BILATERAL WORKSHOP ON ASTROPHYSICS
V.N. KARAZIN KHARKIV NATIONAL UNIVERSITY – INAF

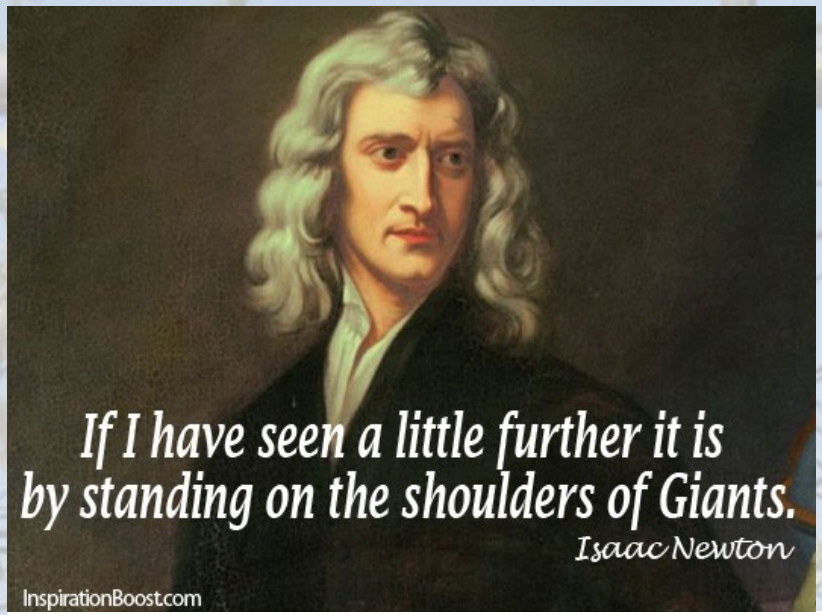
UKRAINIAN OBSERVING FACILITIES AND TECHNOLOGIES

22-23, March 2018, Rome, Italy

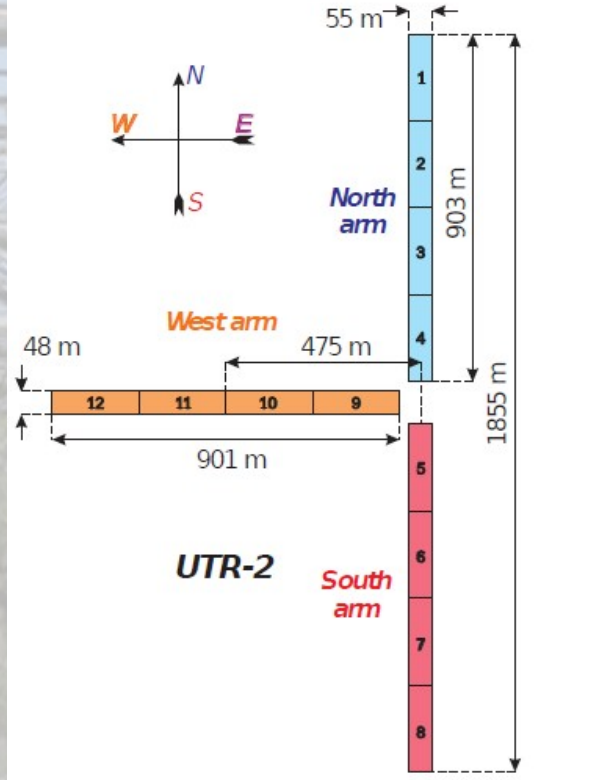
O.M. Ulyanov and IRA NASU team

Institute of Radio Astronomy of NAS of Ukraine

oulyanov@rian.kharkov.ua



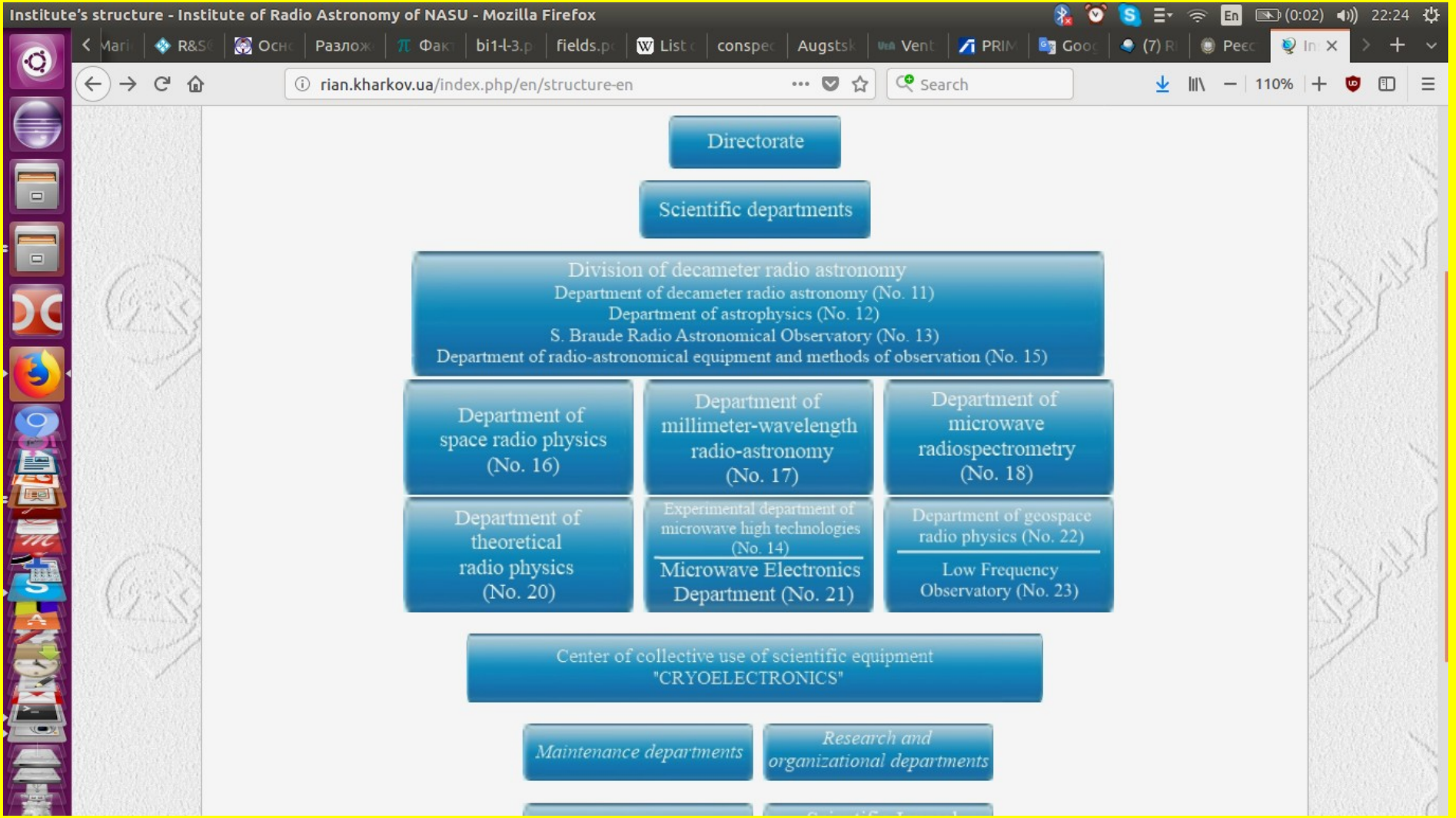
S. Ya. Braude Radio Observatory



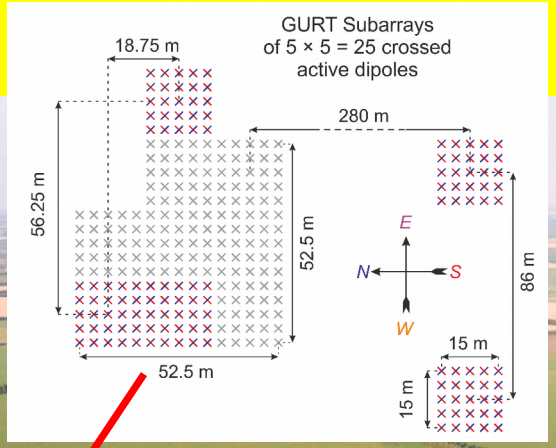
Scientific Structure of the Institute of Radio Astronomy NASU

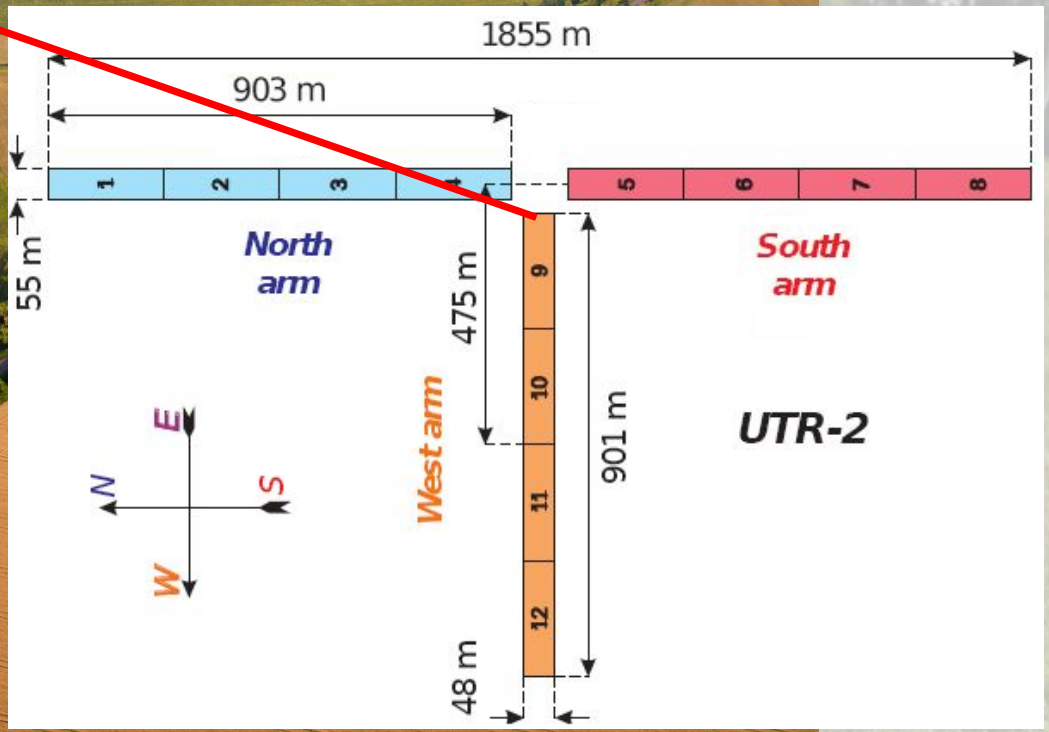
- Division of Low-frequency Radio Astronomy
  - Decameter Radio Astronomy
  - Astrophysics
  - Radio-astronomical equipment and methods of observations
- Space Radio Physics
- Millimeter-Wave Radio Astronomy
- Microwave Spectroscopy
- Theoretical Radio Physics
- Microwave Electronics
- Geospace Radio Physics

http://rian.kharkov.ua/index.php/en/structure-en

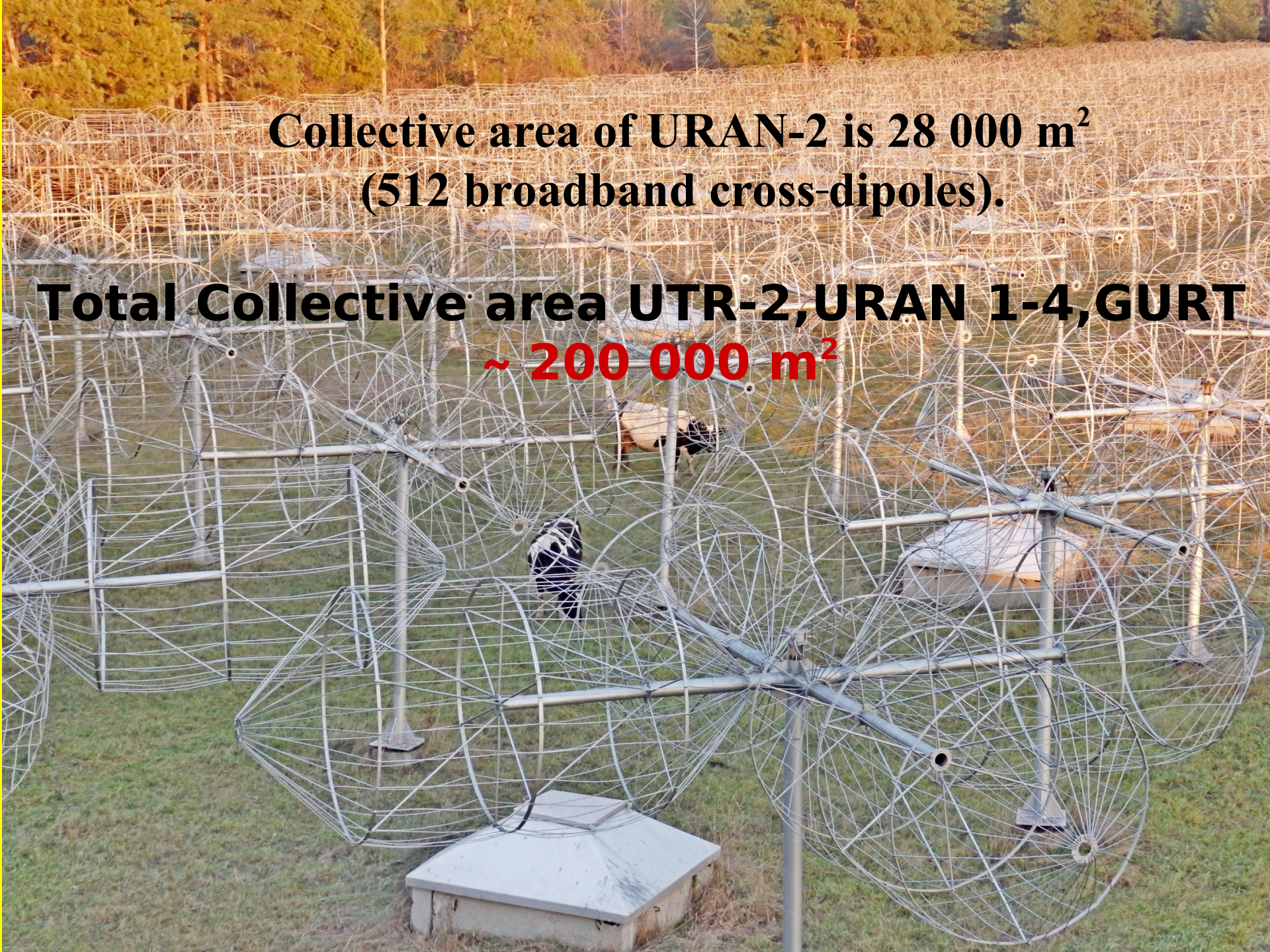


Radio telescopes UTR-2 and GURT (September, 2017)

