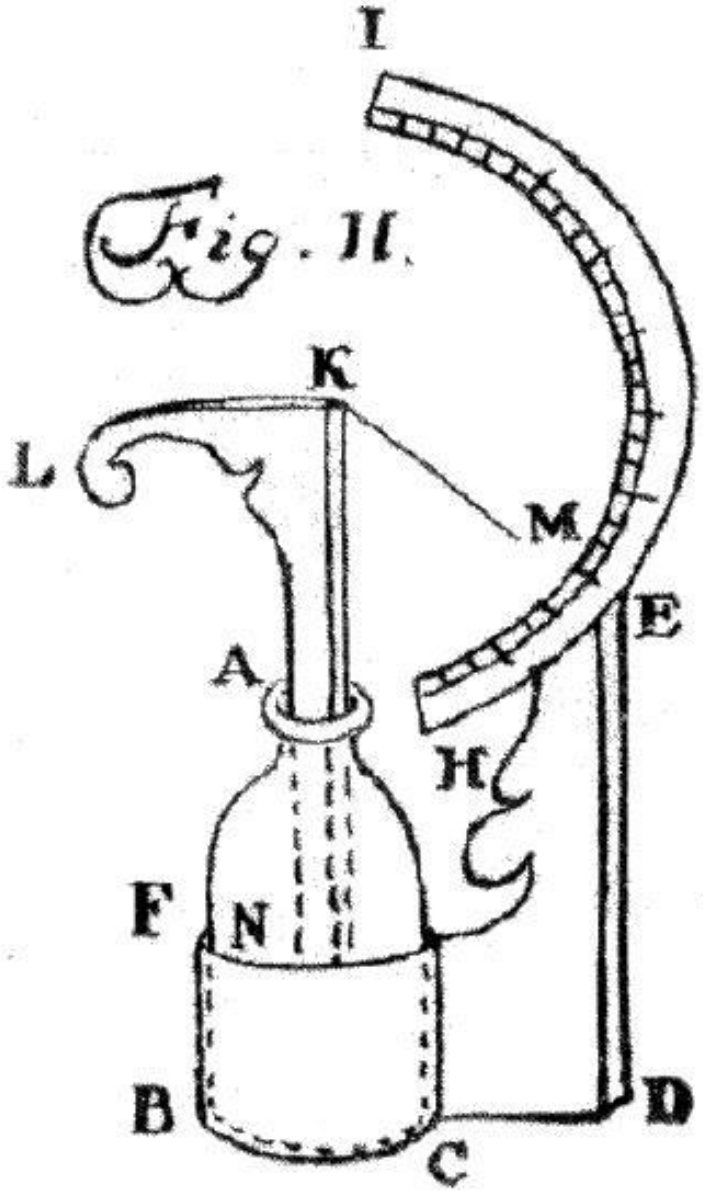
$$P=RT/(V-b)$$

- Idea of absolute cold (zero temeperature) – when corpuscles stop moving or/and rotating
- Theory of colors (4000 experiments himself)
  - Mosaics
  - Mosaics factory

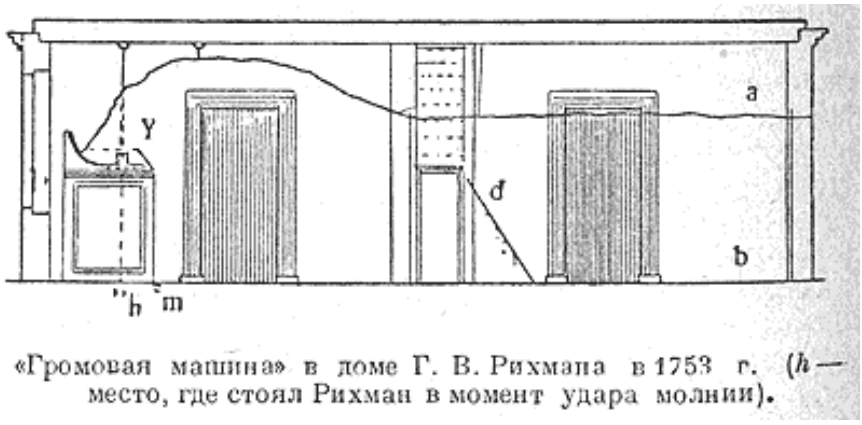
Mosaics “Poltava Battle” (1764)

Lomonosov’s Porcelain Factory

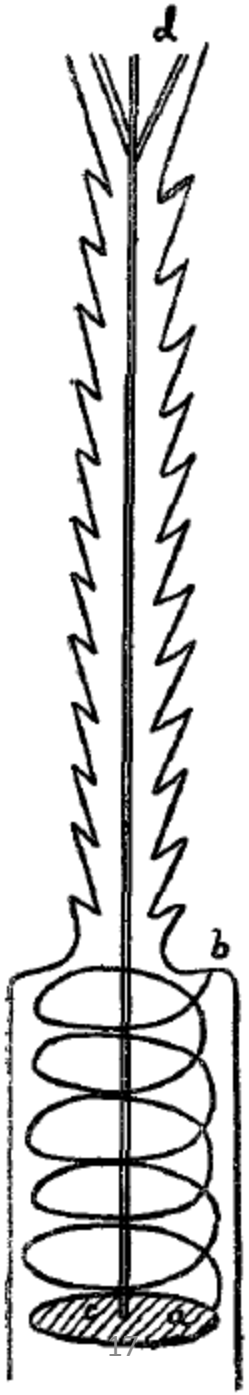
Опыты с электричеством



Georg Richman and Lomonosov



«Громовая машина» в доме Г. В. Рихмана в 1753 г. (*h* — место, где стоял Рихман в момент удара молнии).

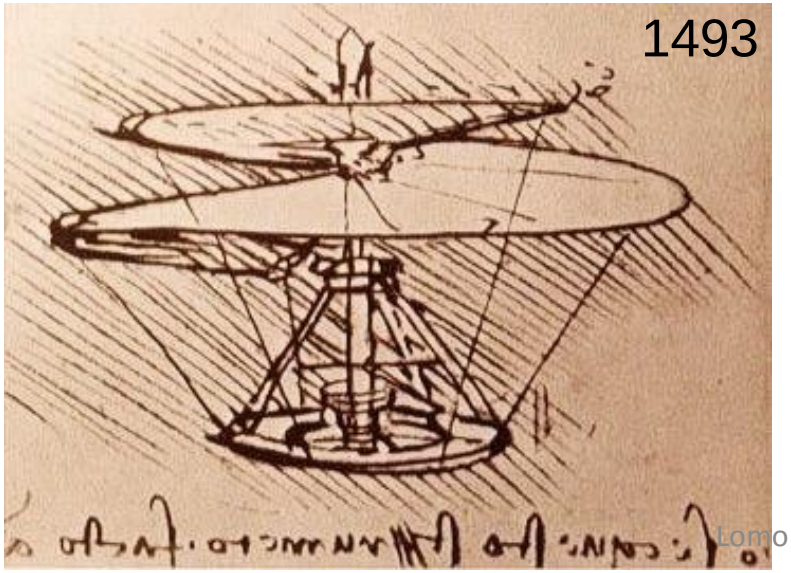


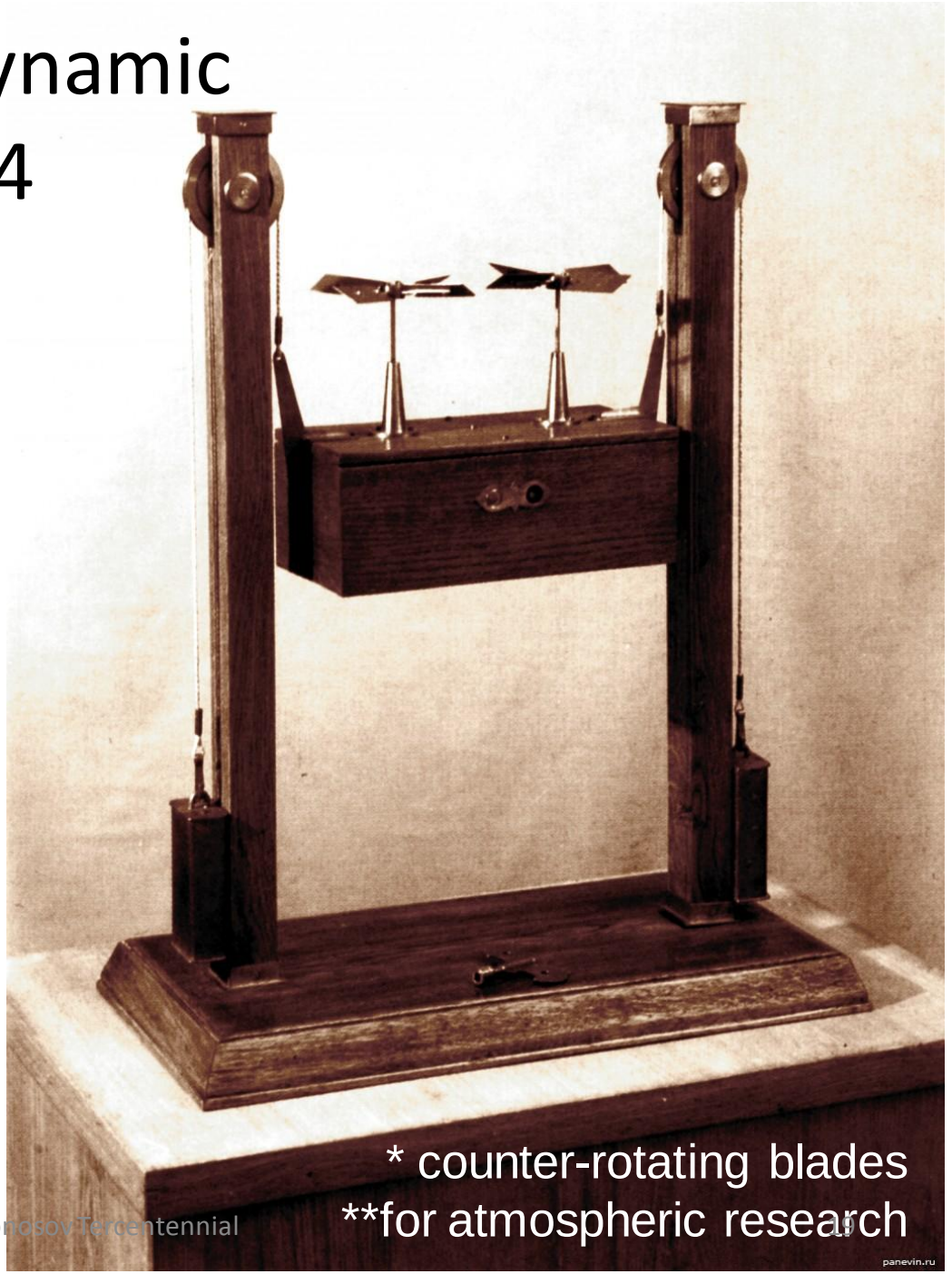
Theory of Atmospheric Electricity

Lomonosov Aerodynamic Machine 1754

Chinese top
4th cent. A.D.

