Half a century of SETI in the USSR and Russia

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The roots: before the beginning

- When has [modern scientific] SETI begun?
 - Image: Image:
 - but E. Neovius, 1876, Helsingfors
 "The greatest problem of our time"
 - Optical interplanetary CETI (Mars)
 - Functional linguistics
 - Budget: need of international collaboration (!)
- Philosophers of the "silver century":







N.K. Roerich



A.L. Chizhevsky



BRAHYAM

ЗАДАЧА НАШЕГО ВРЕМЕН

HEOBIYO

Early days: 1957 – 1965

- First steps in Space major boost for "cosmic" thinking
- Interest among astronomers to planetary science in a broad context:
 - I. Shklovsky in "Priroda", 1960
 "Is communication to intelligent creatures on other planets possible?"
 - N. Kardashev, Astron. Zh.", 1964



Lovell 76 m, Jodrell Bank, UK

""Broadcast of information by extraterrestrial civilisations" (three types of civilisations classified along the consumed energy scale)

The impact: "SETI" is on the agenda of science discussions

- support (moral and otherwise) by I. Tamm, Ya. Zeldovich, V. Kotel'nikov,
 S. Khaikin, V. Siforov, V. Troitsky, S. Sobolev, V. Ambartsumian, S. Pikel'ner et al.
- "Project Au" ["Hey, is there anybody?"]
 - not implemented, but played its role assessment studies in radio and optics
 - ...even an institute (but not approved beyond a group at Sternberg Institute)



All-Union meeting, Byurakan, May 1964

- Hosted by V.A. Ambartsumian
- Major impact on "SETI" (but no term yet) in the USSR
- Many ideas ["all new things are well forgotten old ones"]





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2000 SESSEPSEELEPE UMUSERFILST 2PUSUPUSOEPSAFF hpballb 1965 АКАДЕМИЯ НАУК АРМЯНСКОЙ ССР БЮРАКАНСКАЯ АСТРОФИЗИЧЕСКАЯ ОБСЕРВАТОРИЯ

BHE3EMHbIE ЦИВИЛИЗАЦИИ

ТРУДЫ СОВЕШАНИЯ БЮРАКАН, 20-23 MAS 1964 1

ИЗДАТЕЛЬСТВО АКАДЕМИИ НАУК АРМЯНСКОЙ ССР 1965 EPEBAH

Byurakan 1964: strategies and ideas

- Emphasis on search of ETI signatures in radio domain
 - F. Drake's observations at Green Bank ("Ozma"),1960s a benchmark
 - Isotropic continuous wideband broadcasting by ETI N. Kardashev
 - High-gain (targeted) narrow-band broadcasting V. Troitskii et al.
 - 11 nearby stars and M31
 - Multi-antenna systems with multi-channel receivers V. Kotelnikov
- Observational follow-ups (over >30 years):
 - Targeted search of selected nearby stars Radiophys. Res. Institute
 - Search for wide-band pulsing beacons (1970s, radio "light-houses") Radiophys. Res. Inst, Sternberg Inst, Space Res. Institute
 - Statistical properties of maser sources (1970s, Nancay, France)
 - VLBI experiment at 1.6 GHz, 1998

1965: precursor of VLBI (with SETI flavour)



Variability of CTA 102 G. Sholomitskii, 1965, IBVS 83







USSR-US CETI meeting, Byurakan, 1971

- Participants
 - Multidisciplinary
 - Astronomers
 - Physicists
 - Biologists
 - Linguists
 - Radio/communication engineers
- Synchronised publication of proceedings in English and Russian, ed. S.A. Kaplan



Byurakan 1971 - participants

Chrownes

5.6% of participants – Nobel Prize Laureates

V. Ginzburg

F. Crick

Aftermath of Byurakan 1971

- Theory: optimisation of [search parameter-space]:
 - Radio beacons and informative broadcast
 - ...also "eavesdropping" on unintended radio transmission (recall the opening minute of the movie "Contact")
 - Band/frequency
 - HI 21 cm (1.4 GHz) in all incarnations:
 - "Special frequencies" πf_{HI} and $f_{H}/\pi P$. Makovetsky, 1970s
 - Positronium line, 1.5 mm N. Kardashev, 1979
 - Cadence
 - Synchronisation with "cosmic agenda" e.g. SN explosions
 - "Full-sky" vs. targeted search
- Search for astro-engineering signatures
 - IR signature of Dyson spheres (e.g. in IRAS catalogue)

Victor Shvartsman: MANIA (1970s)

- MANIA (MAHINA) Multi-channel Analyser of Negligible Variations of Brightness
- Opto-electronic backend on 6-m telescope, Special Astroph. Observatory
 - Ultra-fast variability ($\tau \sim 10^{-7}$ s)
 - Ultra-narrow laser spectral line ($\lambda \sim 10^{-6} \text{ Å}$)
 - Astrophysical spin-offs

 ...but also:
 "SETI: a problem of astrophysics or culture as a whole"?





Victor Shvartsman 1945–1987

Tallinn-1981, Moletai-1987 and on



- I. Shklovsky: dead-end of a civilisation as a result of its "intelligence"?
 - ...and a logical consequence: we are alone (also recall the Fermi paradox)
- Moletai 1987: emphasis on philosophical concepts of SETI
 a concept of the Scientific-Cultural Centre of SETI

SETI as observational project: 1990–2010

RATAN-600

- Solar-type stars
- 21 cm (Dravskikh et al.)
- VLBI INTAS, 1998
 - 4 stars from the list of



- L. Filippova observed with 6 telescopes at 1.6 GHz
- One suspicious object, 37 Gemini, detected twice over te noise level
- Several sessions of METI
 - some with participation of schoolchildren

METI – Messaging to ETI: be proactive?

- S. Khaikin, 1964 (and A. Sakharov, 1980s): call message "ready to communicate!"
- but there is an opposite opinion too....
- Anyway, several messaging sessions conducted in the last ~15 years:

Project	Cosmic Call 1999	Teenage Message	Cosmic Call 2003	A Message From Earth
Date	24.05, 30.06, 01.07.1999	29.08, 03.09, 04.09.2001	06.07.2003	09.10.2008
Authors	Chafer, Dutil, Dumas, Braastad, Zaitsev, et al	Pshenichner, Filippova, Gindilis, Zaitsev, et al	Chafer, Dutil, Dumas, Braastad, Zaitsev, et al	Madgett, Coombs, Levine, Cooper, Zaitsev, et al
Facility	Evpatoria planetary radar			
Number of sessions	4	6	5	1
T [min]	960	366	900	240
P [MJ]	8640	2200	8100	1440

Forward look: the next 50 years?

- Theoretical/methodological studies
 - Increasing the volume of search in the "cosmic haystack"
 - Frequency, cadence and, of course, sensitivity
 - New means/channels of communication
 - Gravitational waves
 - New physics?
- The impact of new astrophysical results:
 - Exoplanets!
 - new look on the Drake formula
 - New tragets (see the next talk by Andrew Simeion)
- [Expected] impact of new facilities
 - LOFAR and other low-frequency telescopes (> 300 MHz)
 - SKA
 - Space-based radio astronomy
 -but watch for unexpected too