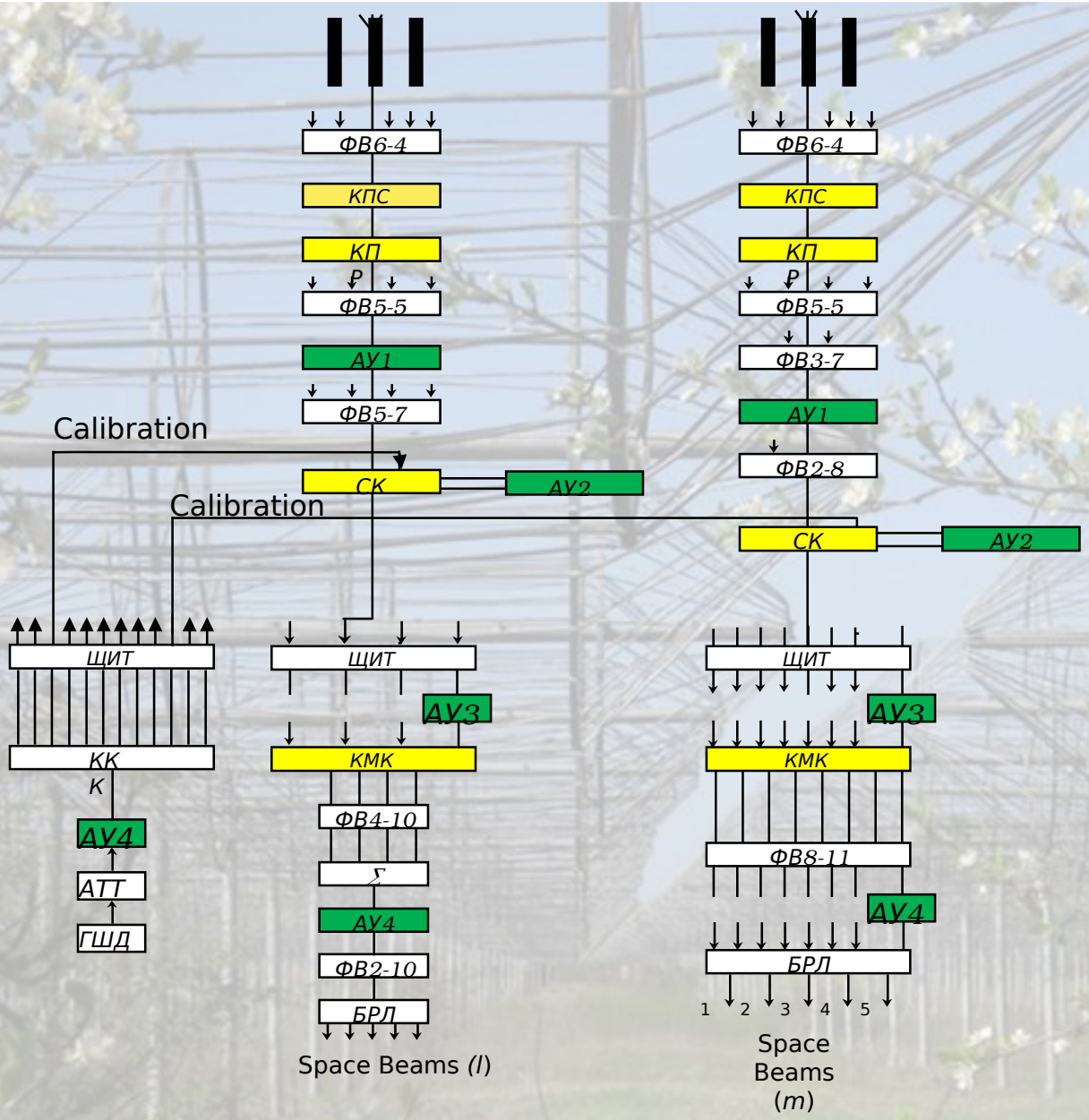




The largest in the world radio telescope UTR-2 (1.8 km x 60 m) Frequency range 8…32 MHz; 2040 Dipoles; Collective area ~ 150 000 m^2.


Collective area of URAN-2 is 28 000 m²
(512 broadband cross-dipoles).
Total Collective area UTR-2,URAN 1-4,GURT
~ 200 000 m²

Modernization of Amplification System of UTR-2



1. **Array Amplification System (1988-1994)**

2. **Commutators (1997-2004)**

3. **Digital Receivers (2000 - …):**

   - 60-channal receiver,

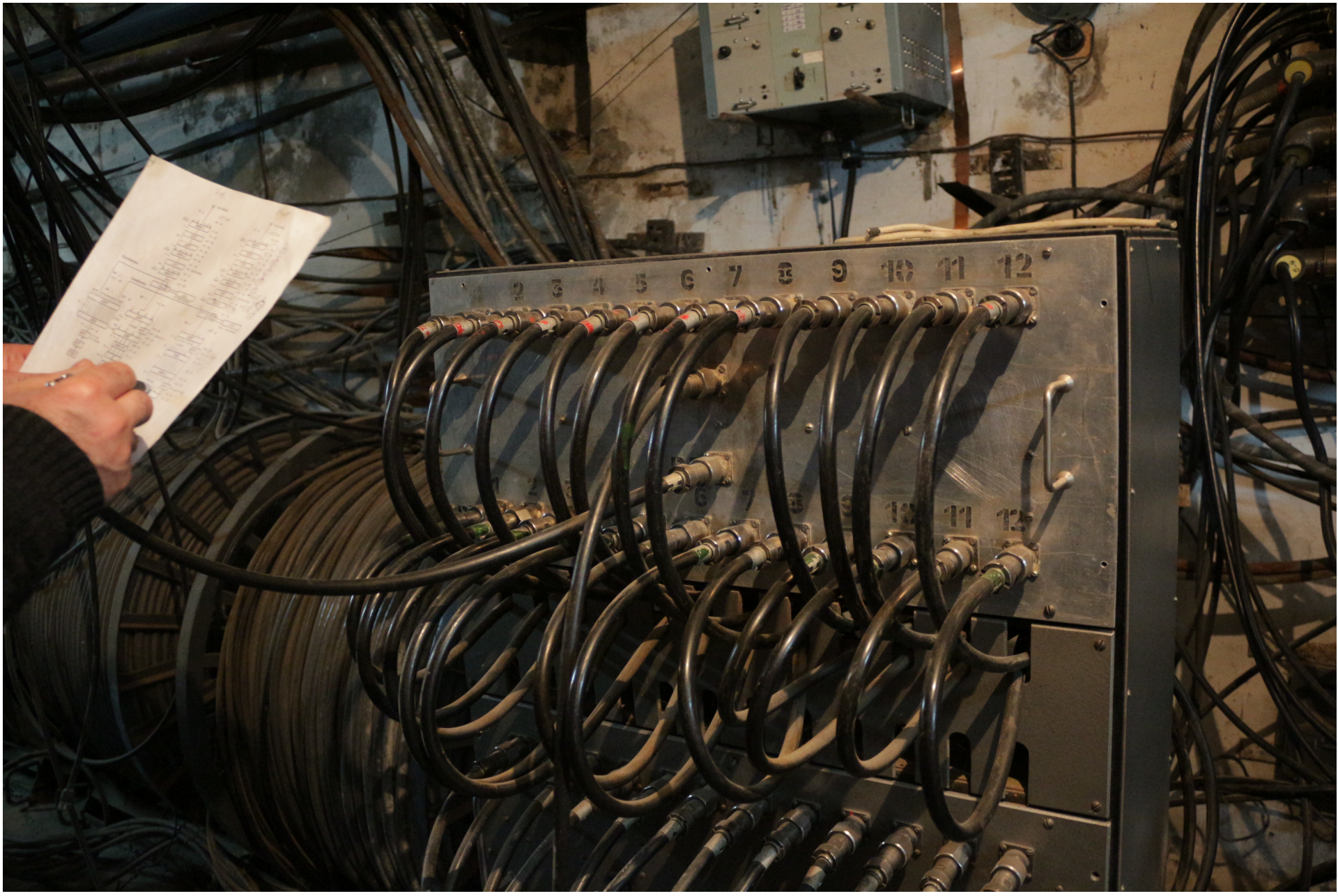
   - Pulsar Portable Receiver (WF 2 x 1.5 MHz; 2 bits),

   WF Receiver (WF 2 x 7.5 MHz; 8 bits),

4. **DSPZ (Sp; Corr; WF 16 bits) (2x8192; 4x8192; 15ns)**

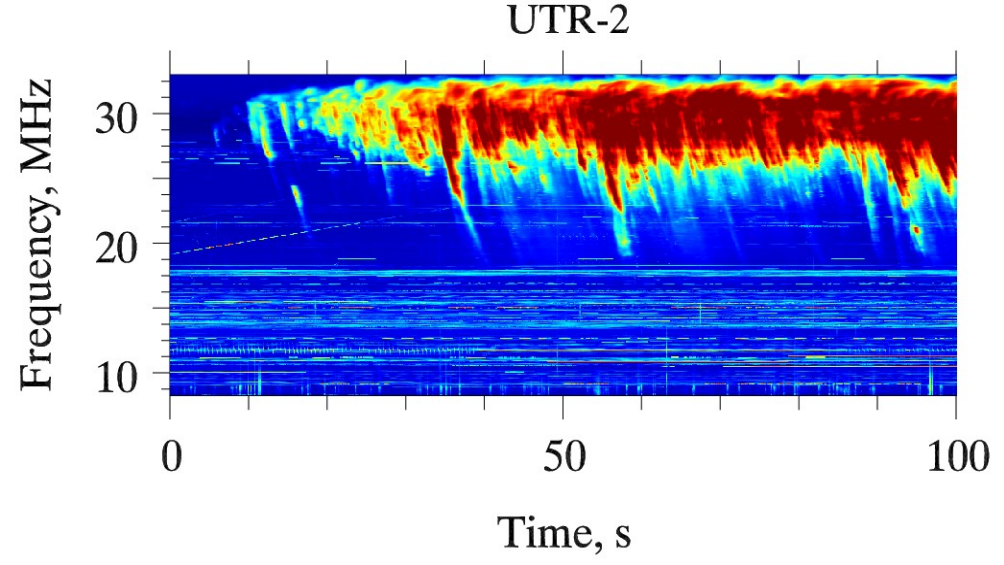
Cable system of UTR-2

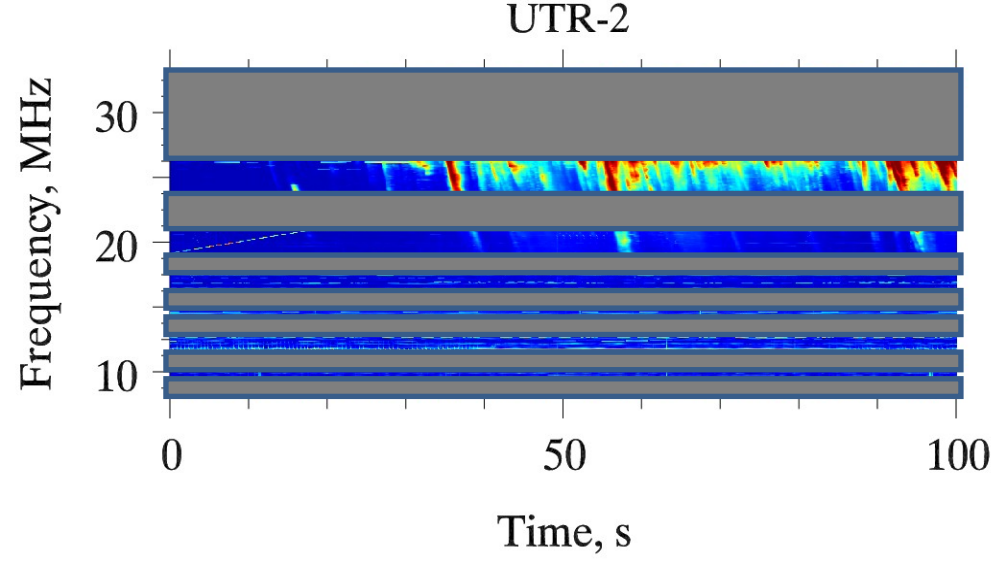
Huge Phase Shifters (left side)