Leonardo's "airscrew"
1493





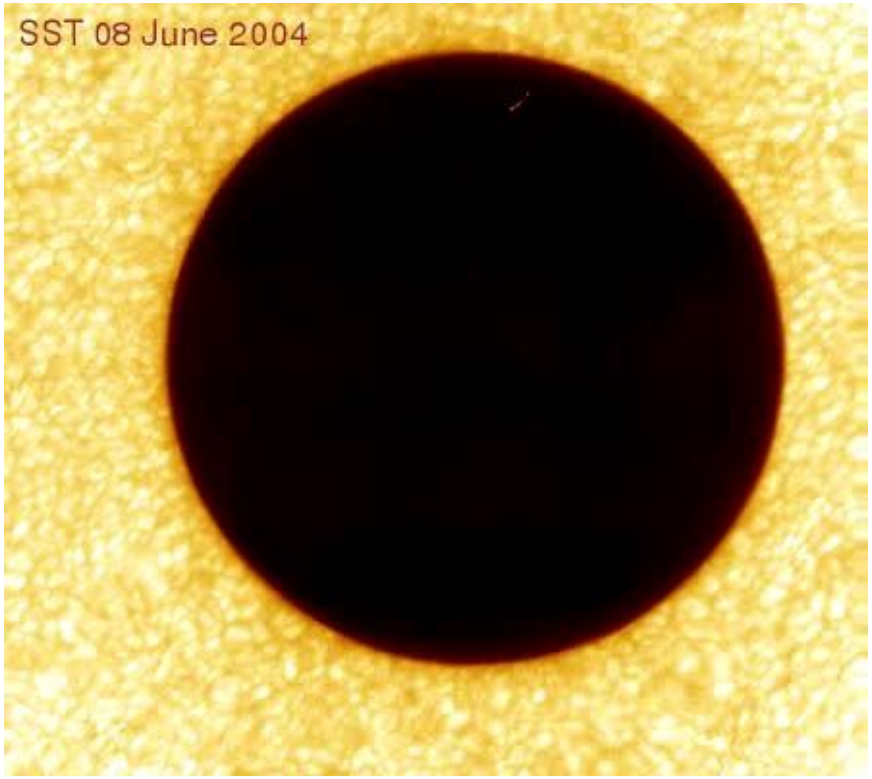
* counter-rotating blades
**for atmospheric research

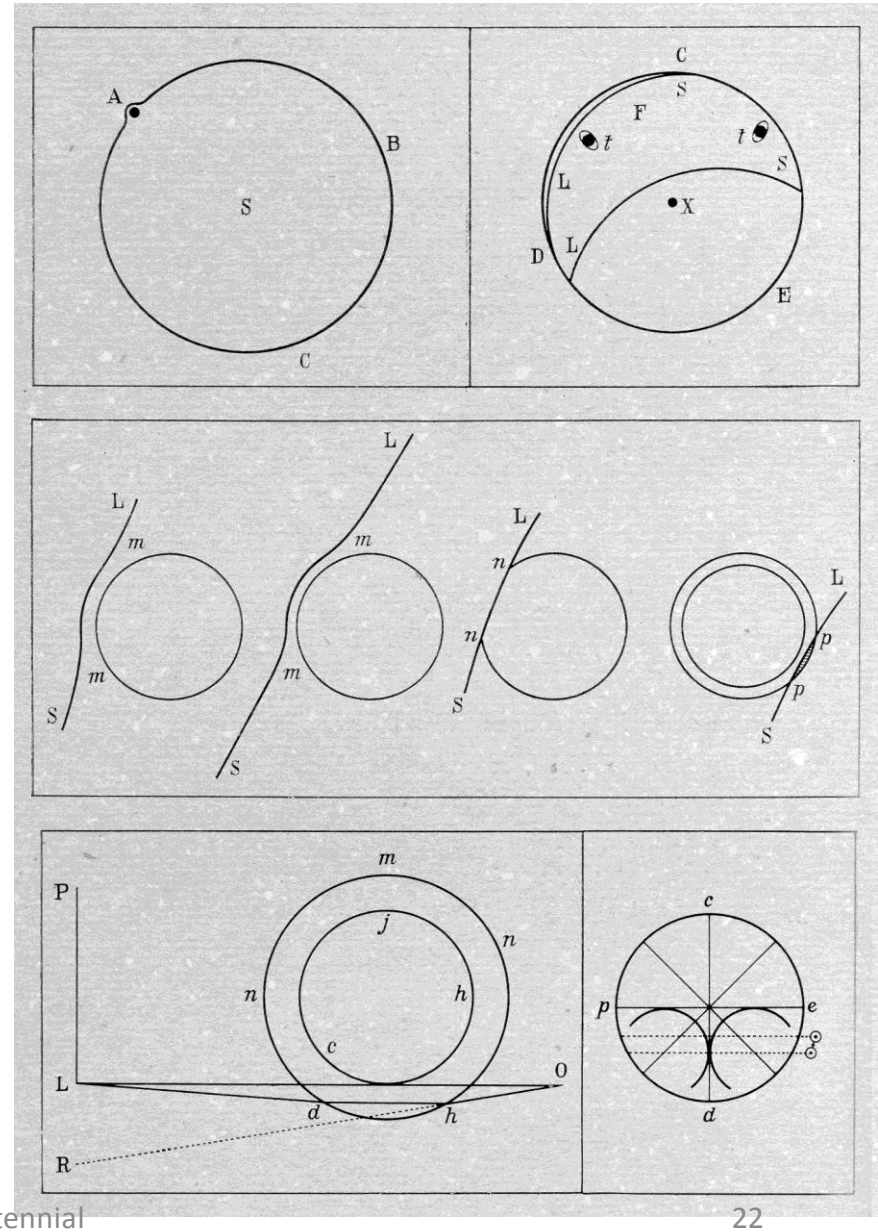
also in *Yak*-24, *Piasecki* H-21, all *Kamov*'s helicopters

Lomonosov's Actions in 1761

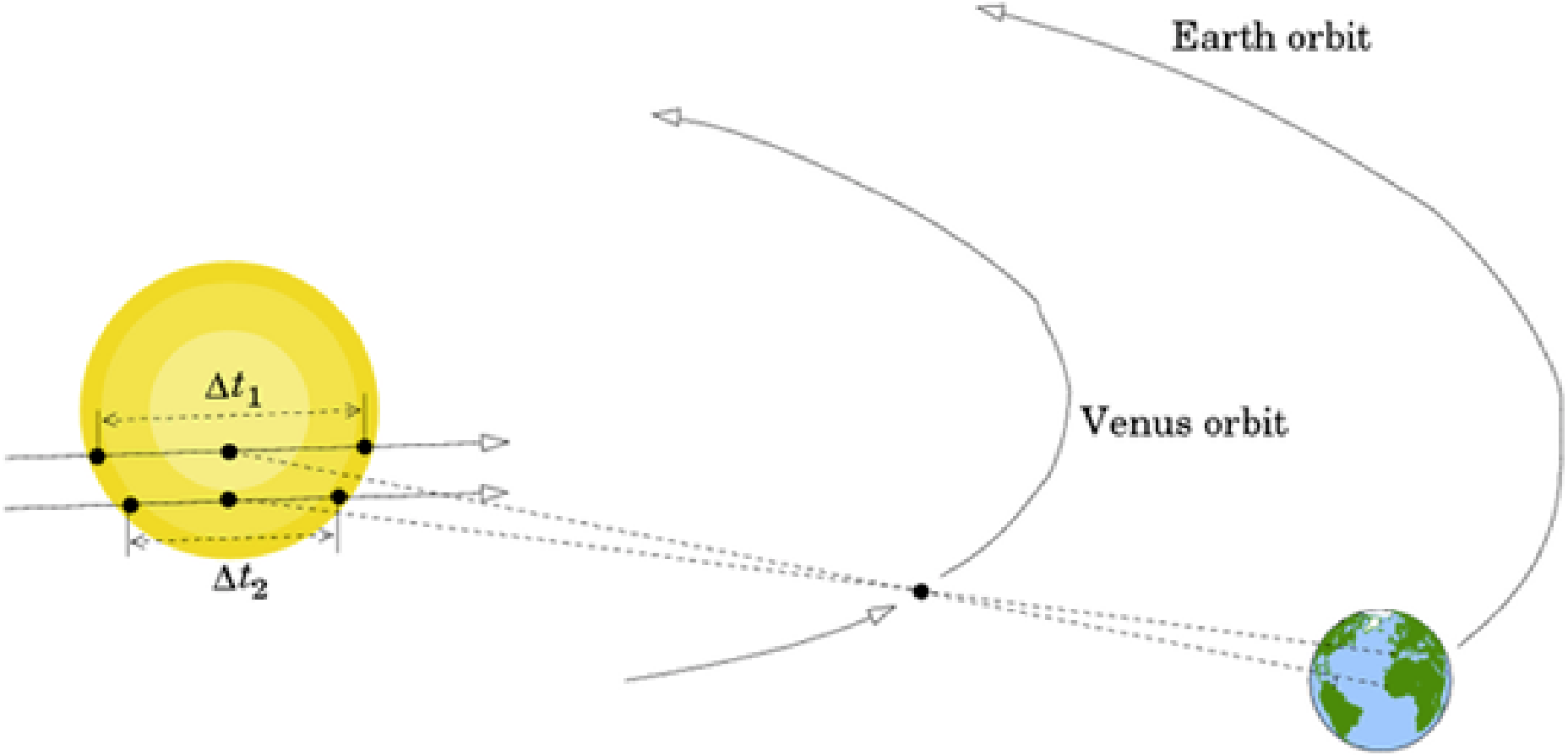
rcenter

Lomonosov Discovers Atmosphere of Venus





Transit of Venus May 1761



Transit of Venus June 5-6 2012

You can see it, your kids can see it, your neighbor kids can see it!

