



About astronomy and astronomical polarimetry in contemporary Latvia

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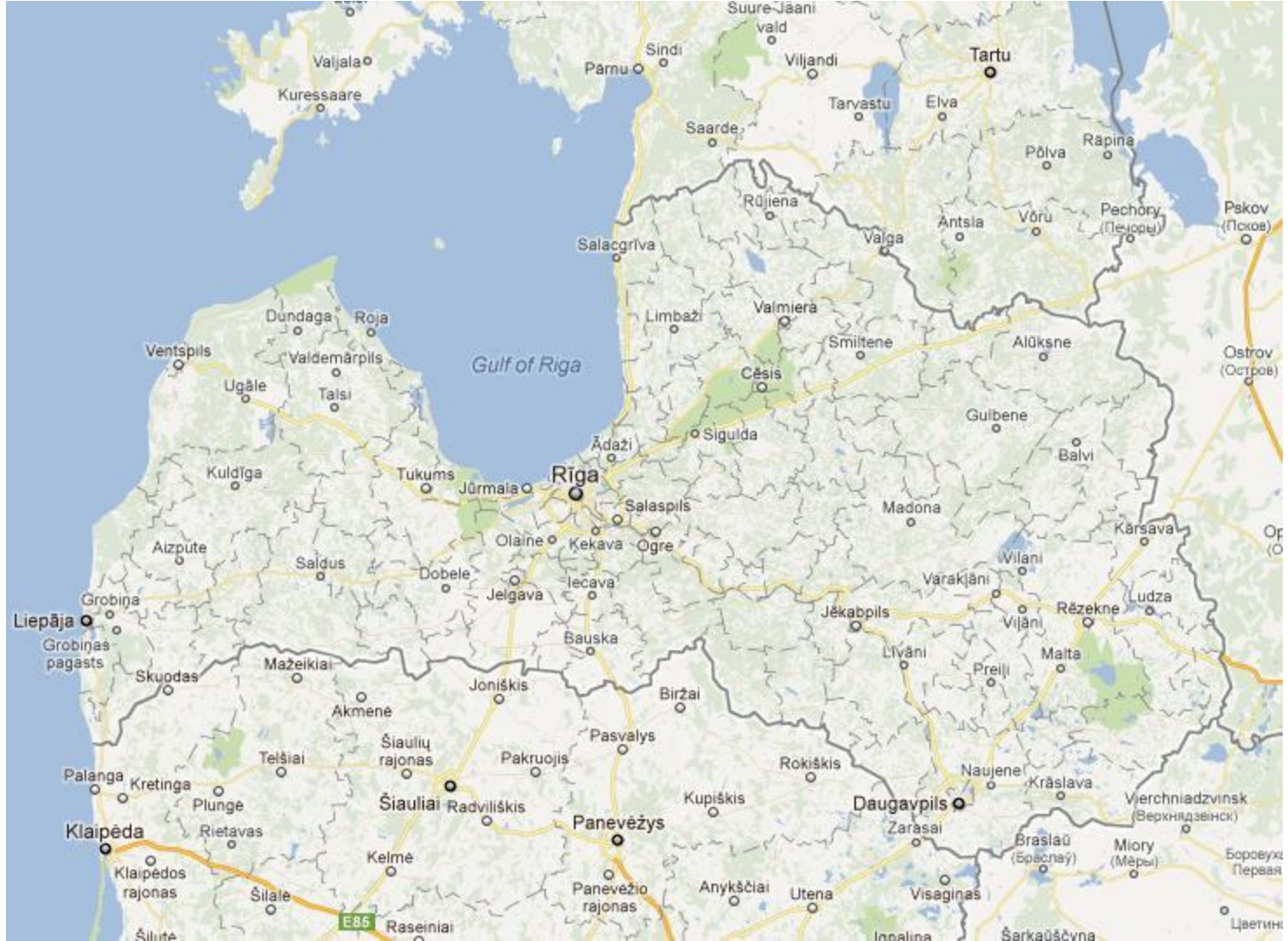
Professional astronomical institutions in Latvia:

1) Institute of Astronomy, University of Latvia – long-term photometric variability studies of late-type giants and supergiants; low-resolution optical spectroscopy of late-type stars, search for new carbon stars; monitoring nova flashes; theoretical studies of active galaxies; search for new minor planets in Solar System; laser ranging of artificial Earth satellites and elaboration of the gravity potential of the Earth; development of astronomical optics. **Main instrumentation:** 80/120/240 cm optical Schmidt telescope (located in Baldone near Riga) with CCD matrix and objective prism; 1-m optical telescope with satellite laser ranging equipment (located in Riga). **Probably best known experts:** Dr. Ilgmārs Eglītis (director), Dr. Dmitrijs Docenko, Dr. Māris Ābele, Dr. Kazimirs Lapuška. **Main location of the institute:** Riga, Latvia.