Broad Banwidth 8-32 MHz

Wide Frequency Band Instead of 6 Narrow Frequency Ranges

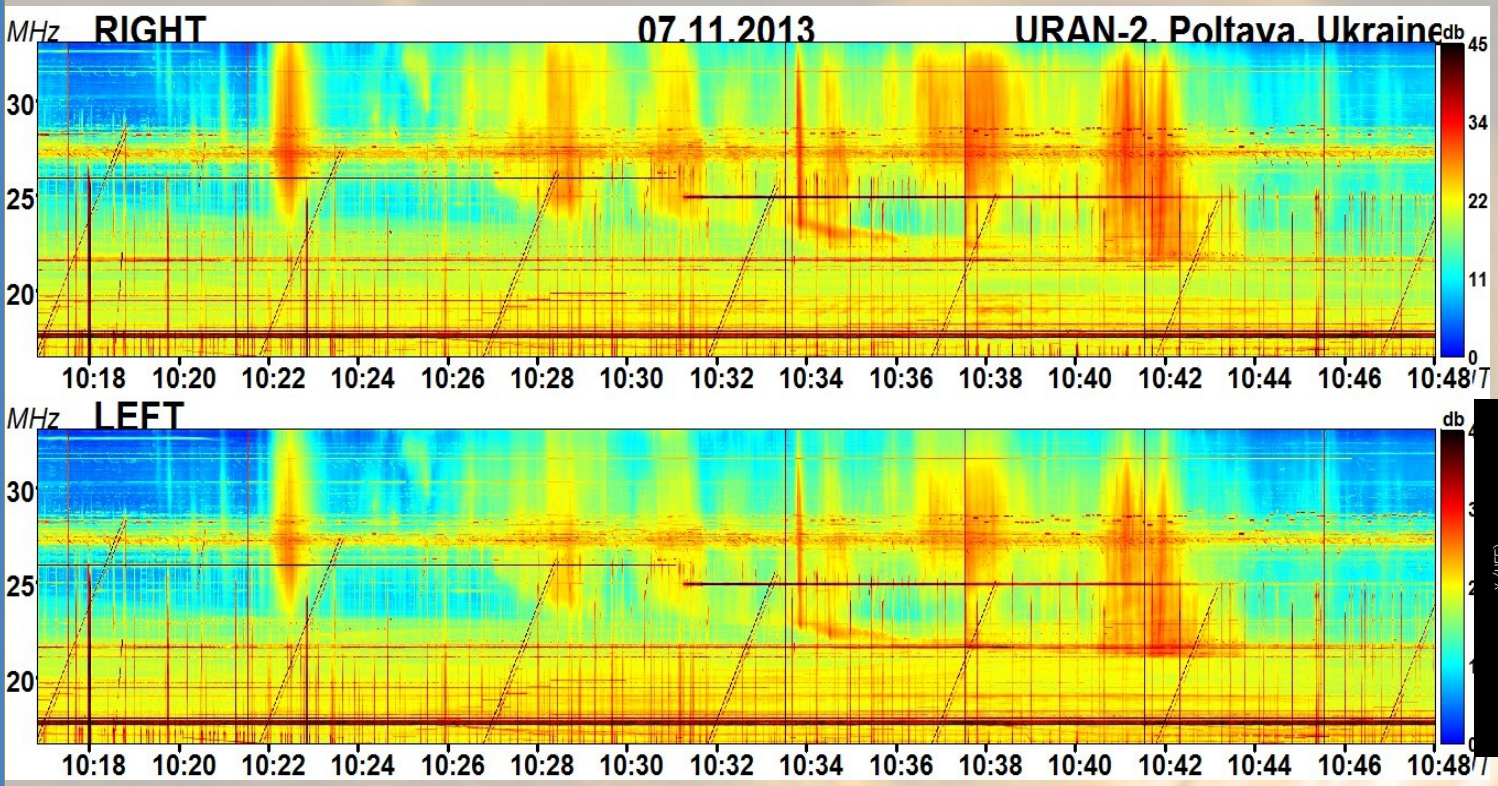


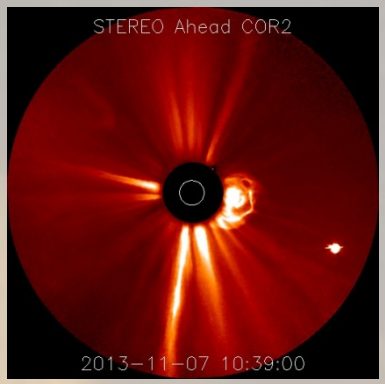


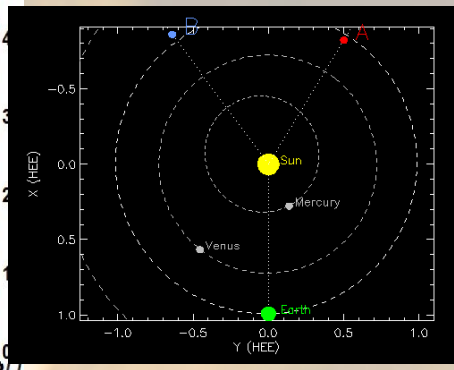
Solar Hurricane = Coronal Mass Ejections (CME) Bursts of the IV Type as indicator of CMEs

The Dynamic Spectrum of the IV Type Burst. Observations on URAN-2 on November 7, 2013.

Coronal Mass Ejections (CME) moving into south-west direction (STEREO A)



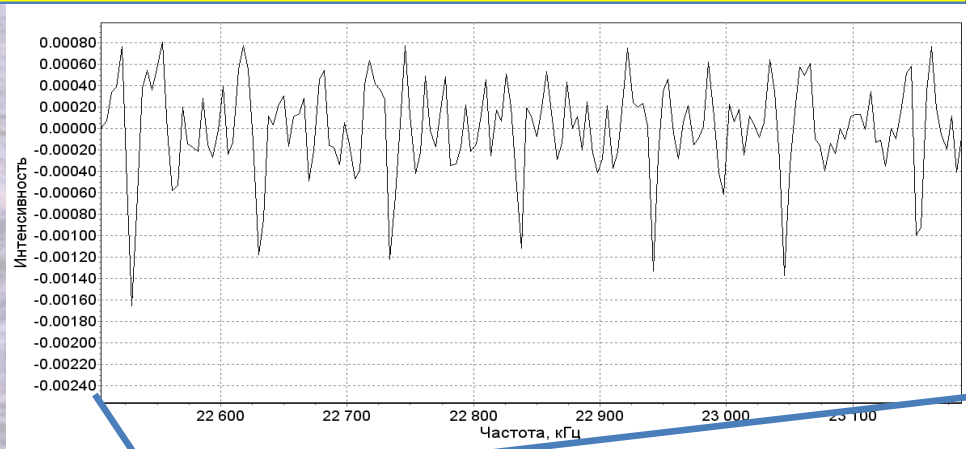


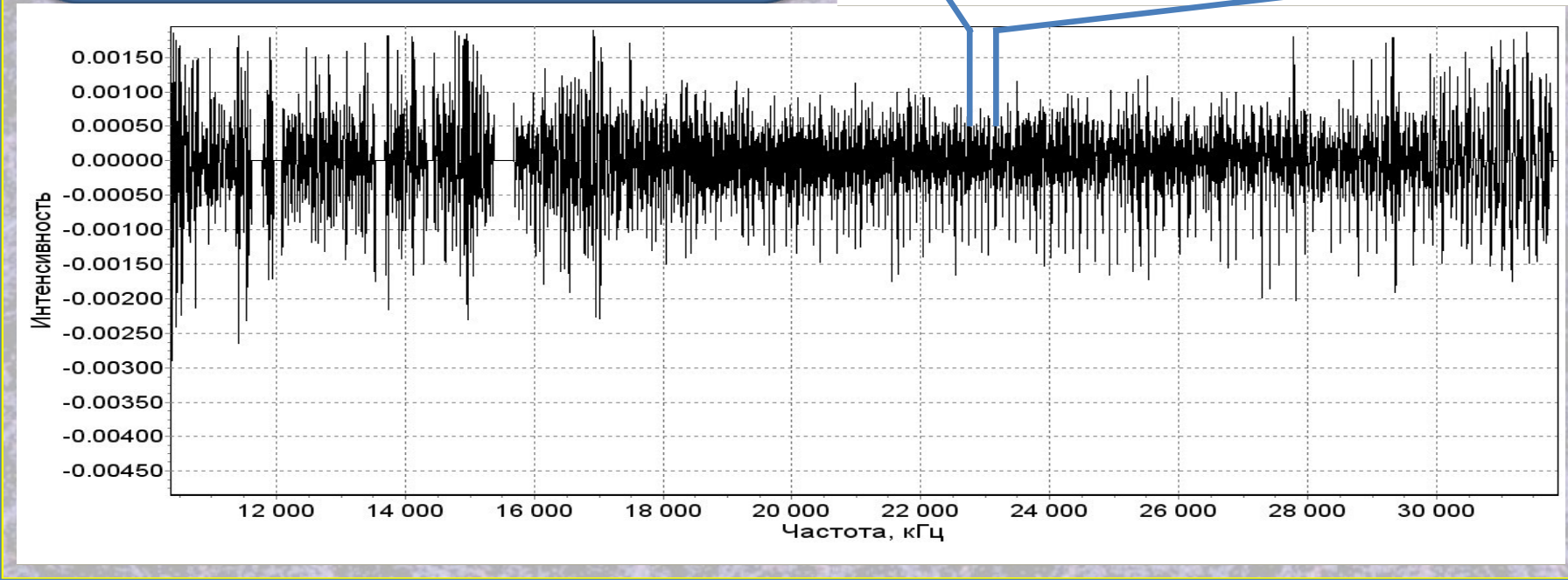


V.N. Melnik, A.I. Brazhenko, A.A.Konovalenko, V.V. Dorovskyy, H.O. Rucker, M. Panchenko, A.V. Frantsuzenko, M.V. Shevchuk “Decameter type IV burst associated with behind-limb CME observed on November 7, 2013”, Solar Physics 2017 (submitted)

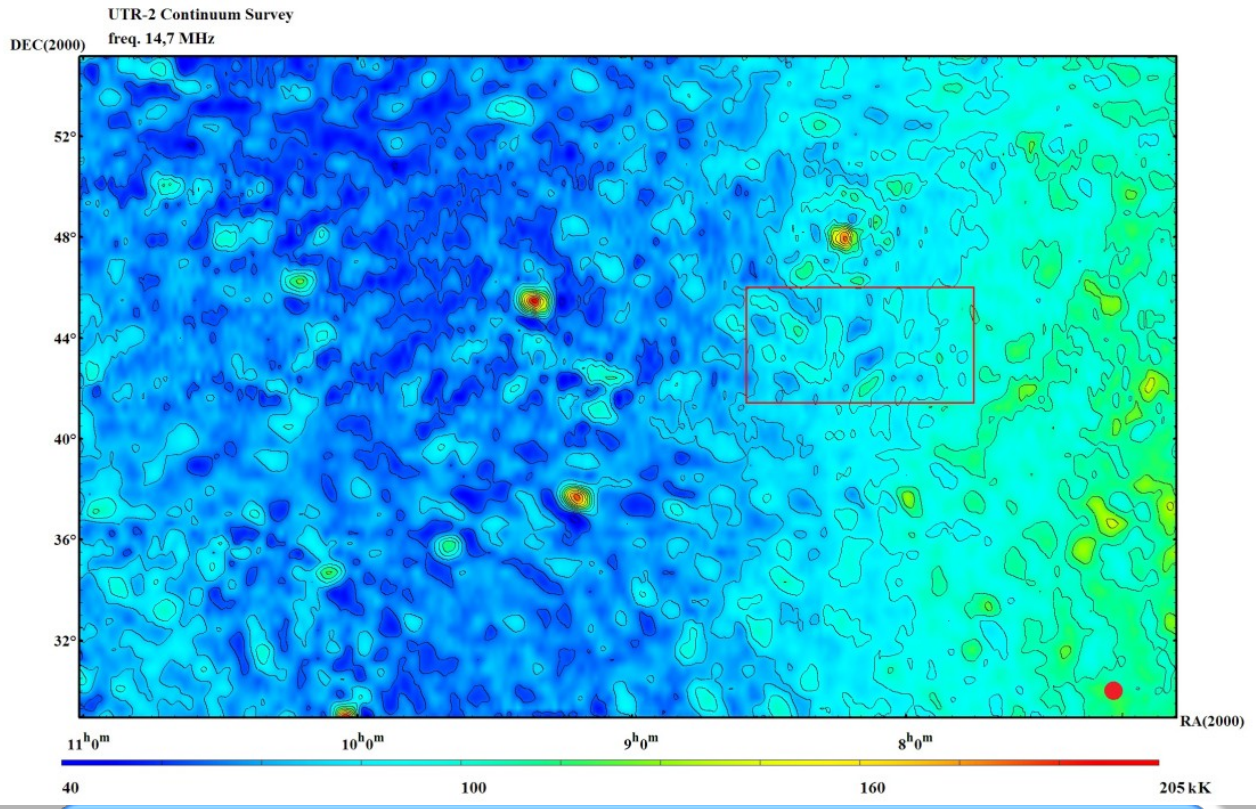
Investigations of the interstellar medium