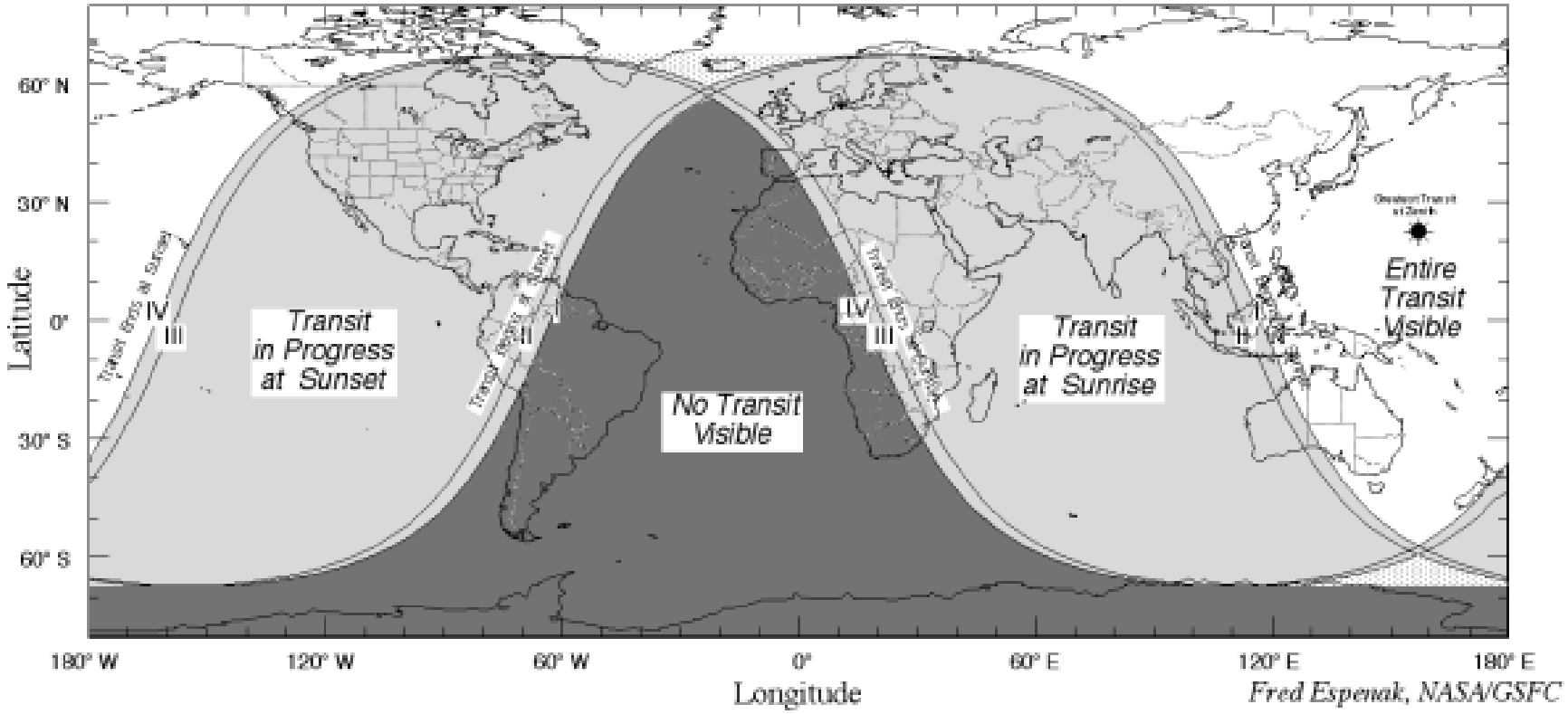
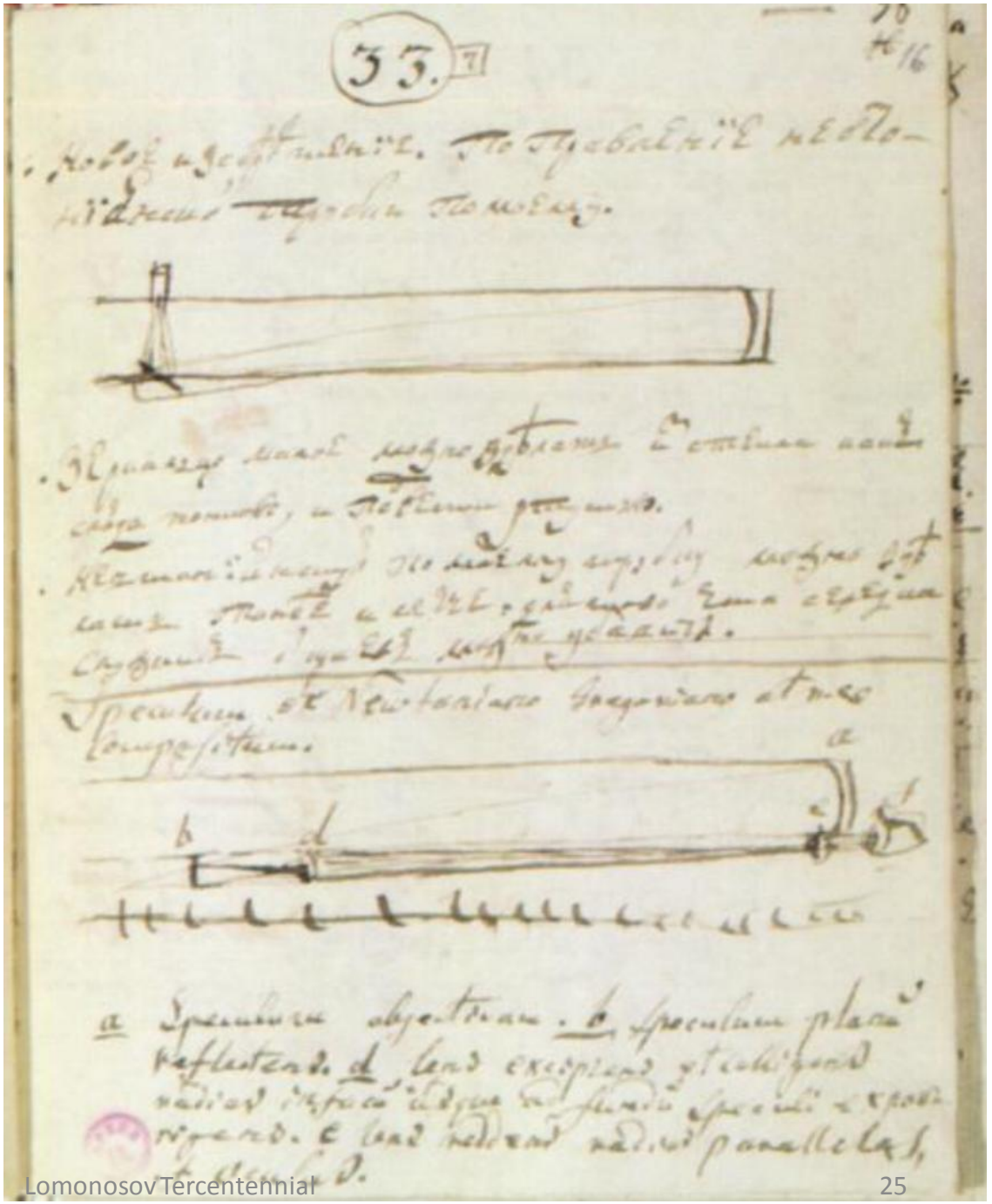


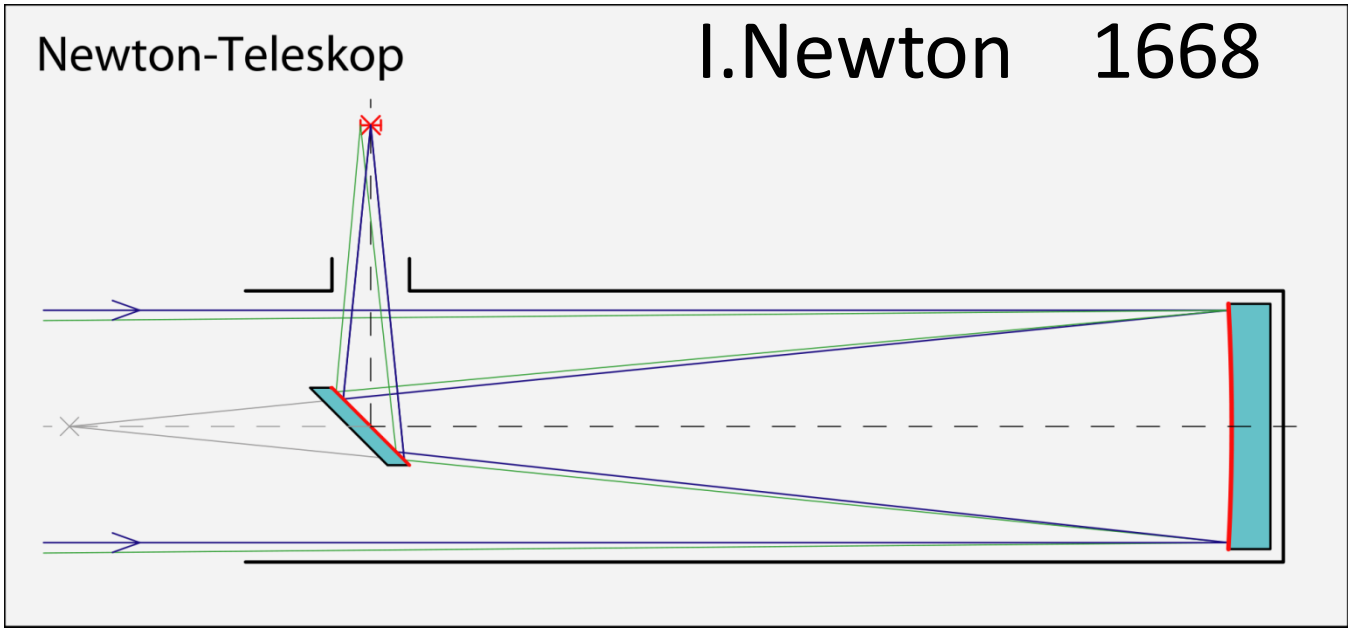
Figure 3 - World Visibility of the Transit of Venus — 2012 June 06

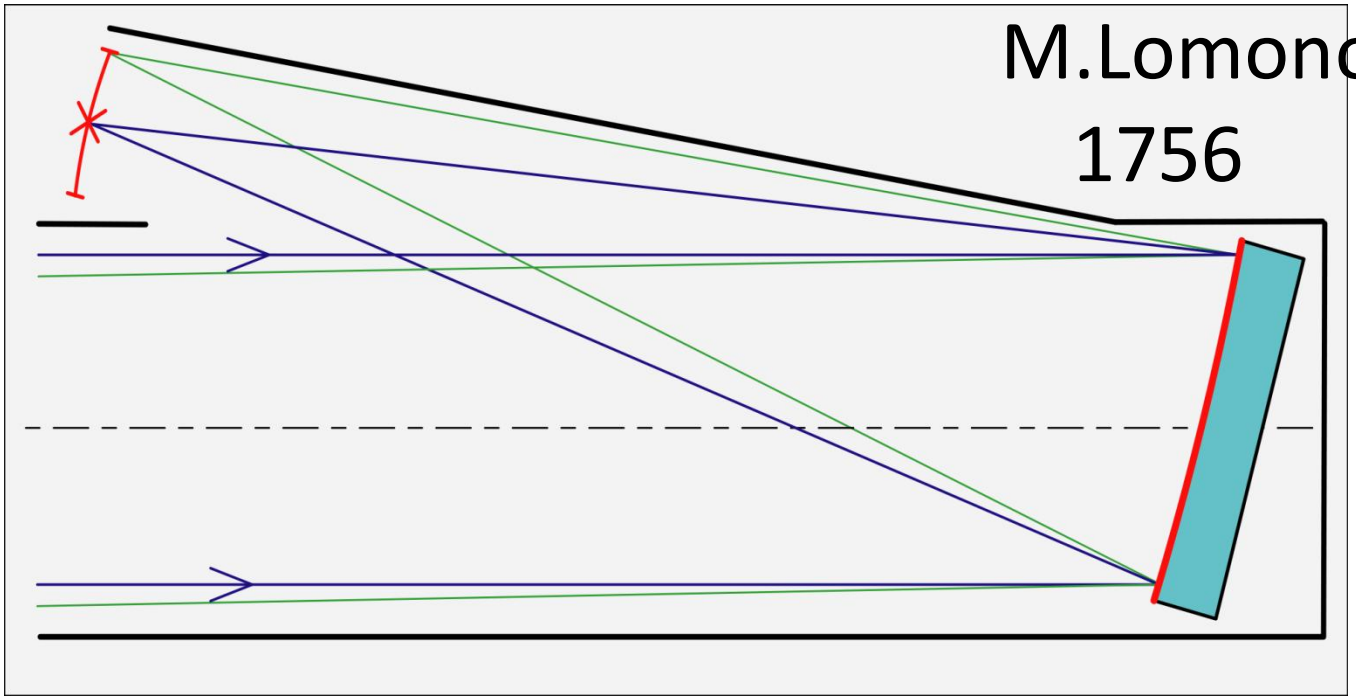
Celebrate 250th Anniversary of the Discovery of Venus Atmosphere by Lomonosov

Lomonosov Reflector Telescope

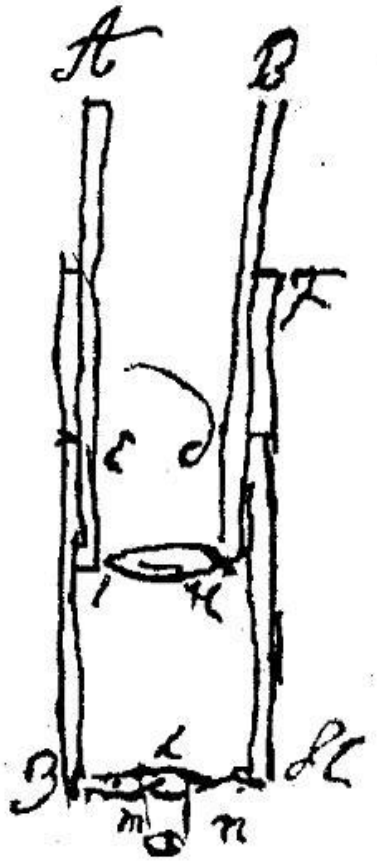
- I.Newton 1668
- Lomonosov's concept 1756
  successful model 1762
- William Hershel 1789