Sequense of the Carbon Radio Recombination Lines (C854α ... C596α) in Cas-A direction. Frequency range from 10,5 MHz up to 31 MHz. Comulative time is 55 minutes and ~250 lines





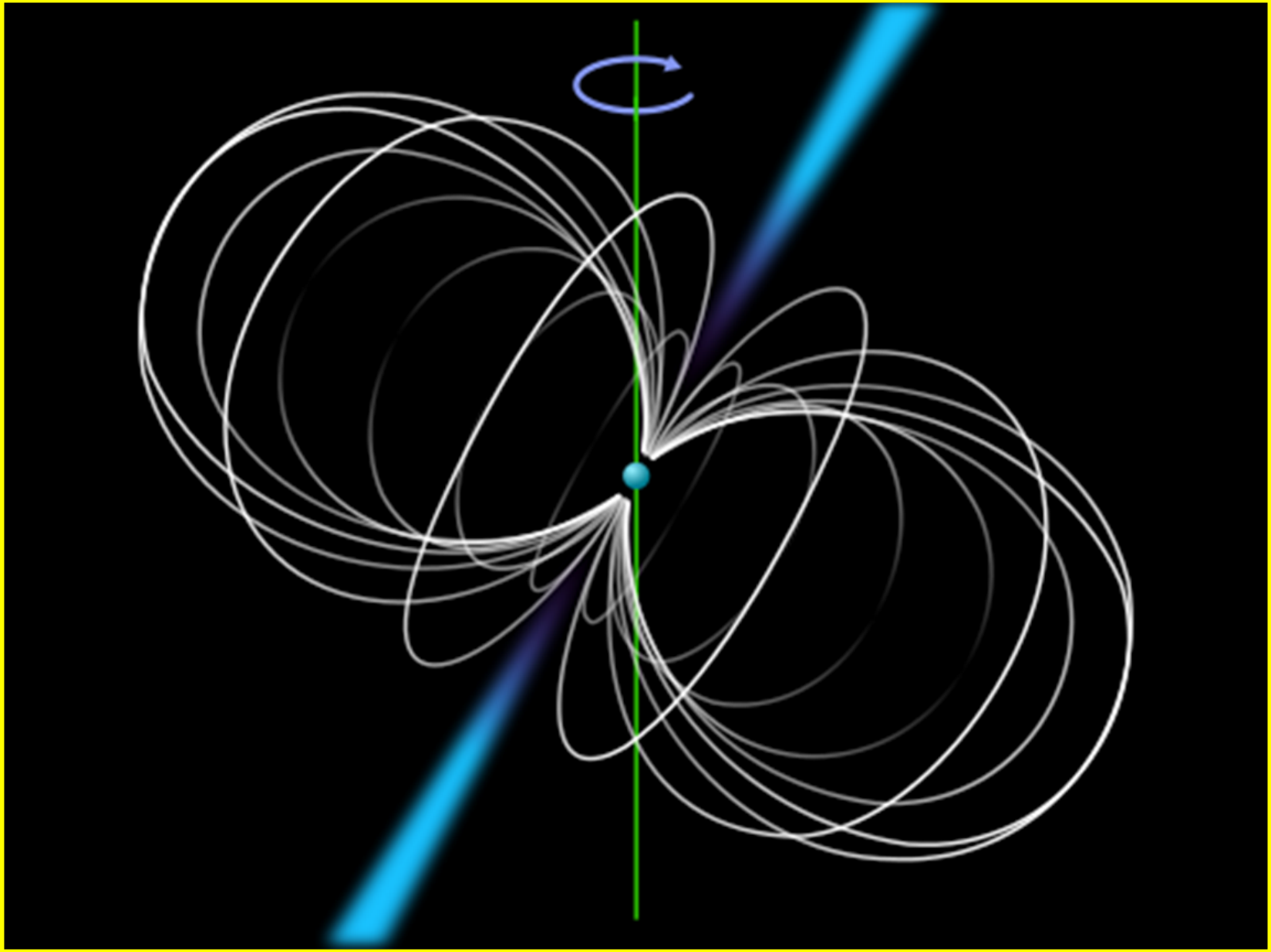
Separation of galactic and extragalactic radio emission at decameter wavelengths



Cold region of the Northern sky F = 14,7 MHz (UTR-2). HPBW ≈ 47 '× 53', 15 000 K < T_b < 40 000 K

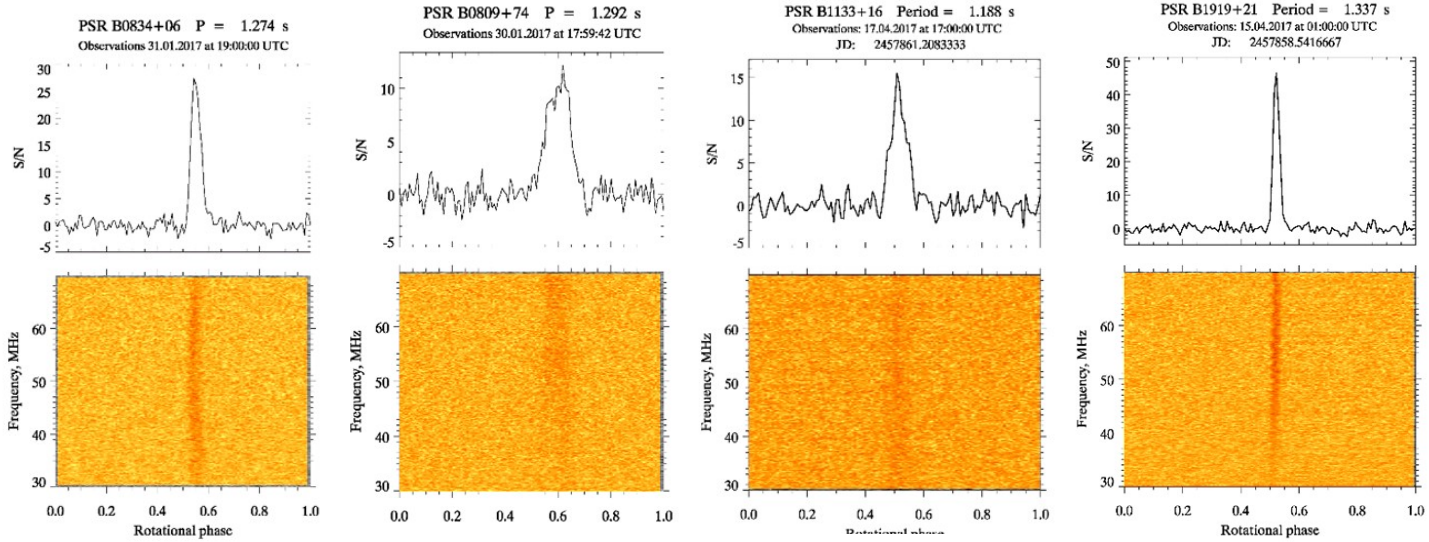
N.M.Vasilenko, M.A.Sidorchuk. Separation of galactic and extragalactic radio emission at decameter wavelengths // Astrophys Space Sci (2017)- Vol.362-Is.12-P.221.

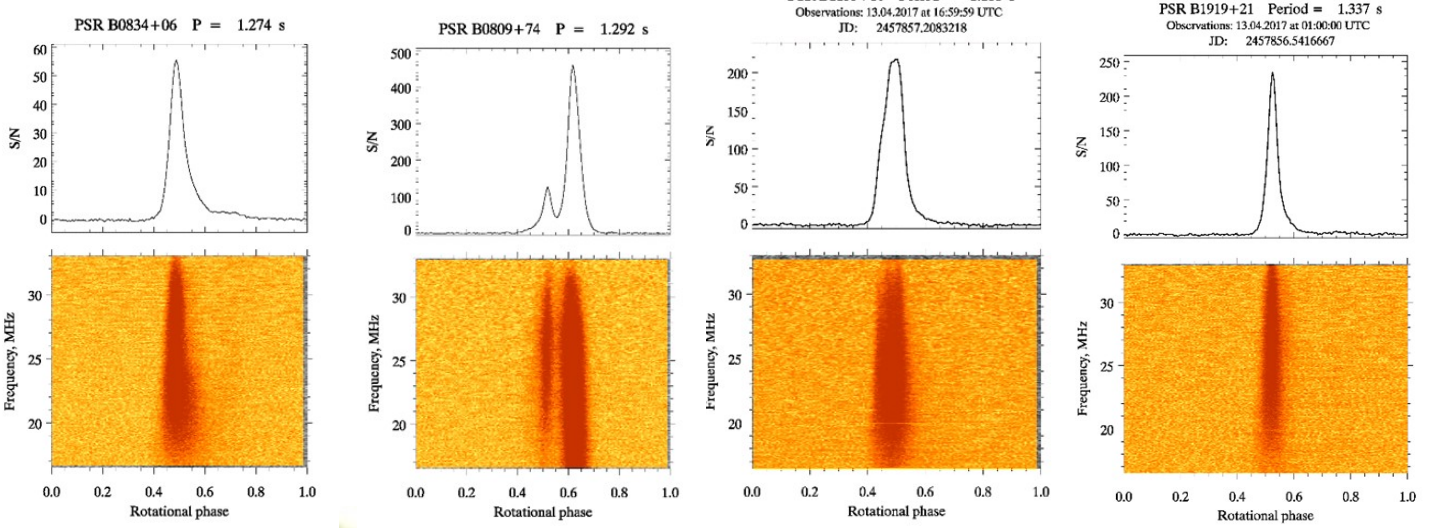
Model of Pulsar magnetosphere



Simultaneously PSRs observations at broad frequency range by UTR-2 and GURT

6 4 6 1





f = 8...80 MHz

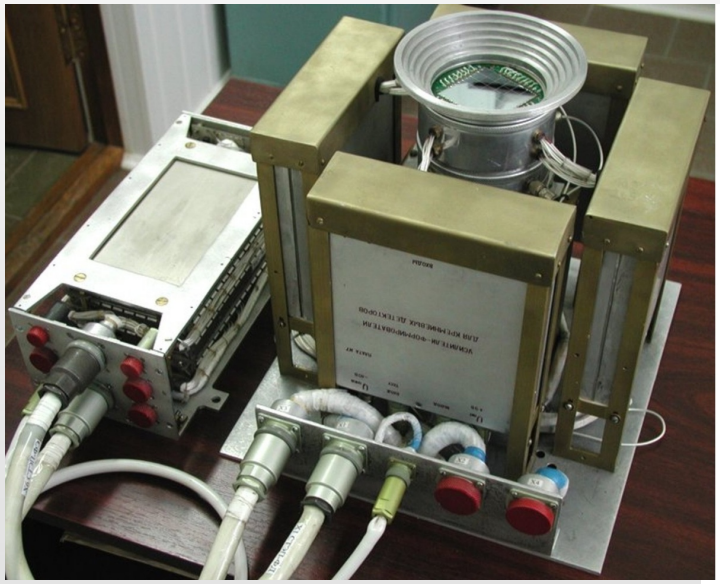
Σ

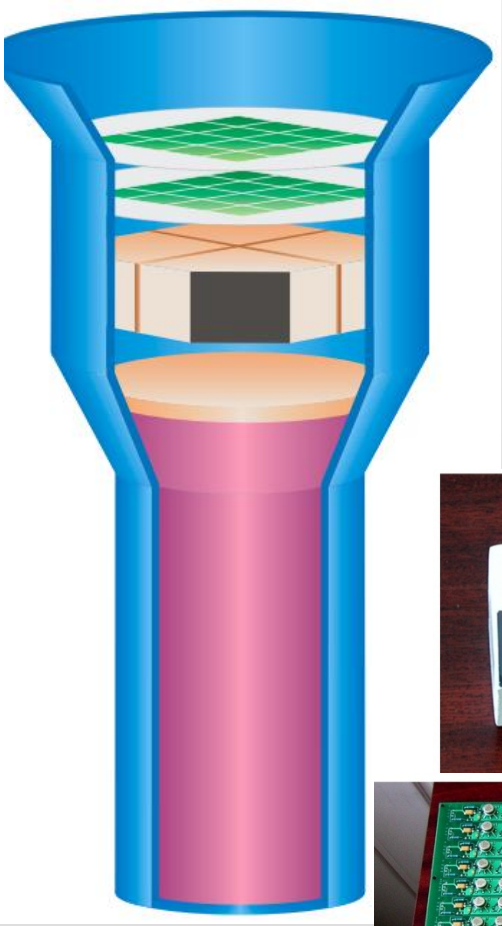
f = 8...33 MHz

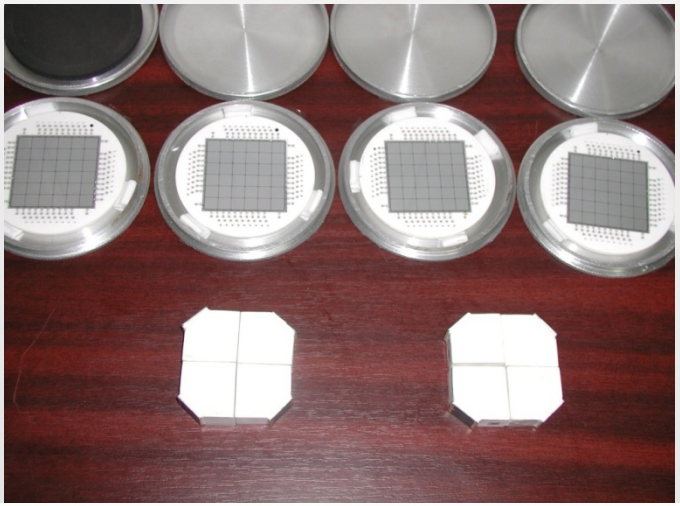
STEP-F instrument on the board of ***CORONAS-Photon*** satellite, 2009

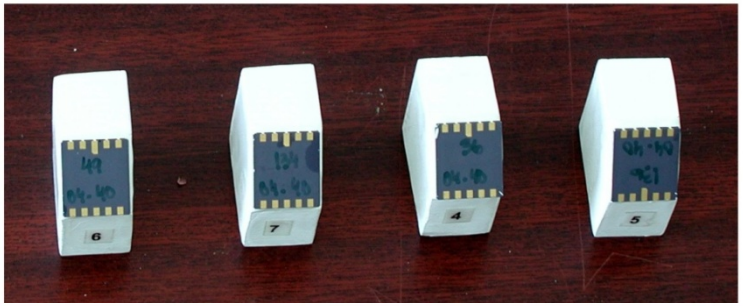
1

Satellite telescope of electrons and protons STEP-F



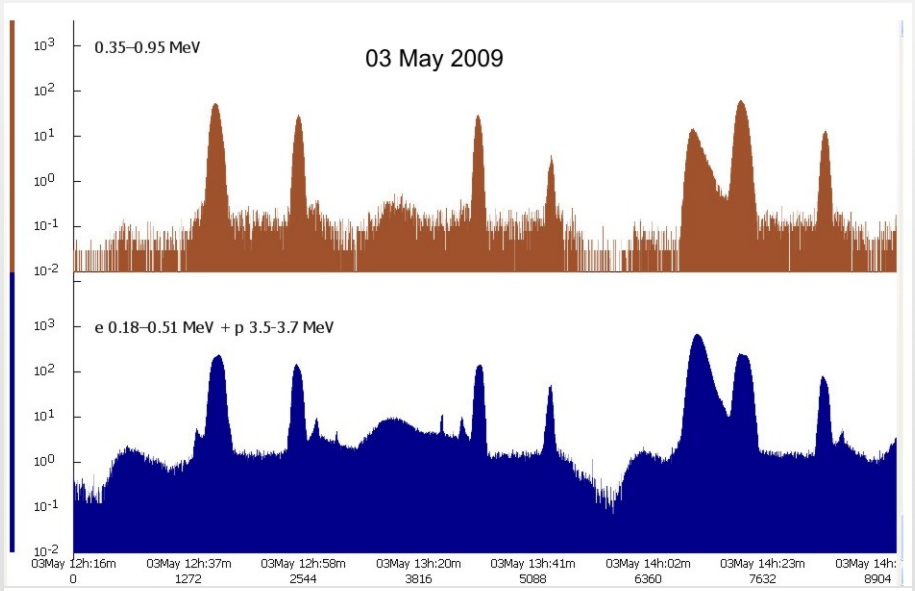


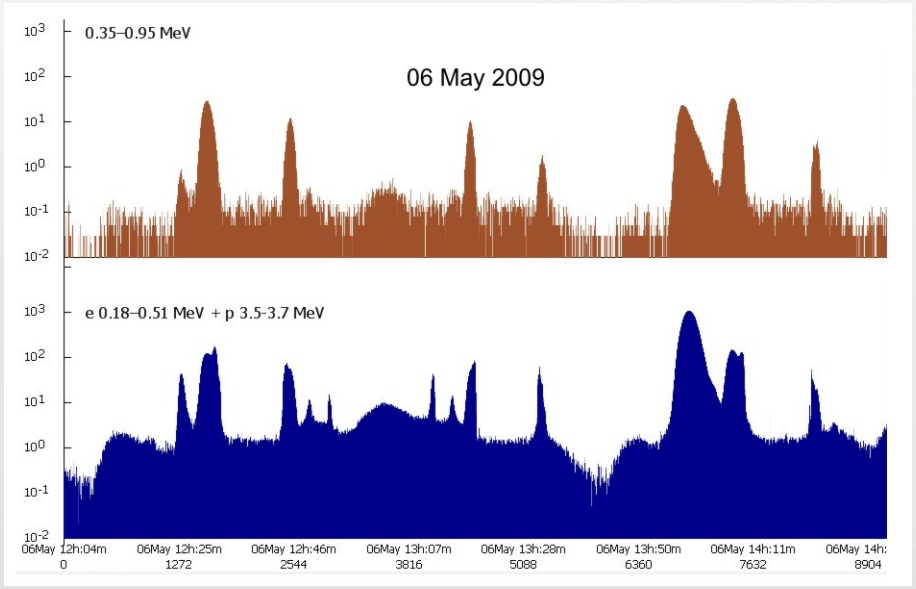


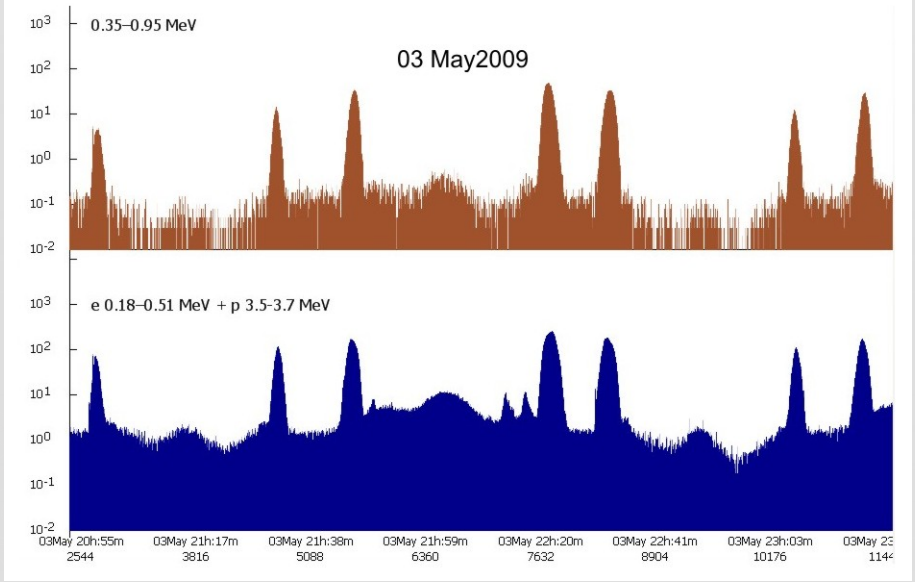


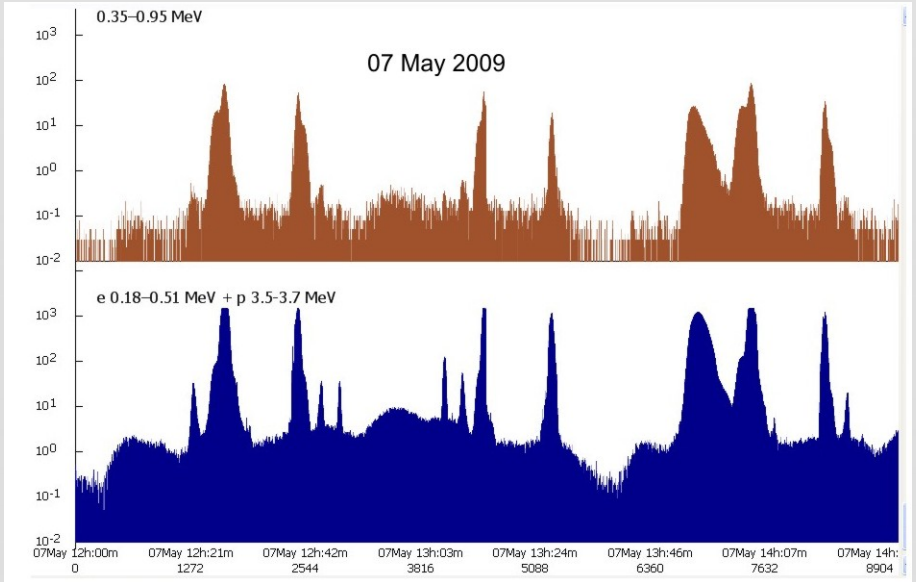
Measurements of electron fluxes of energies from E_e=0.18 to ~1.2 MeV and protons of energies E_p=3.5 to ~55 MeV

Typical initial temporal variations of electron fluxes of intermediate energies in May, 2009 from the data of the STEP-F/*CORONAS-Photon* device. Time resolution: 2 seconds

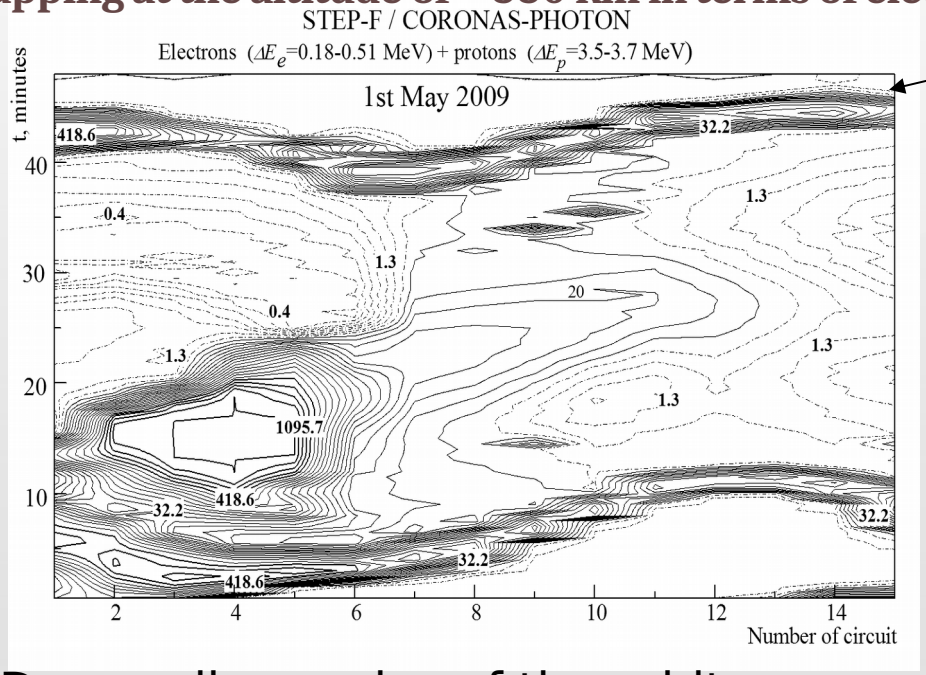




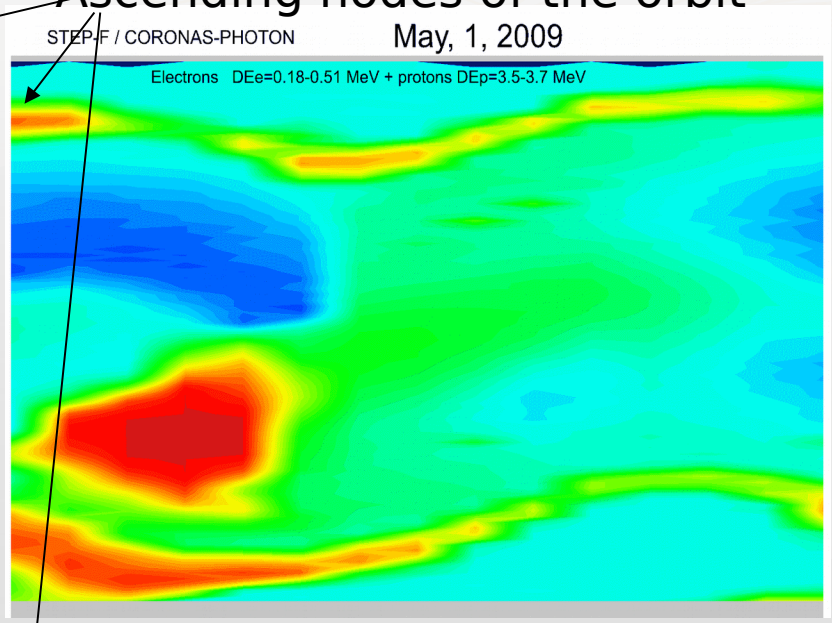




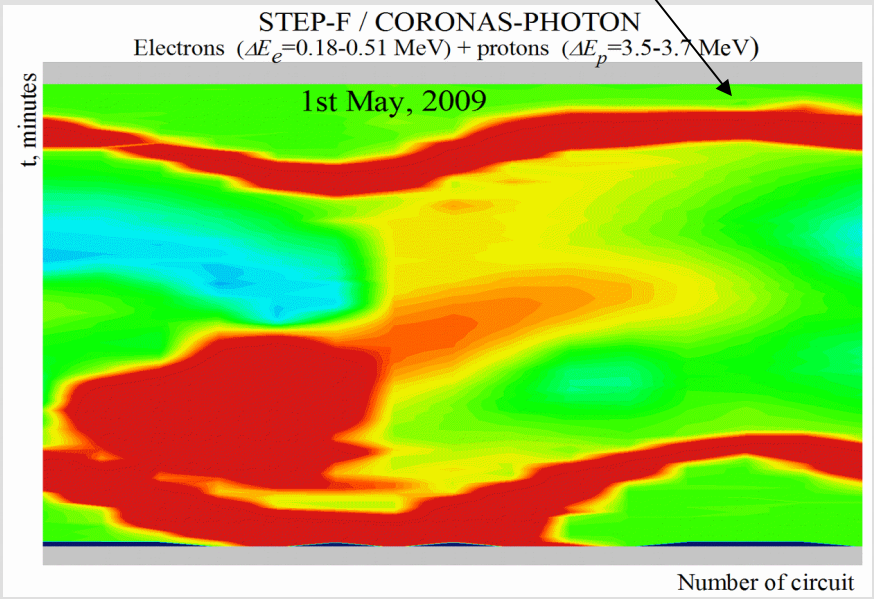
Mapping at the altitude of ~ 550 km in terms of electron fluxes, E_e = 0.18-0.51 MeV; May 1, 2009