Newton-Teleskop
I.Newton 1668


M.Lomonosov
1756

Ночезрительная труба
(рисунок М. В. Ломоносова)



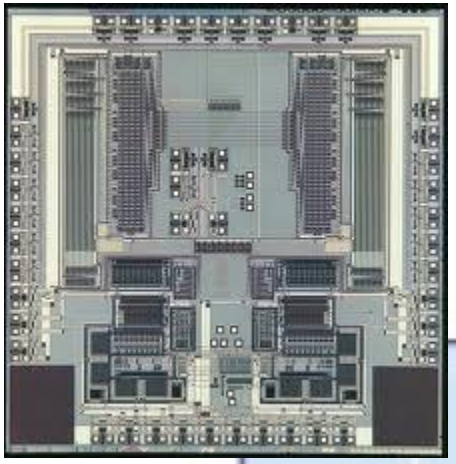
Lomonosov: Beyond "Just" Sciences

- Odes to Tsarinas 1739, 1746, 1763
- Founded Moscow University 1755
- Arctic Sea Expedition 1763
- Russian Grammar 1754
- Mosaics Factory 1752-1764
- Academy Management (top 3) 1757-1765
- Russian History 1765
- Demography Analysis 1761
  - Age difference (15/2), no forced marriages, 3rd time widowers, monks age limit, baptism in warm water, move holydays, pharmacies, birth assistance → 10 million/20 yrs (pop. 22 million in 1750) double the rate

Quantitative Theory of Genius…
or How to Become One:

An Example of Lomonosov's

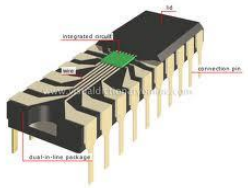
Примеры Сложных Систем



“Закон Мора”

число тразисторов на чипе

растет в 2 раза за 2 года



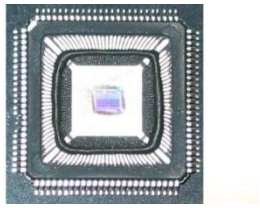
“CPT Теорема” – о сложности

Если научная система характеризуется (1) параметром, то чаще всего она растет экспоненциально

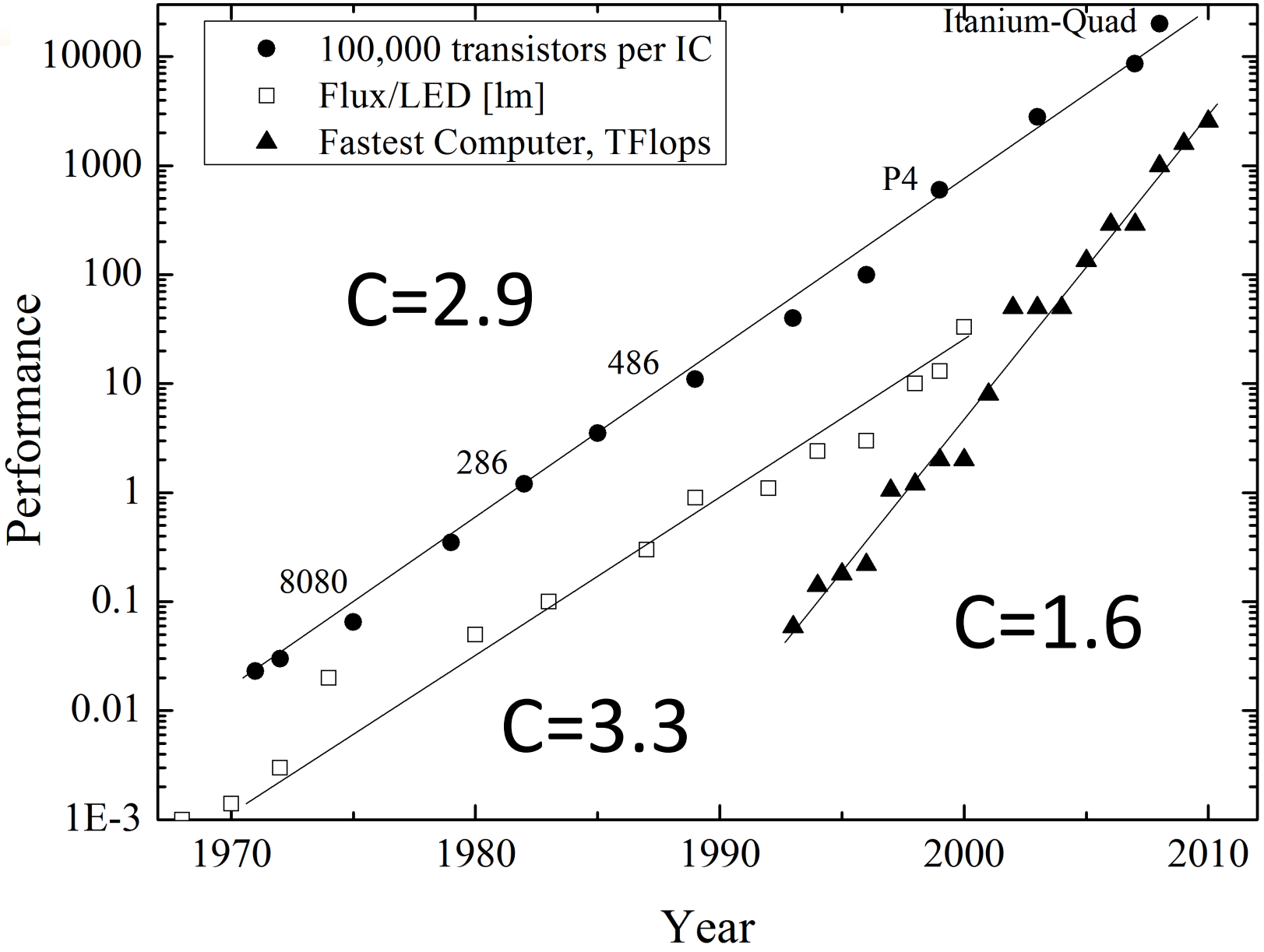
$$L(after\ \ time\ T) = L_0 \times \exp(T / C)$$