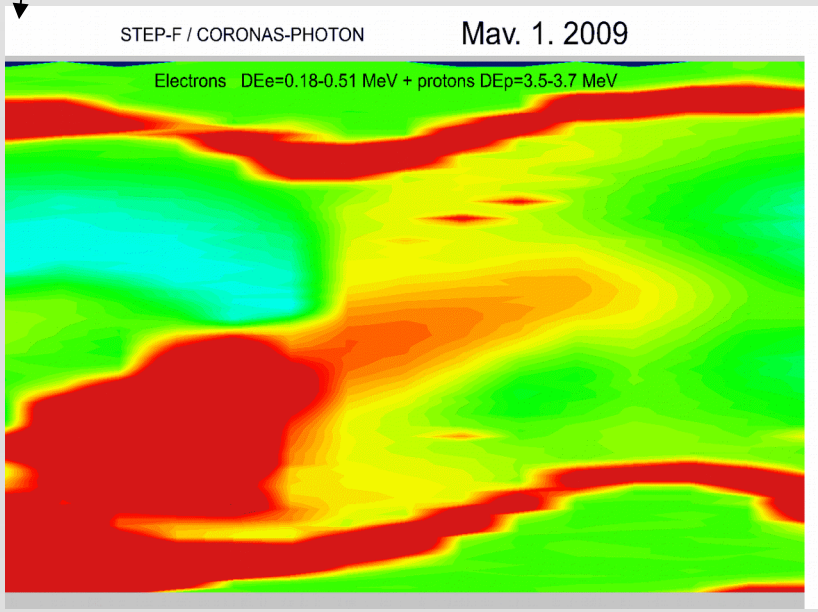


Ascending nodes of the orbit



Descending nodes of the orbit





Technical parameters of the STEP-F device

- **Mass:**
  STEP-FD —15.4 kg;
  STEP-FE —2.7 kg;
- **Power consumption:**
  STEP-FD —40 Watt;
  STEP-FE —8 Watt;
- **Dimensions:**
  1) STEP-FD:
  337 mm x 395 mm x 293 mm;
  2) STEP-FE:
  95 mm x 287 mm x 160 mm;
- **Full angle of view:**
  —108 x 108° for lowest energies;
  — 98 x 98° for highest energies

- **Active areas:**
  semiconductor detectors – 20 cm^2;
  scintillation detectors – 36 и 49 cm^2;
- **Geometry factors:**
  from 21.7 $cm^2 \cdot sr$ for low energies of particles,
  to 12.4 $cm^2 \cdot sr$ for high energies of particles
- **Temporal resolution:**
  2 seconds —12 values in each half of minutes;
  30 s: 24 *s* collection + *6 s transmission information*

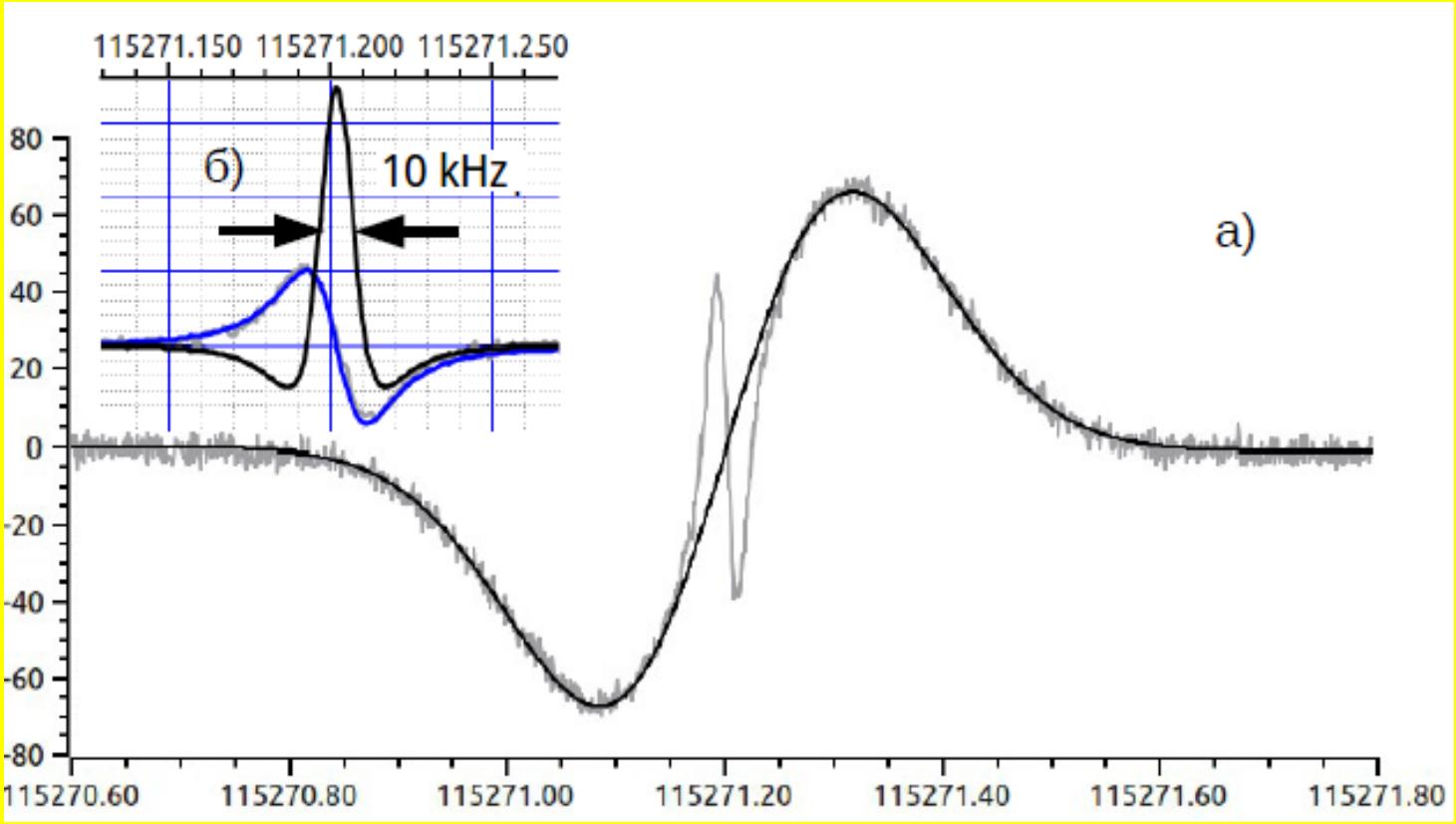
- **Energy ranges:**
  Electrons:
  1) 0.35 – 0.95 MeV;
  2) 1.2 – 2.3 MeV;
  3) > 2.3 MeV
- **Protons:**
  1) 7.4 – 10.0 MeV;
  2) 15.6 – 17.5 MeV;
  3) 17.5 – 19.6 MeV;
  4) 19.6 – 22.2 MeV;
  5) 22.2 – 25.4 MeV;
  6) 25.4 – 29.3 MeV;
  7) 29.3 – 33.2 MeV;
  8) 33.2 – 38.9 MeV;
  9) 38.9 – 46.5 MeV;
  10) 46.5 – 55.2 MeV;
  11) > 55.2 MeV

Channels of mixed particle registration:

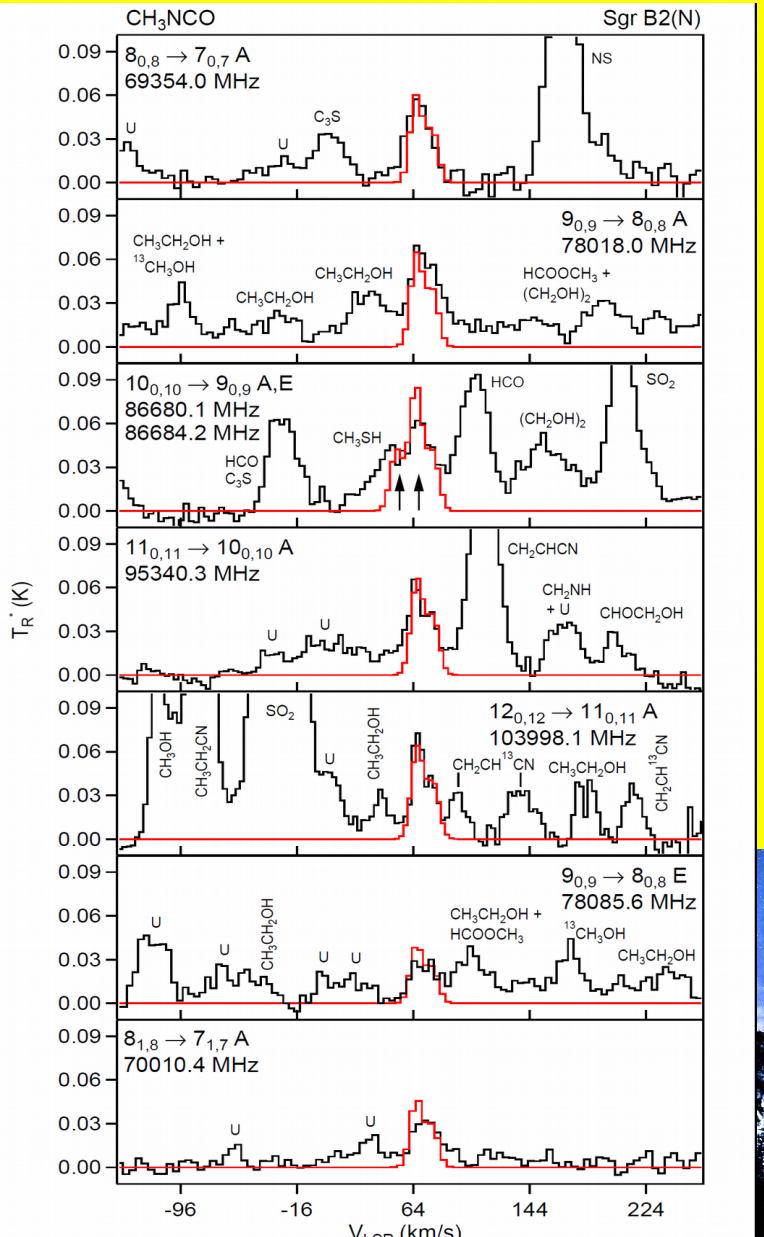
1) e (E_e=0.18-0.51 MeV) + p (E_p=3.5-3.7 MeV);
2) p (E_p=3.7-7.4 MeV) +e (E_e=0.55-0.95 MeV);
3) α (E_α=15.9-29.8 MeV) + p (E_p=7.4-10.0 MeV);

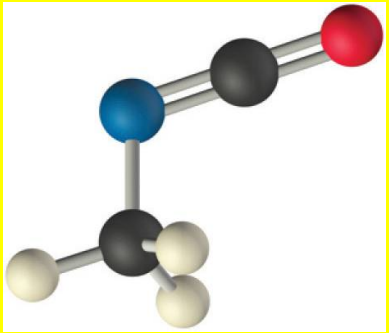
High-accuracy measurements: Lamb-dip record of CO transition

115271,20**19**±0,00**05** MHz *Our measurements*
115271,20**18**±0,00**05** MHz *Winnewisser et al*
115271,20**21**±0,00**04** MHz *Lapinov et al*