C (сложность) = время [годы] нужные для увеличения в ***e раз***

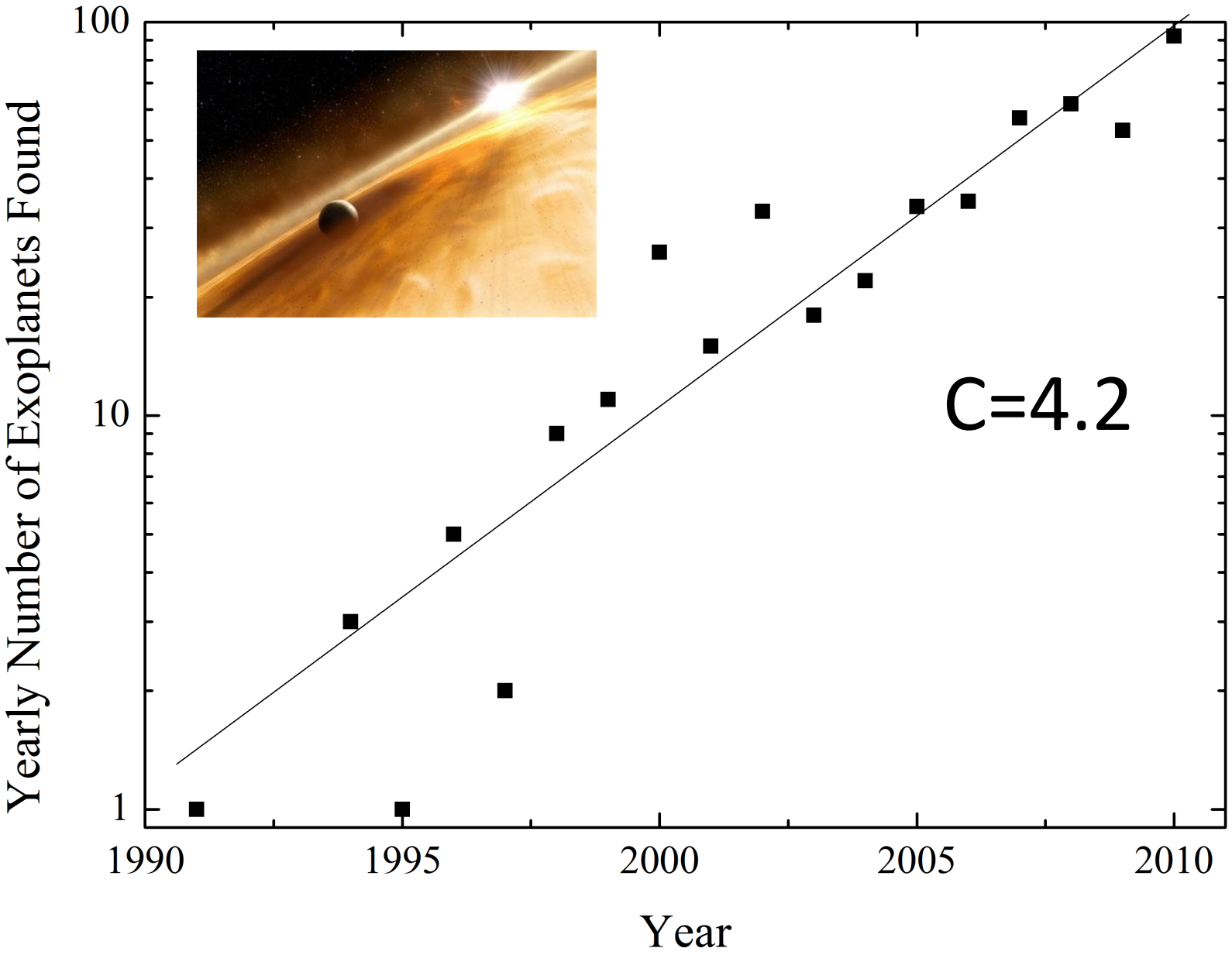
Напр “Закон Мора” → C=2/ln(2)=2.9



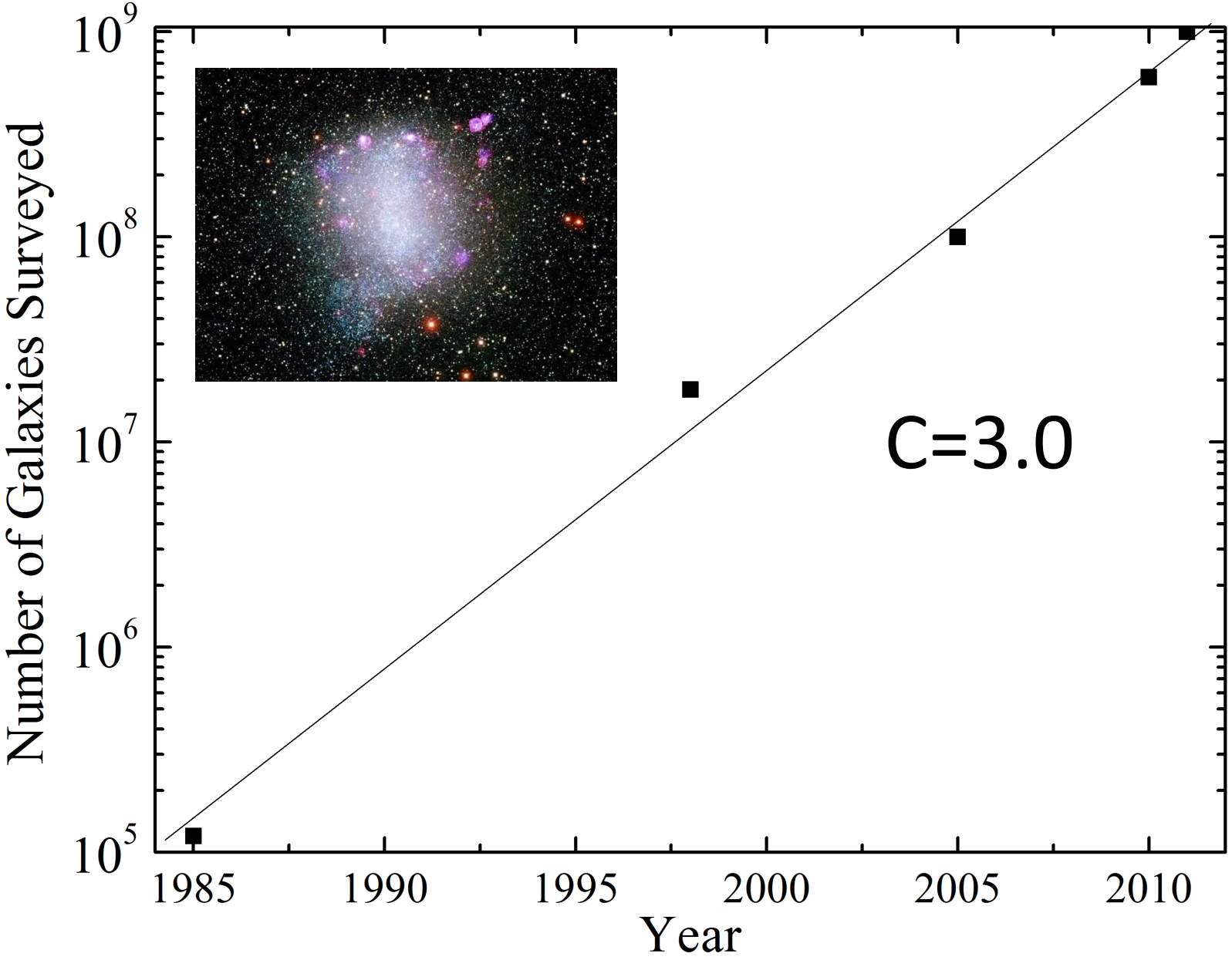
Moore's Law, LEDs, SuperComputers



Примеры из Науки: Экзопланеты



Обследованные Галактики



Сверхмощные Лазеры

Laser Peak Power (Tera-Watts)

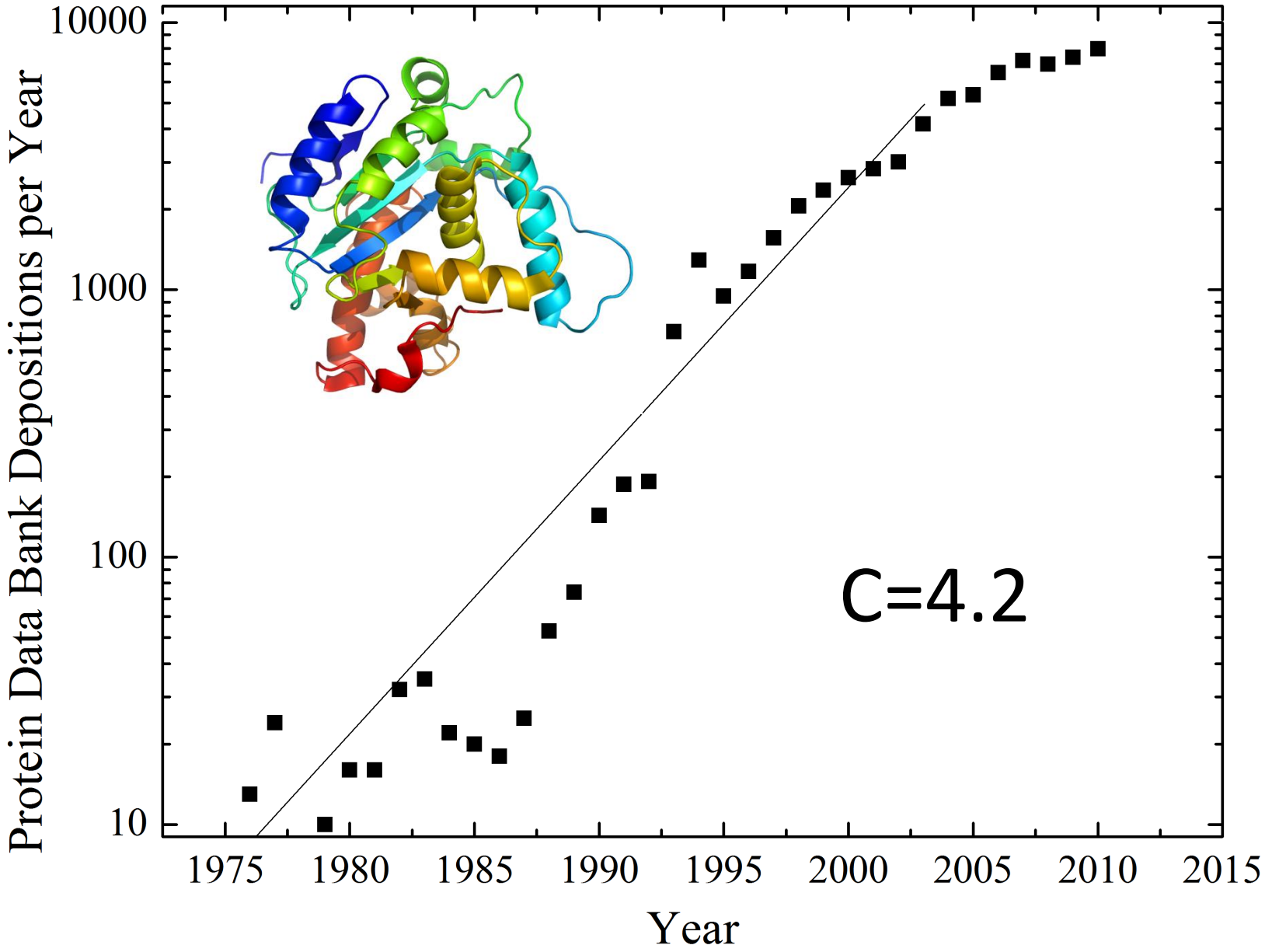
1000
100
10
1

1975 1980 1985 1990 1995 2000

Year

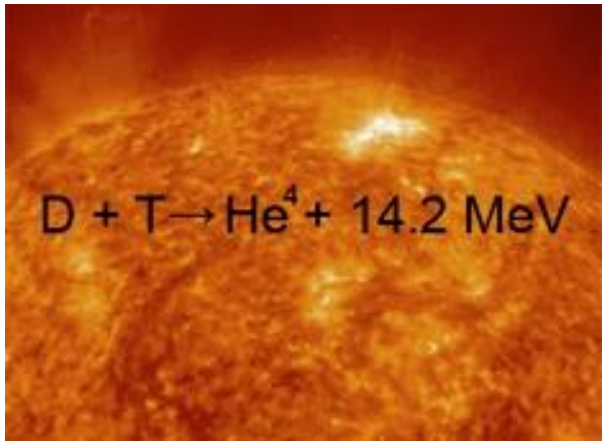
C=3.3

Расшифровка Структуры Белков



Lon

Реакторы Термоядерного Синтеза



Fusion Triple Product $T_i n\tau$ (10^{25} degree m^{-3} s)

1000
100
10
1
0.1
0.01
1E-3

1965 1970 1975 1980 1985 1990 1995 2000

Year

C=2.4

Beam Energy

Beam Energy (eV)

Year

proton
electron

LHC
Tevatron
Main Ring
SPS
U-70
PS
Cosmotron
Crocker
Van derGraaf
Cockroft-Walton
Cyclotron(Lawrence)
Betatron(Kerst)
LEP-II
SLC-LEP
TRISTAN
PETRA
CESR
SPEAR-DORIS-VEPPIII
ADONE
PRIN-STAN-ACO-VEPPII

C_proton=4.3

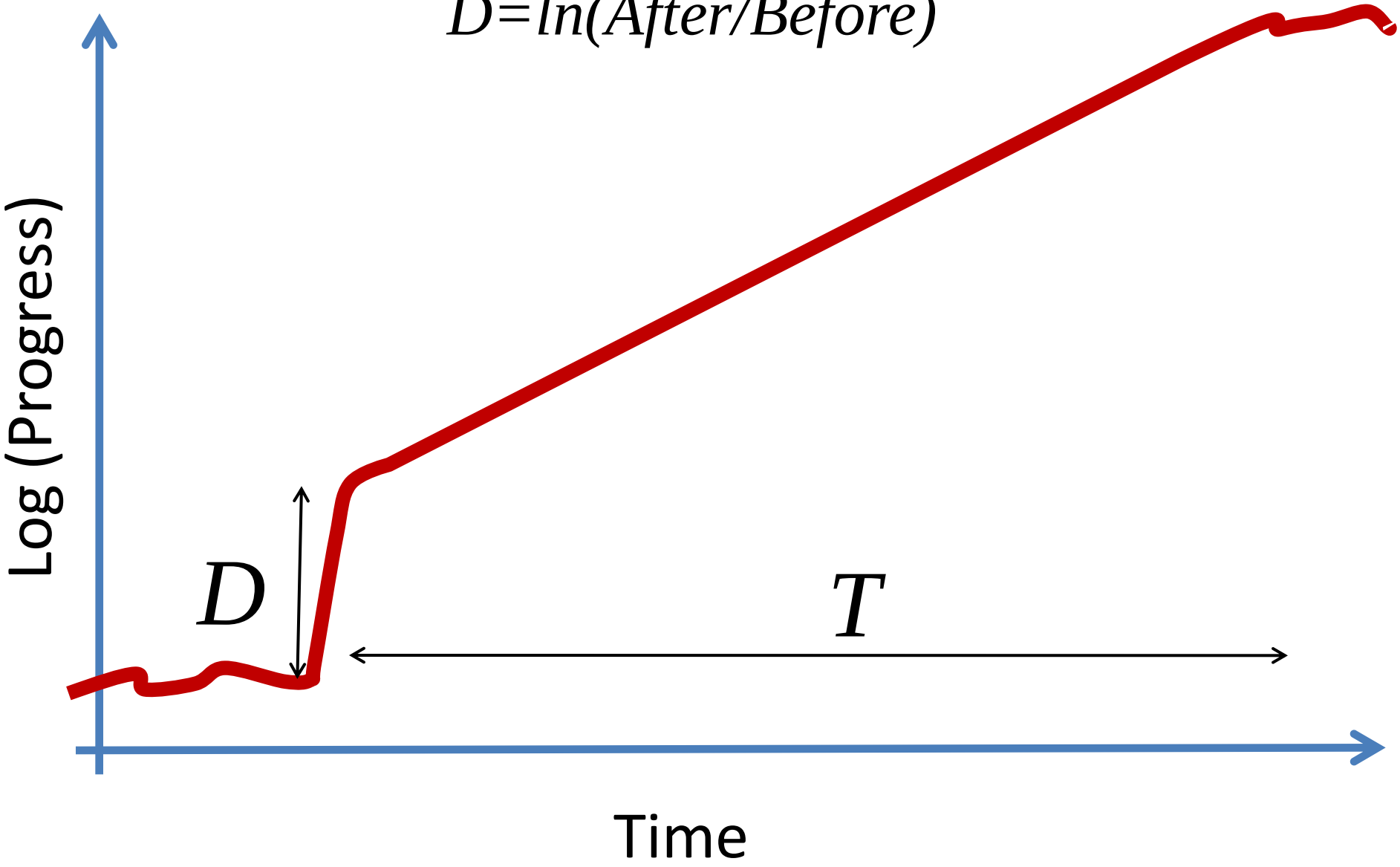
C_electron=5.2

V. Shiltsev
Modern Physics Letters A
Vol. 26, No. 11 (2011) 761–772

	C, years	Interval	Comment
Fastest computers	1.6 ± 0.1	1993–2010	http://www.top500.org/
Luminosity of colliders	$1.6 \ldots 4.4$	1972–2010	see Table 1
Fusion reactors	2.4 ± 0.2	1969–1999	
Transistors per IC	2.7 ± 0.05	1971–2009	Moore's law
Galaxies surveyed	3.0 ± 0.1	1985–1990	
Light per LED	3.3 ± 0.1	1969–2000	Heitz's law
Most powerful lasers	3.3 ± 0.5	1975–2000	http://laserstars.org/
Protein structures	4.2 ± 0.2	1976–2010	http://www.pdb.org/
Exoplanets search	4.2 ± 0.3	1991–2010	NASA
Energy of accelerators	5.2 ± 0.3	1930–1990	Livingston plot
Protons accelerated	7.2 ± 0.6	1960–2009	