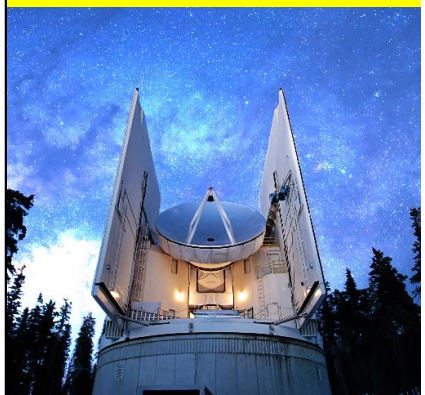


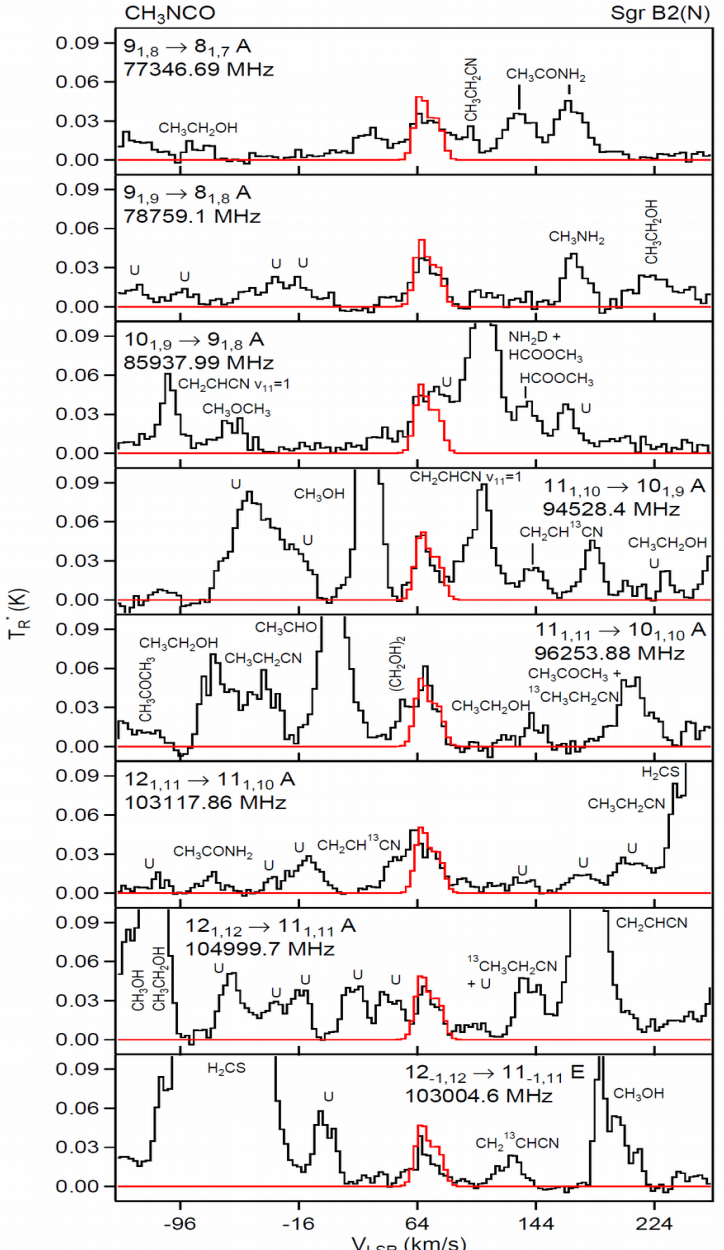
Detection of interstellar methyl isocyanate CH3NCO in Sgr B2 (N)



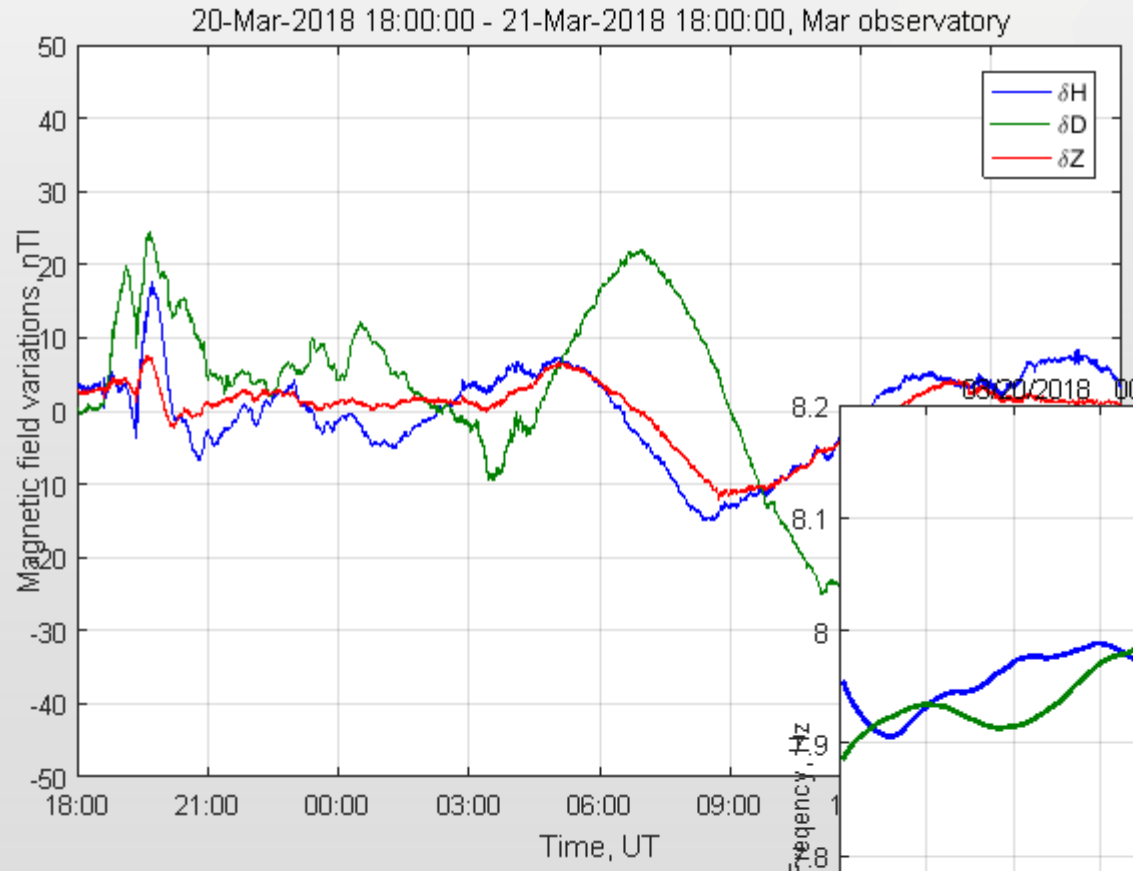


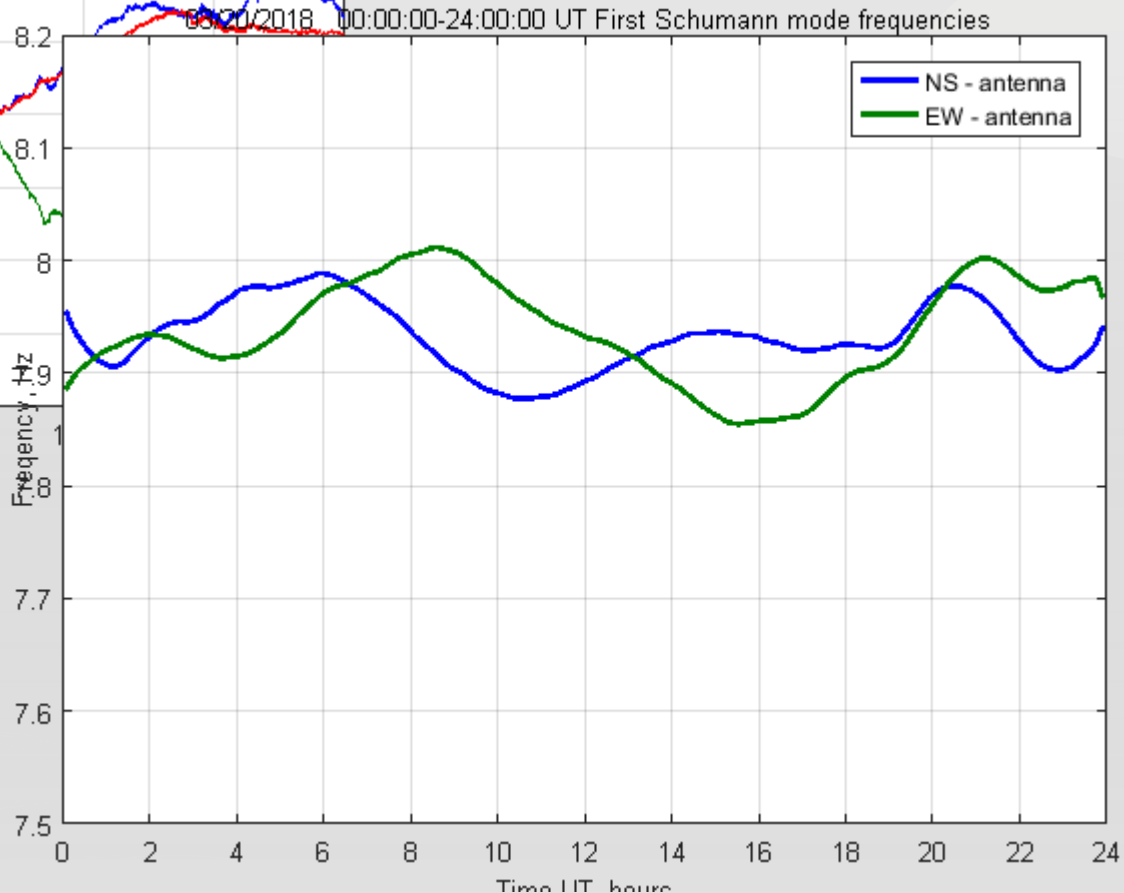
3 of ~ 190 molecules in space were identified in IRA NASU





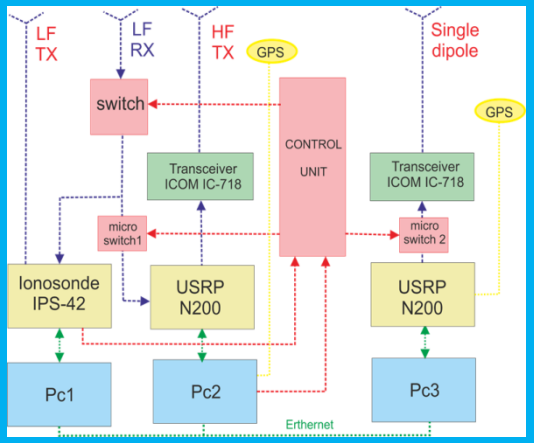
Department of Radiophysics of Geospace



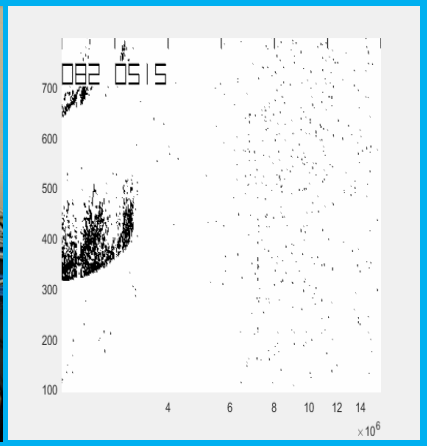


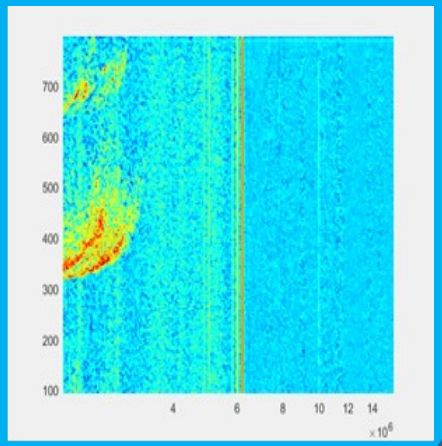
Facilities of the Antarctic station “Academician Vernadskii”

Transmitter/Receiver for ionosphere sounding

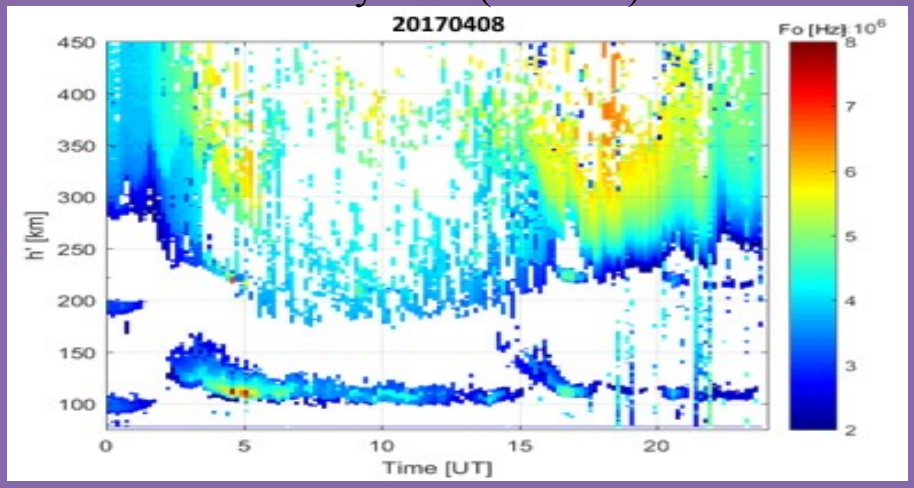


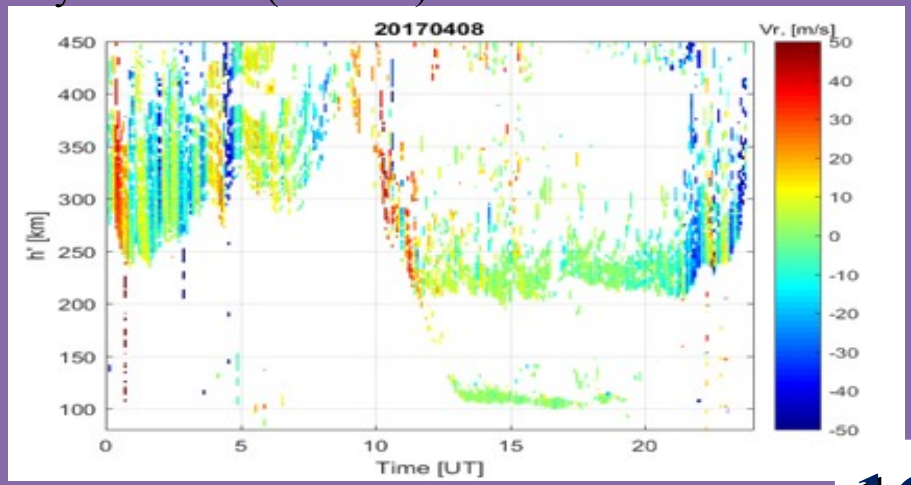
Data analyses (IPS-42 , left side) and new facilities of IRA NASU design (right side)





Daily TEC (left side) and Vertical velocity variations (left side)



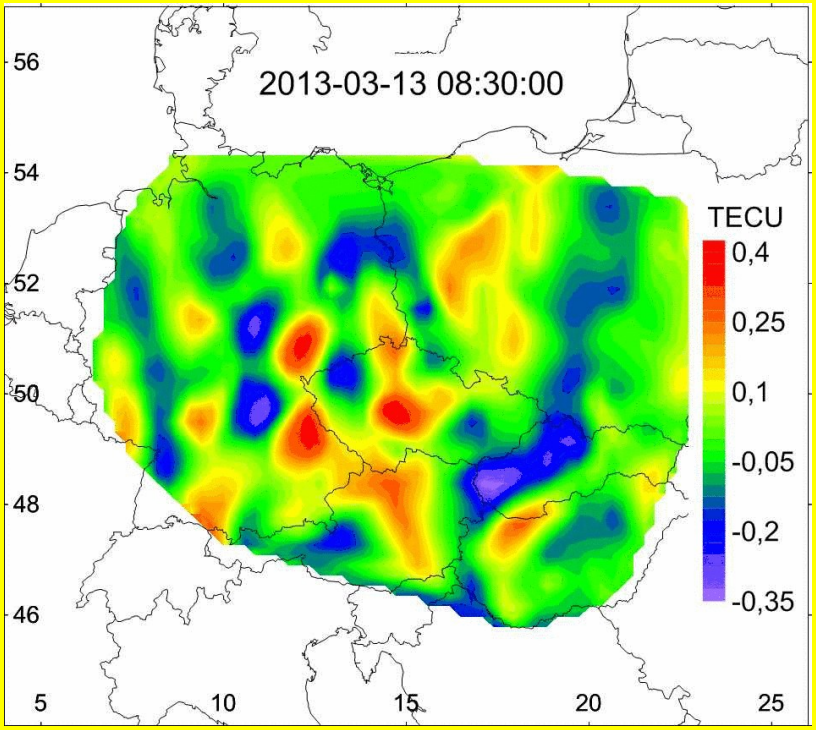


Detection of plasma irregularities in near-Earth space

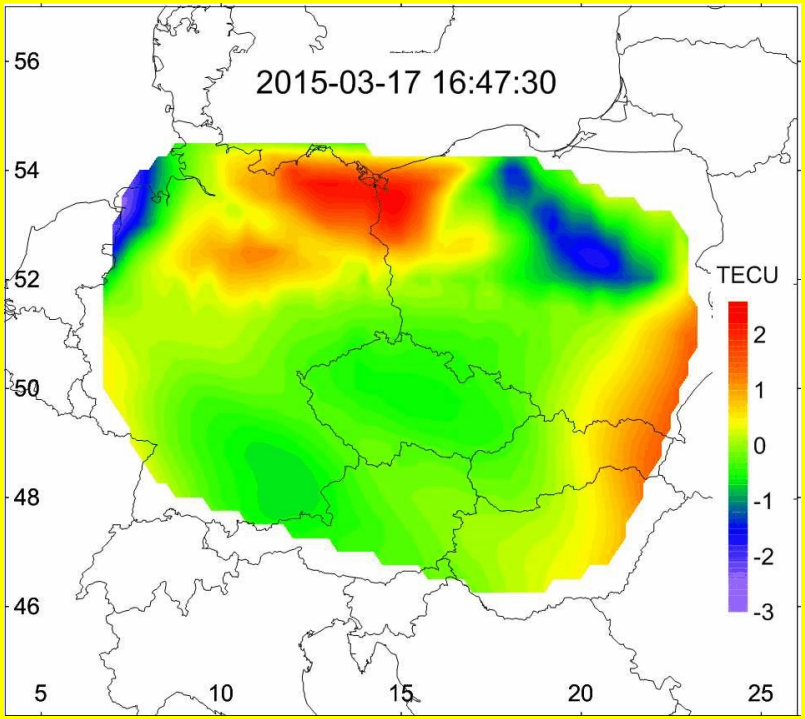
Two frequency sounding by single GPS satellite and with net of receivers:

Time delay between signals with different frequencies was measured

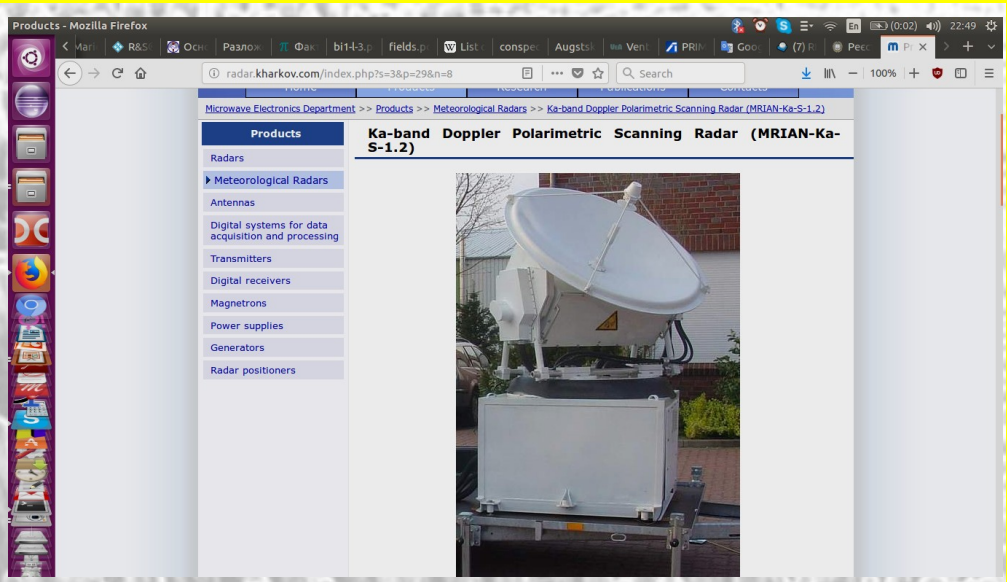
Quiet ionosphere



Disturbed ionosphere



Department of Microwave Electronics
IRA NASU



Meteriological Radar
8-mm range.

International collaboration of IRA NASU

"ЗАТВЕРДЖУЮ"

Директор Радіоастрономічного інституту Національної академії наук України

_____ Л. М. Литвиненко

"___" _____ 2016 р.

"ЗАТВЕРДЖУЮ"

Ректор Луцького національного педагогічного університету імені Олександра Довженка

_____ О. І. Курок

"7" _____ 2016 р.

ДОГОВІР
про наукове співробітництво

Договір укладено з метою розвитку і налагодження плідного співробітництва установами Національної академії наук України та установами Міністерства науки України, координації їх спільної діяльності та виконання у найбільш обсязі Закону України "Про вищу освіту" та Закону України "Про наукову і технічну діяльність" .

Національна академія наук України
РАДІОАСТРОНОМІЧНИЙ ІНСТИТУТ РІ НАНУ
вул. Мистецтв 4, м. Харків, 61002
тел/факс: +38(057)706-14-15
E-mail: rian@rian.kharkov.ua
Web: http://ri.kharkov.ua
Код ЄДРПОУ 02772020

National Academy of Sciences of Ukraine
INSTITUTE OF RADIO ASTRONOMY IRA NASU
4, Mystetstv St, Kharkiv, 61002, Ukraine
tel: +38(057)315 20 92
fax: +38(057)706 14 15
E-mail: rian@rian.kharkov.ua

09. 11. 2017 р. № 237-574/11
На
№ _____ від _____
GURT mini array specification

Financial Information
The detailed cost break down is given in the Table 2

	#	€/each (incl. VAT*)	Total € (incl. VAT*)	Remarks
1. Antenna array				
Low band antennas	25	€ 210	€ 5250	
Coaxial cable	2500 m	€ 1	€ 2500	RG-58u or better
Equipment cabinet with construction materials	1	€2100	€2100	Incl. power and connec coax cable
2. Amplification system				
Antenna pre-amplifiers	60	€ 100	€ 6000	incl. 10
5-channels amplifiers	3	€ 750	€ 2250	incl. 1
Base amplifiers	3	€ 200	€ 600	incl. 1
Output amplifiers	3	€ 250	€ 750	incl. 1
Power suppliers	12	€ 240	€ 2880	incl. 2 s
3. Phasing & control				
Phase shifters	14	€ 1300	€ 18200	incl. 2 s
Beam former & control board	1	€ 1500	€ 1500	
4. Back-ends facility				
Digital receiver ADR incl. software	1	€ 24800	€ 24800	
Total			€ 66 830	

Table 2. Financial overview.

The total costs of GURT mini array is 66 830.00 € *
* Currently there is 0% VAT rate in Ukraine for the export of goods and services.

All local infrastructure related items and works as well as transport costs are excluded labour hours for the system integration and tests at the local site are excluded. Th documentation will be delivered. All GURT system components are electronically tested before shipment. The quotation includes a one year guarantee for all electronical

Yours sincerely,

Director
Dr. Sc. V. V. Zakharenko

Deputy director on science
Academician NASU O. O. Konovalenko

SADARBĪBAS LĪGUMS STARP VENTSPILS AUGSTSKOLU (LATVIJA) UN UKRAINAS NACIONĀLĀS ZINĀTŅU AKADĒMIJAS RADIO ASTRONOMIJAS INSTITŪTU (UKRAINA)

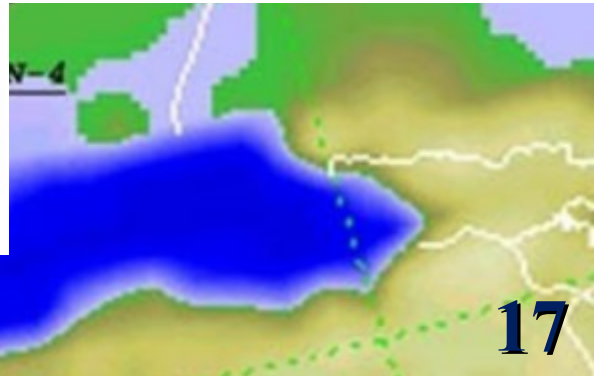
Ventspils Augstskola – juridiska persona, kas reģistrēta un darbojas saskaņā ar likumu "Par Ventspils Augstskolas Satversmi", kas 23.11.2009. publicēts Latvijas Vēstnesī, adrese: Inženieru iela 101, Ventspils, LV-3600, ko pārstāv rektors Asoc. Prof. Dr. Kārlis Krēsliņš (turpmāk – Rektors), un

Ukrainas Nacionālās Zinātņu akadēmijas Radio astronomijas institūts (IRA) – juridiska persona, kas reģistrēta un veic darbības saskaņā ar Ukrainā spēkā esošajiem normatīvajiem aktiem, ko pārstāv tā direktors Vjačeslavs Zharenko (Vyacheslav Zakharenko) (turpmāk – Direktors), kurš rīkojas pamatojoties uz Statūtiem un kura juridiskā adrese atrodas Ukrainā, 61002, Harkovā, Mystetstv ielā 4, un

УГОДА ПРО СПІВРОБІТНИЦТВО МІЖ ВЕНТСПІЛЬСЬКИМ УНІВЕРСИТЕТОМ ПРИКЛАДНИХ НАУК (ЛАТВІЯ) ТА РАДІОАСТРОНОМІЧНИМ ІНСТИТУТОМ НАН УКРАЇНИ

Вентспілський Університет Прикладної Науки - юридична особа, яка зареєстрована та діє відповідно до Закону про Конституцію Вентсільського Університетського Коледжу, що опублікована в "Латвійському Вестніст" 23.11.2009, адреса: вул. Інженерів 101, Вентспілс, LV-3600, представлена в особі ректора Асоц. Професор д-р Карліс Крелінс (далі - Ректор), та

Радіоастрономічний Інститут НАН України (РІНАНУ) – юридична особа, яка зареєстрована та здійснює діяльність за законодавством України та представлена в особі її директора Вячеслава Захаренка (далі - Директор), діючи на підставі Статуту, чиє зареєстроване представництво розташоване за адресою: вул. Мистецтв 4, Харків 61002, Україна,




ДЯКУЮ ЗА
УВАГУ!
Thank You !