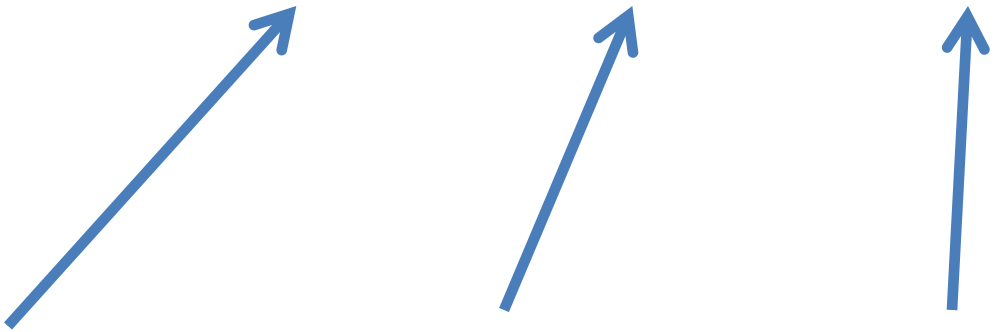
“Genius Effect”

$$D = ln(After/Before)$$



“Genius Formula”

$$Genius = T \times B \times D$$



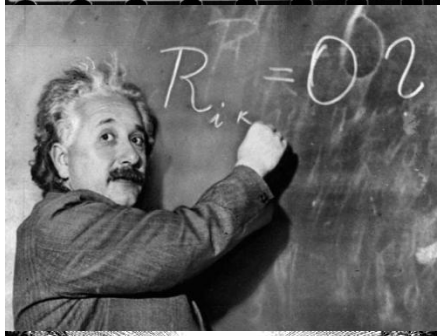
Time
(duration)

Breadth
(# of areas)

Depth
(of impact)

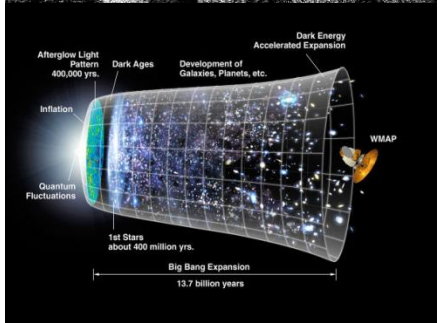
$Genius = T \times B \times D$

$= 15yrs \times 3kids \times ln(7B + 1/7B) = 7 \times 10^{-9}$



$= 106yrs \times 1 \times ln(4) = 147$

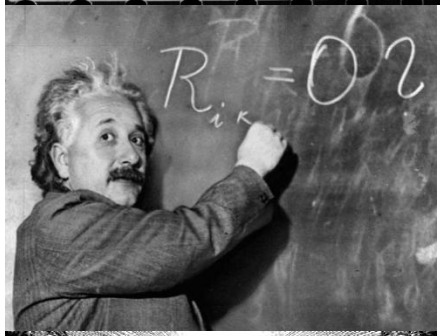
$= 7519yrs \times 6 \times ln(10) = 103{,}000$



$= 14 \times 10^{9}yrs \times 1 \times ln(10^{6}) = 2 \times 10^{11}$

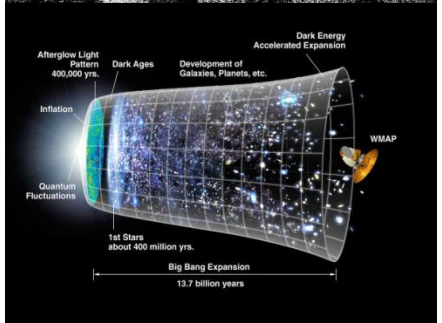
$Genius = T \times B \times D$ or $\ln(T) \times B \times D$

$= 7 \times 10^{-9}$ $= 1.2 \times 10^{-9}$



$= 147$ $= 6.5$

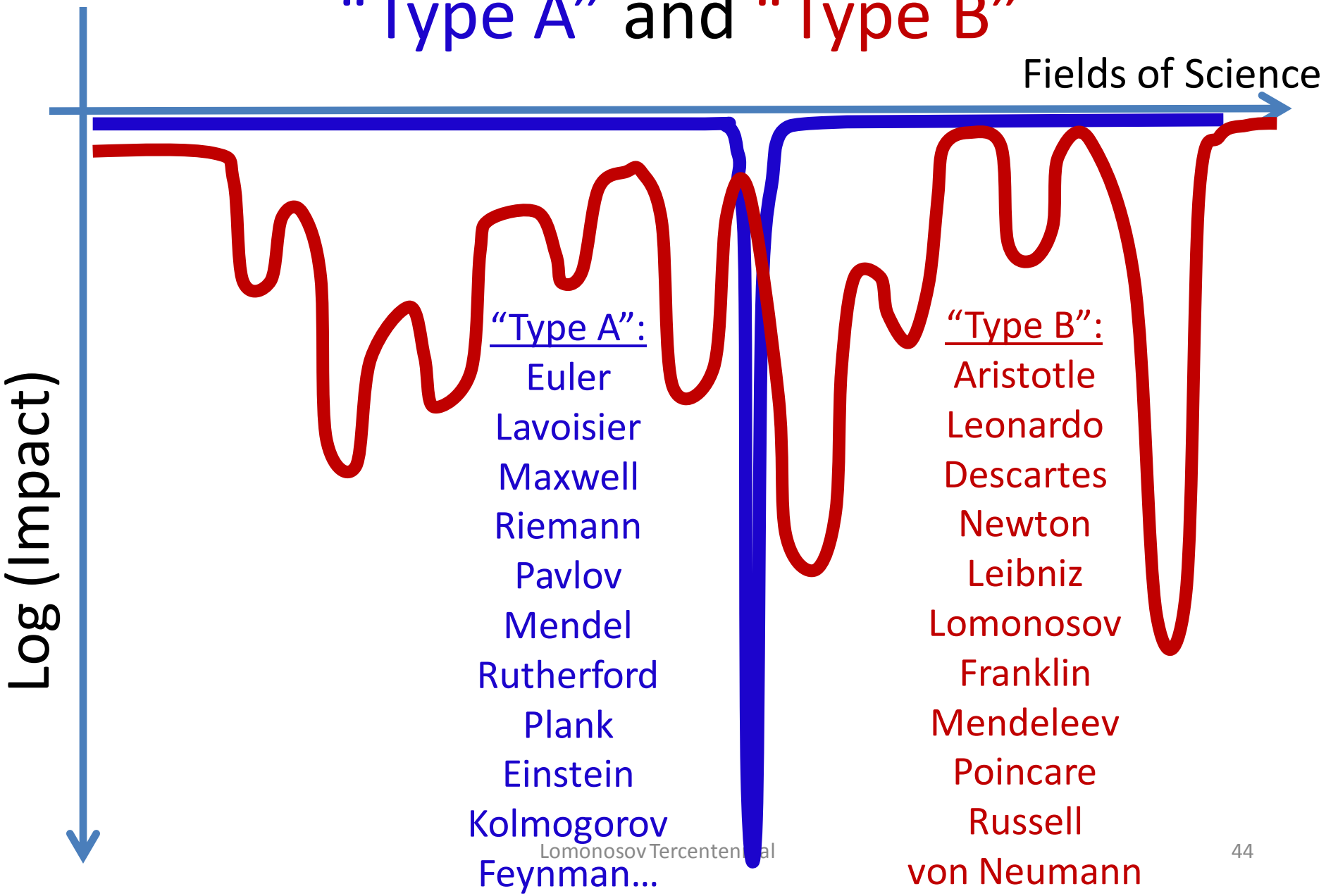
$= 103{,}000$ $= 123$



$= 2 \times 10^{11}$ $= 656$

Scientific Geniuses:

"Type A" and "Type B"



Lomonosov's *G_l*:

- Grammar ln(100 yrs) × ln(2) = 3
- Poetry ln(60 yrs) × 1/3 = 1.3
- Chemistry ln(20yrs) × 0.1 = 0.3
- Optics ln(100 yrs) × 1/20 = 0.2
- Venus ln(60 yrs) × 1/5= 0.8
- Geography ln(60 yrs) × 1/4 = 0.9
- History ln(250 yrs) × 1/10 = 0.5

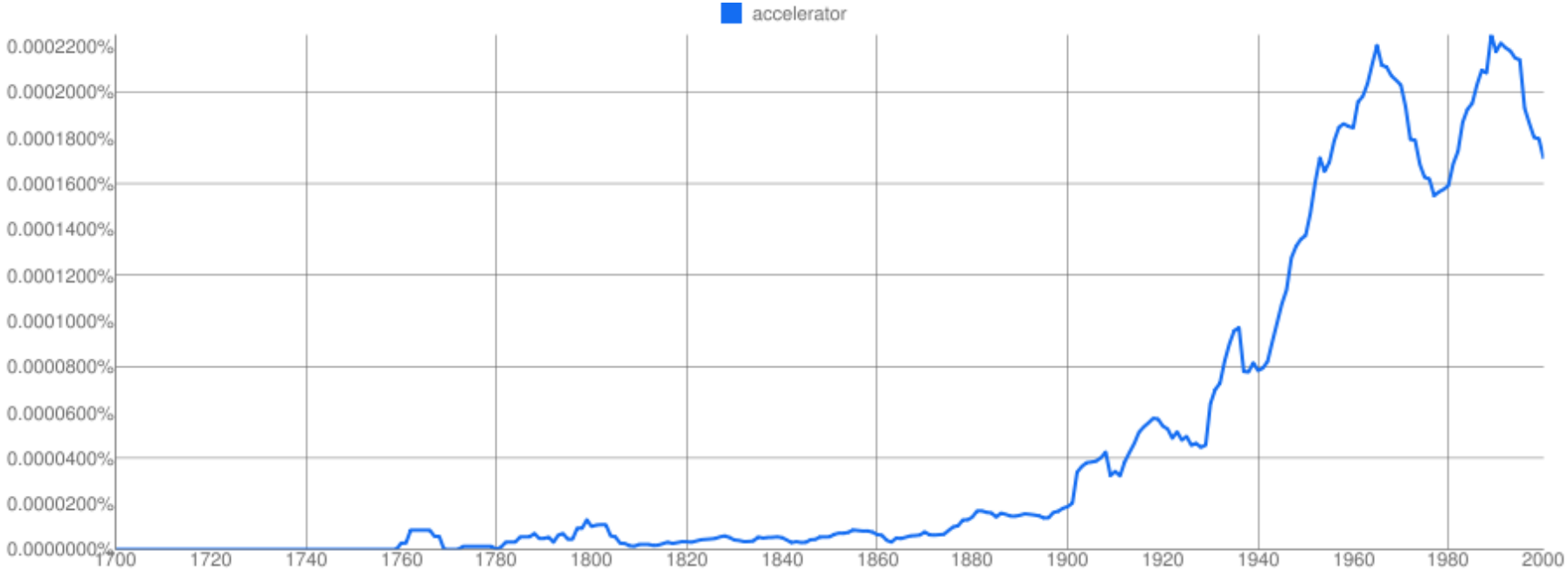
TOTAL 7.0

Genius Coefficients *G_I*:

- **Parent** **0.0000000012**
- **Scientist(me)** **0.03**
- **Inventors** **0.01-1**
- **Nobelists** **0.2-2**
- **Aristotle,Pifagor, Einstein, Lomonosov, Newton** **4-9**
- **Sheakespeare, Pushkin** **7-10**
- **Biblical God** **123**
- **Big Bang** **140-300**

Google books Ngram Viewer

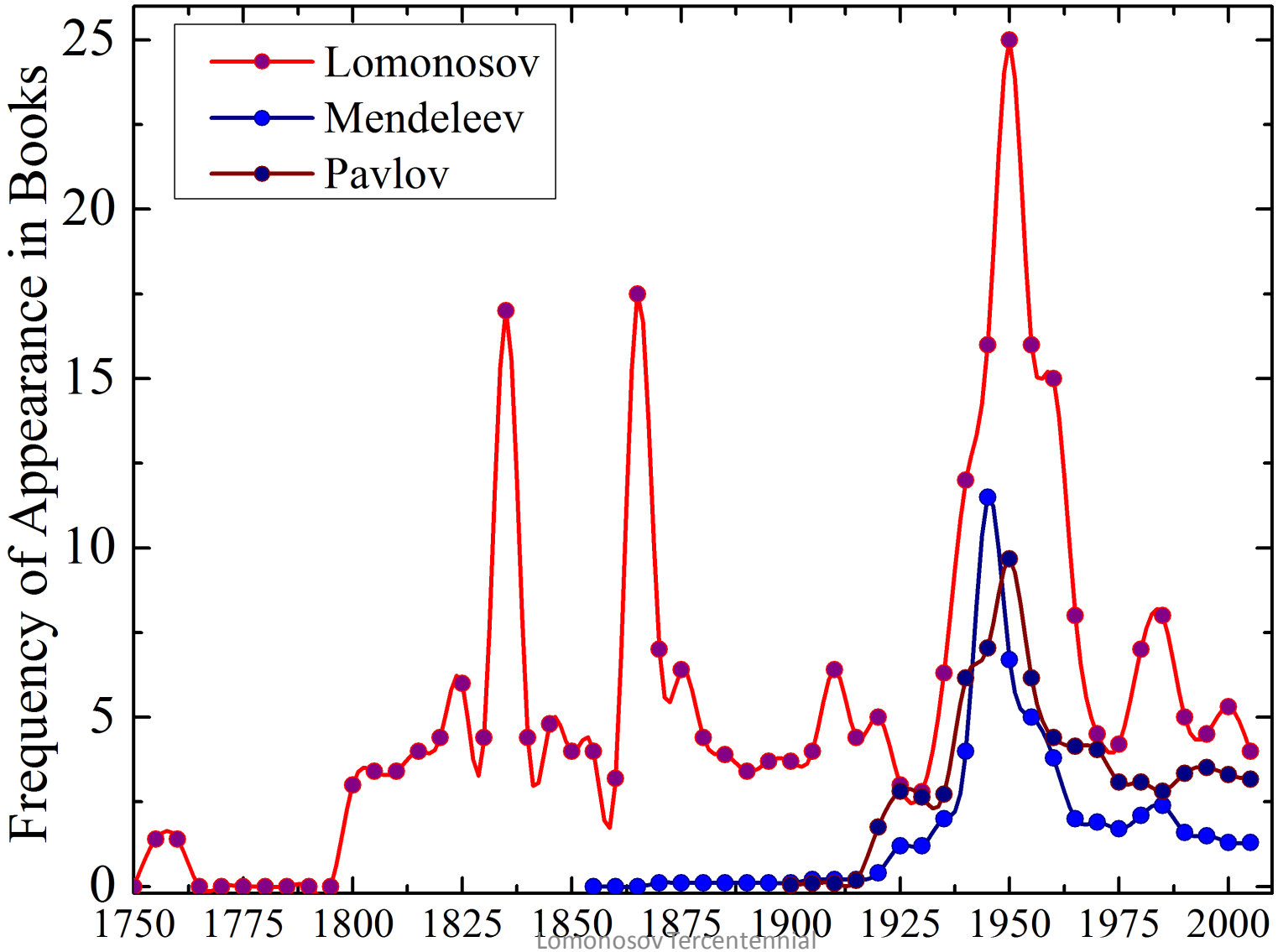
- New culturonomics tool:
  - http://books.google.com/ngrams



  - Frequency of appearance of the word or combination of words in the published books vs year
  - search >5M books, (5%), 500B words in 7 languages

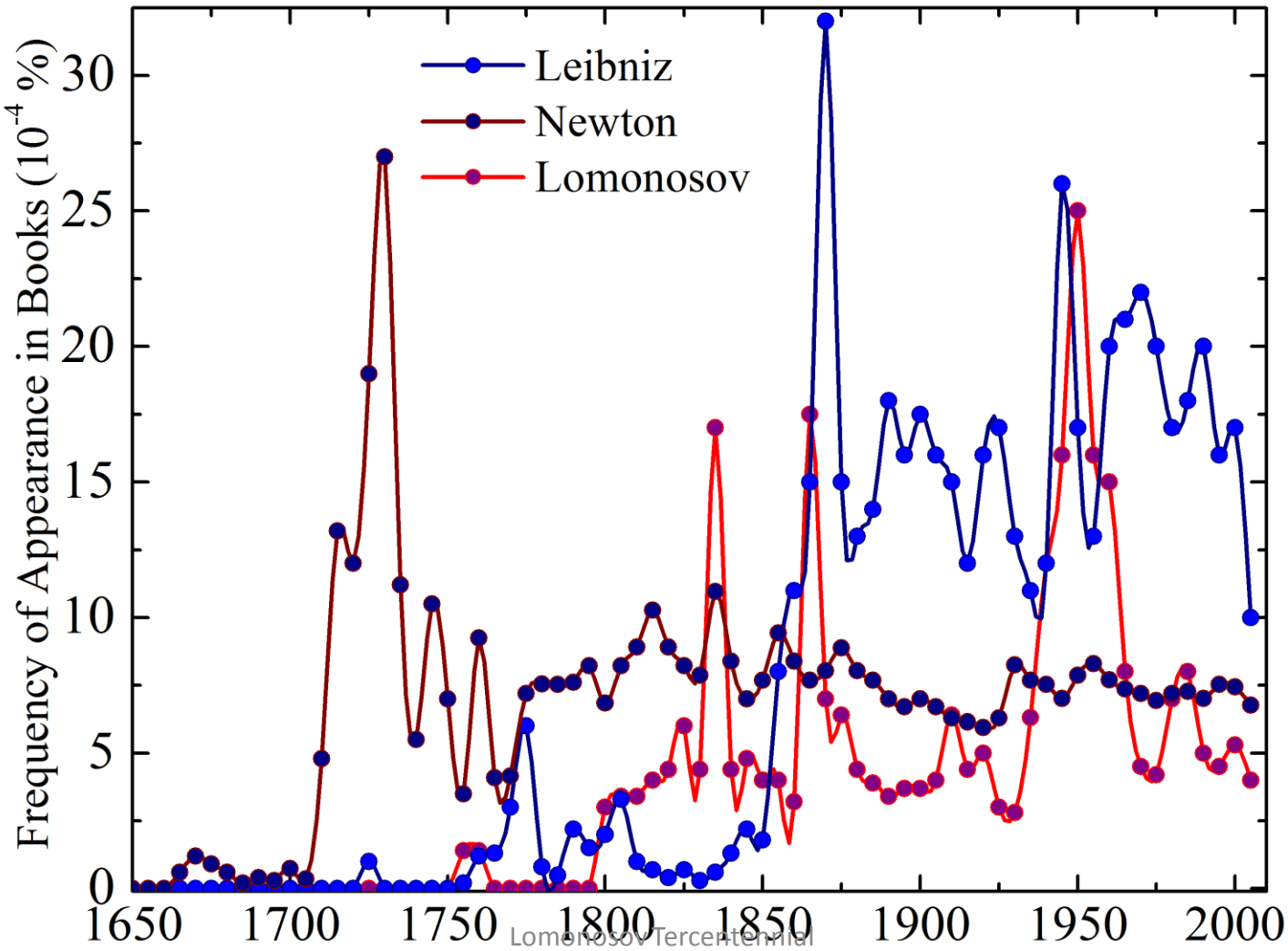
Most Prominent Russian Scientists

Russian collection



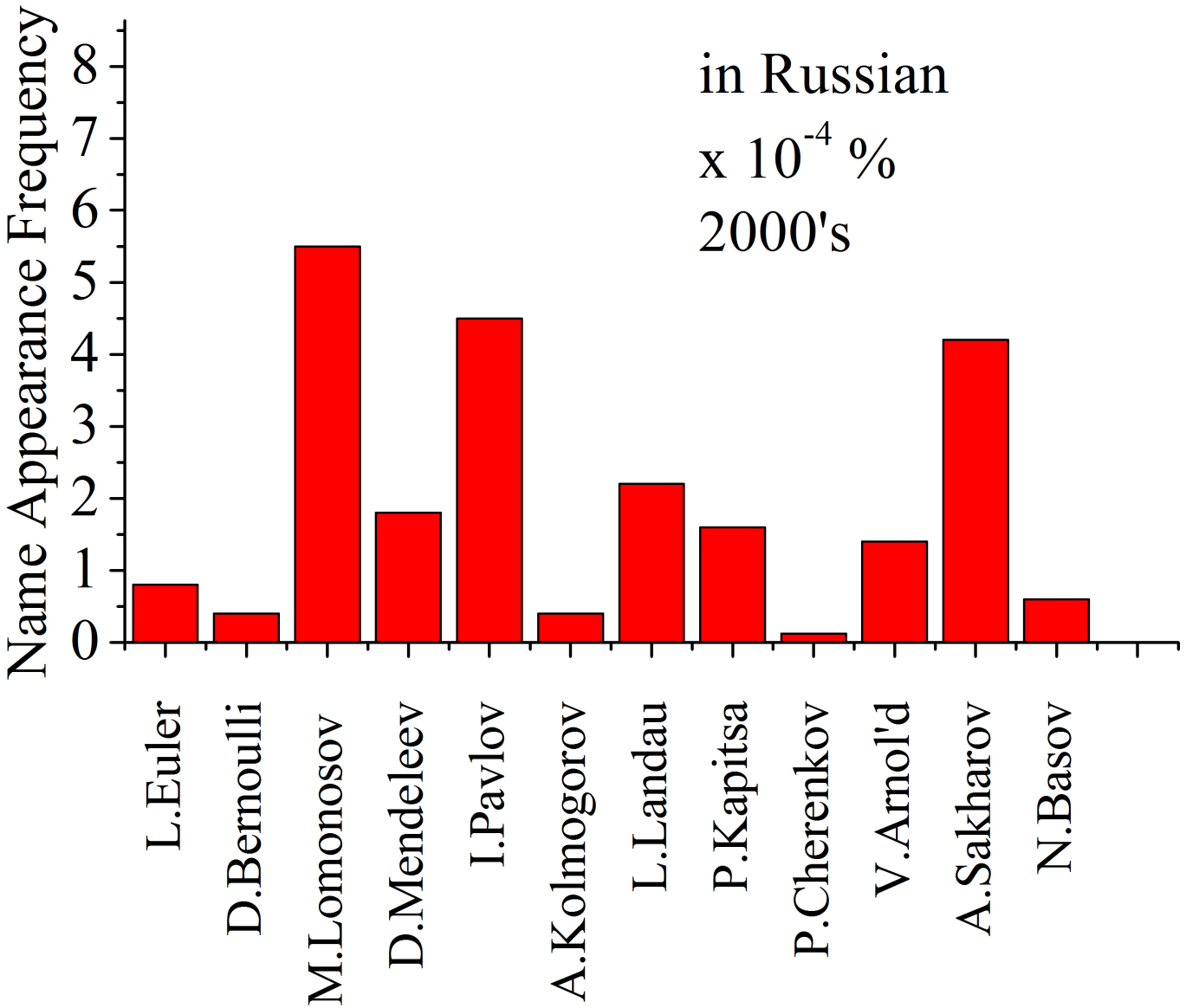
Three Scientific Geniuses:

search English, German, Russian collections



Russian Scientists

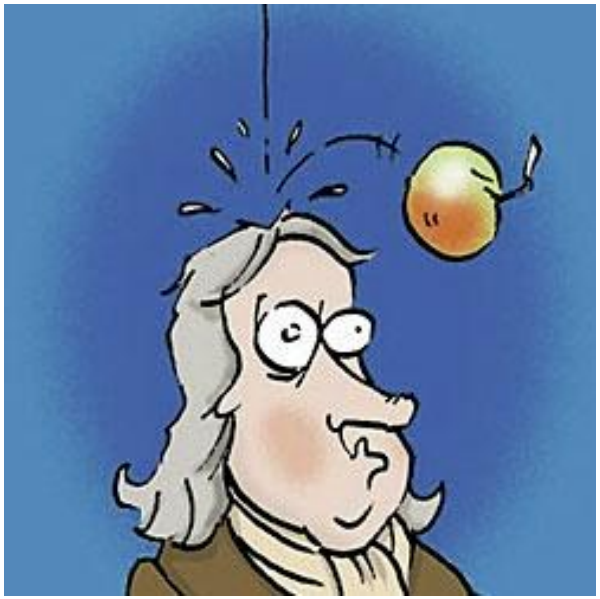
in Russian book collection

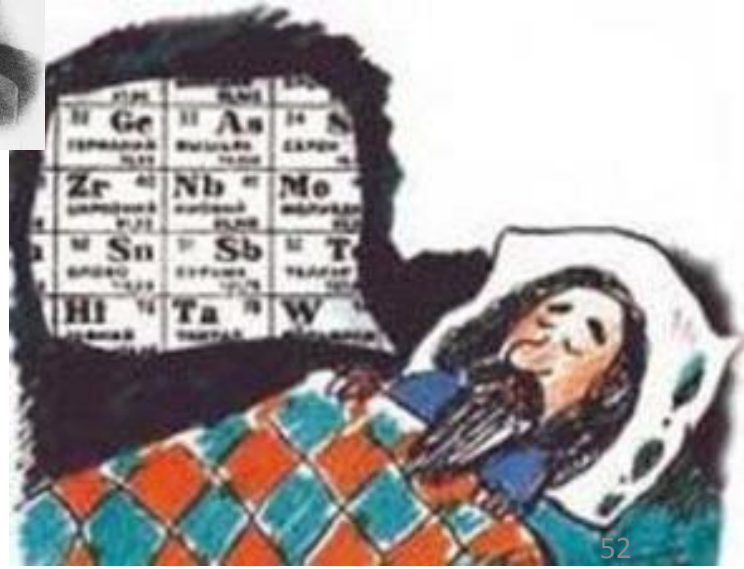


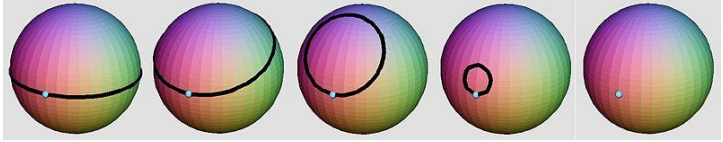
Misha Lomonosov leaving for Moscow in bad mood

-Hey, folks, should we pick that student up?

Every Genius Has (Impressive) Story!







Declined European Math Prize 1996
Solved Poincare Conjecture 2002
Declined Fields Medal 2004
Declined 1M$ Clay Prize 2010
Refused Academy Position 2011

Another Sign of Genius: Rebelliousness

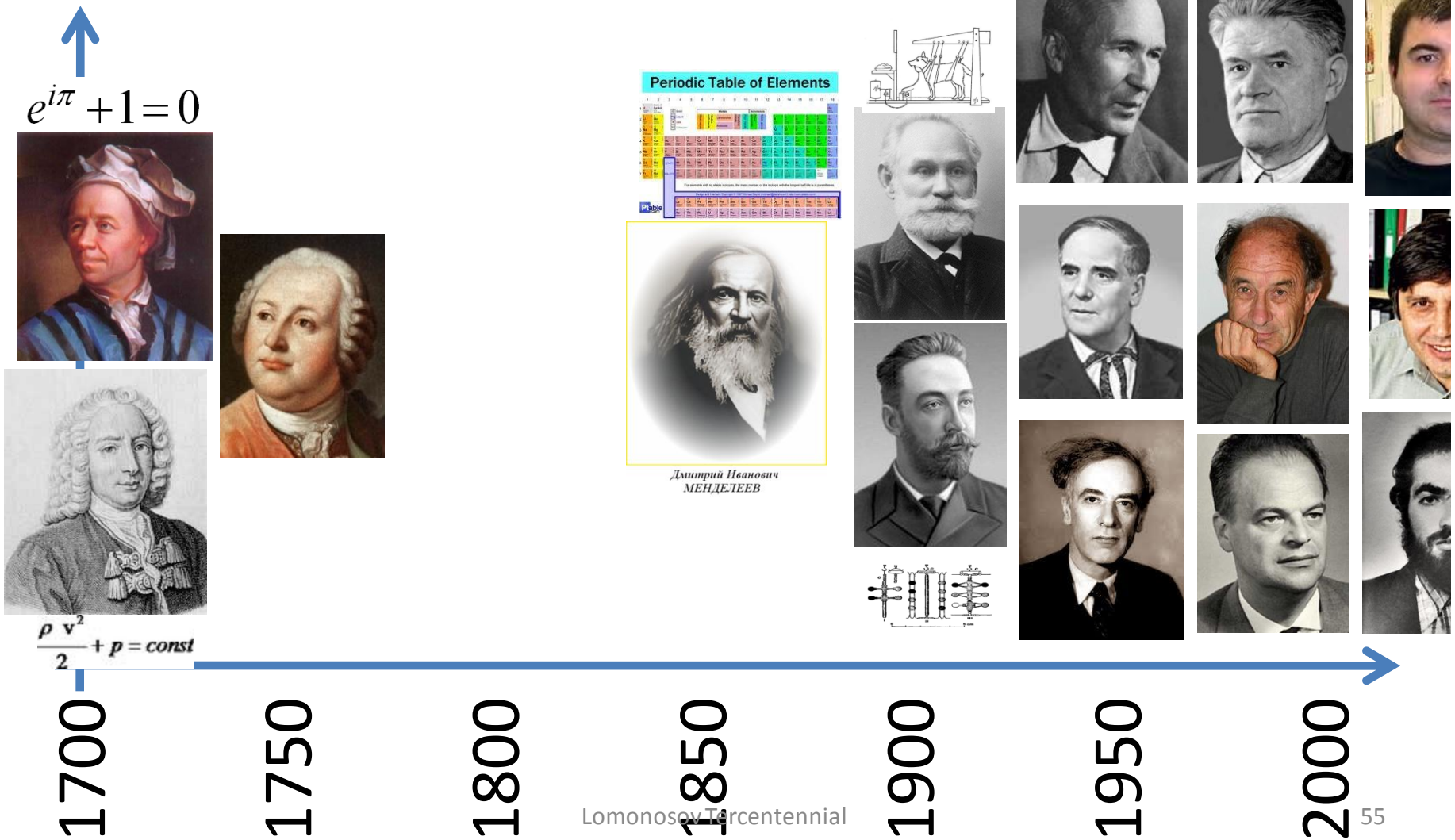
Petr Kapitsa, USSR

1978 Nobel Prize

Superfluid Helium

- Kapitsa On Geniuses:
  - Lomonosov vs Schumacher
  - Michelangelo and Medici
  - Kapitsa and Beriya

History of Science in Russia



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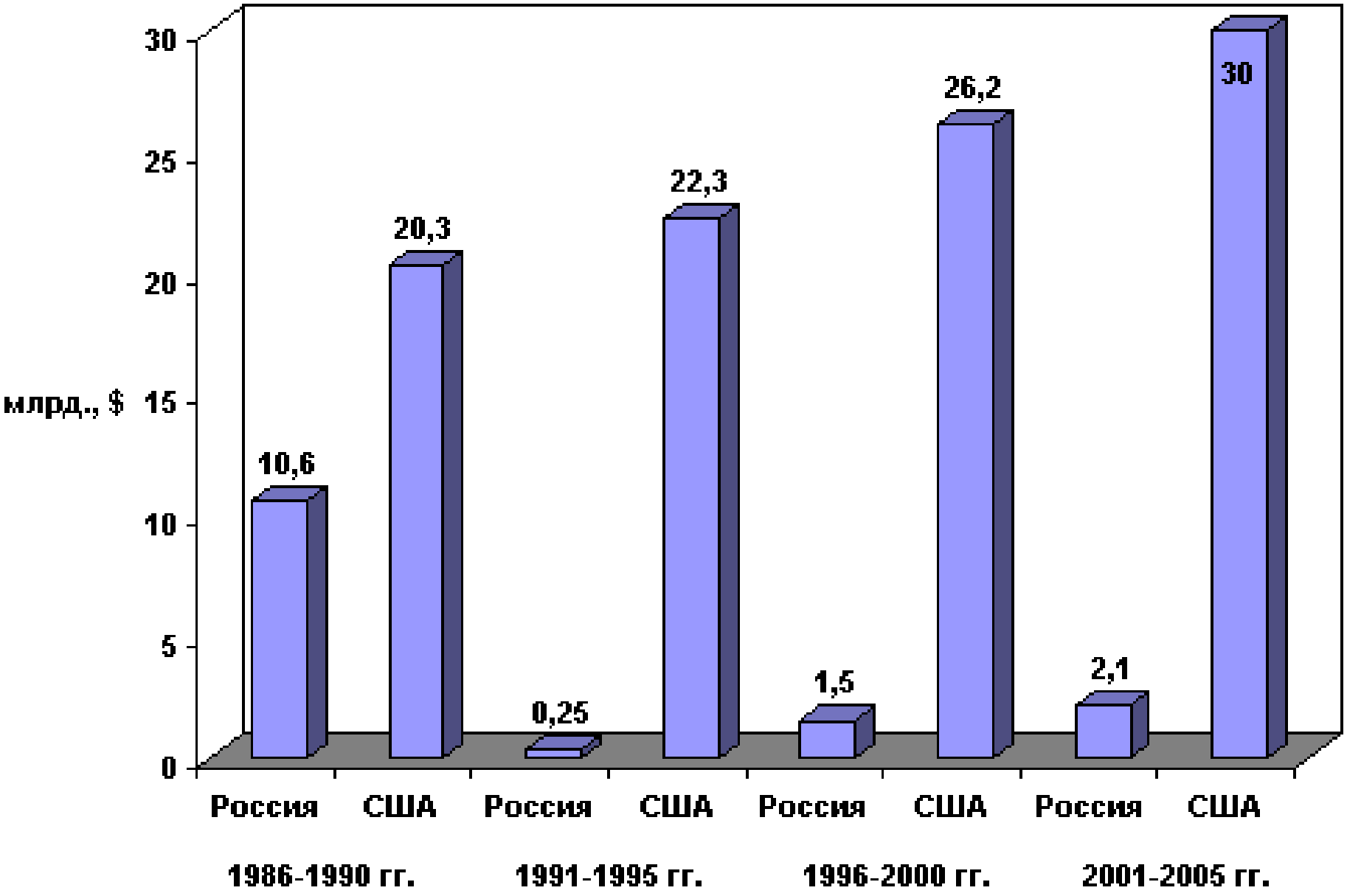


LA TUA VITA ADESSO
PUOI CAMBIARE SOLO SE
SEI DISPOSTO A PARTECIPARE


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