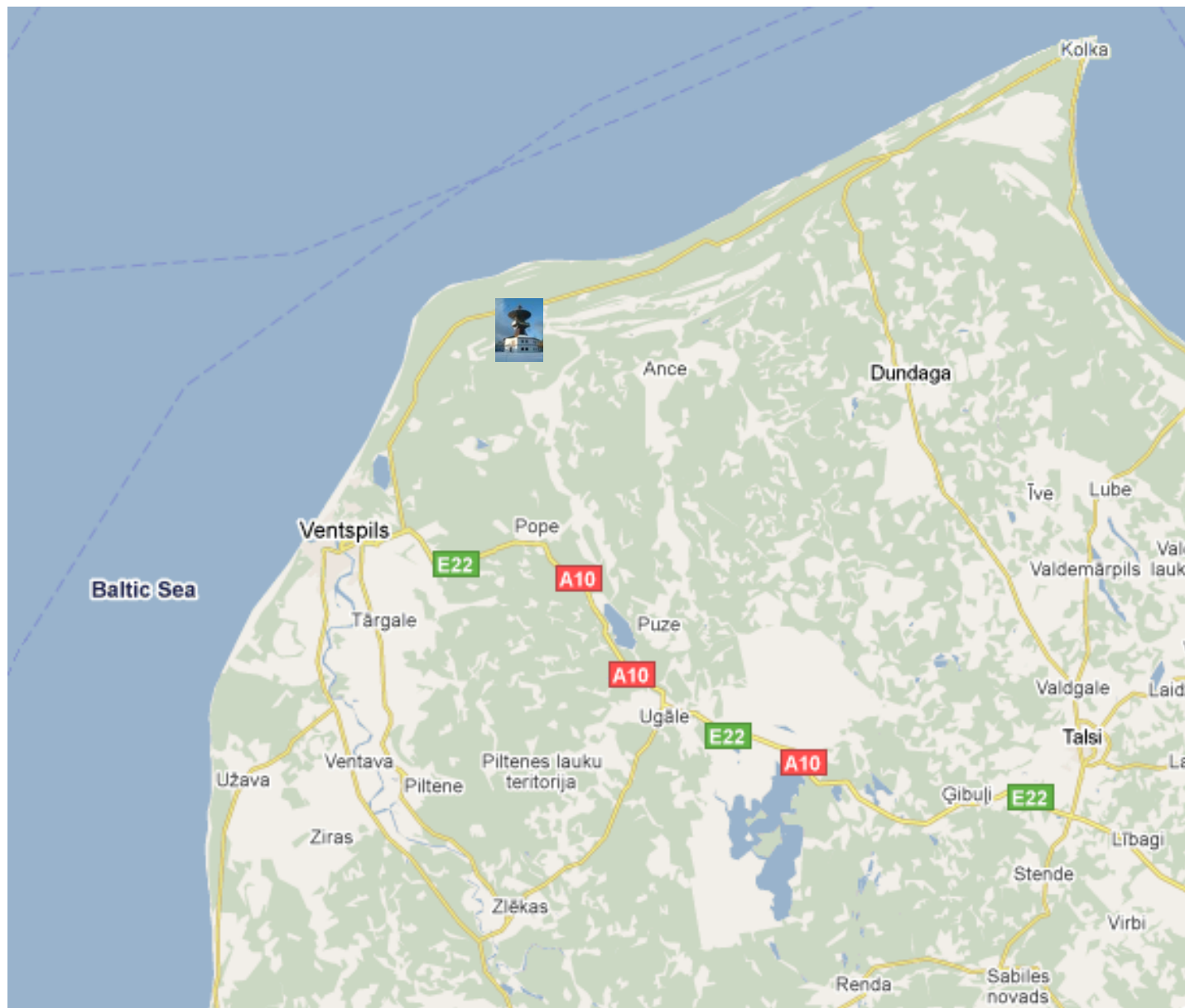
2) Laboratory of Astrospectroscopy, Laser Centre of the University of Latvia – high-dispersion optical spectroscopy of stars, derivation of their chemical composition and the physical parameters of stellar atmospheres. **Instrumentation:** the corresponding own instruments are fully absent, but the observations are made on the big telescopes of European Southern Observatory, Special Astrophysical Observatory of Russian Academy of Sciences and others. **Best known expert:** Dr. Laimons Začs (head of the laboratory). **Location:** Riga, Latvia. **Last achievement:** PhD Thesis successfully defended by O.Smironova and A.Barzdis on May 3.



3) Engineering research institute “Ventspils International Radio Astronomy Centre” of Ventspils University College (VIRAC) – engaged in astronomical research, development of space communication technology, remote sensing of the Earth, high-performance computing, applied engineering research. **Main astronomical instrumentation:** one 32-m and one 16-m radio antenna located in **Irbene**, 30 km from Ventspils. **Additional facilities:** the computing cluster of Ventspils University College. **Main location of the institute:** Ventspils, Latvia. **Staff:** approx. 64 people, including 20 PhD’s (10 full-time, 10 part-time). **PhD’s – astronomers:** 5 (4 full-time, 1 part-time).



Ventspils International Radio Astronomy Centre (VIRAC)





Astronomy at VIRAC until now:

- i) Solar physics (especially the active regions and magnetic fields), Solar activity, forecasting of large flashes – **Dr. Boriss Rjabovs, Dr. Maria Nechaeva, Dmitrijs Bezrukovs** (PhD student). Extensive use of polarimetric data from the Nobeyama Radio Heliograph (Japan), development of capabilities of VIRAC 32-m antenna (currently 6.35 – 9.35 GHz, but mainly as future hopes, 2 – 18 GHz), theoretical modelling;
- ii) Interstellar medium (with emphasis on chemistry) – **Dr. Ivars Šmelds, Juris Kalvāns** (PhD student). Mostly theoretical numeric calculations of chemical reactions based on radio spectroscopic observational results taken from literature;
- iii) Active galaxies – **Vladislavs Bezrukovs**. Multiwavelength radio polarimetry using mainly VLBA (USA);
- iv) Mathematical theory of polarized radiative transfer – **Dr. Juris Freimanis**. Until now – Green's functions with spherical and cylindrical symmetry, RTE in general curvilinear coordinates;
- v) Development of radio interferometric capabilities of VIRAC 32-m antenna, in cooperation with 1) European VLBI network EVN (327 MHz = 91.7 cm, 1667 MHz = 18 cm (OH), 5 GHz = 6 cm, 12 GHz = 2.5 cm; in future 6668 MHz = 4.5 cm (methanol), 8418 MHz = 3.56 cm), 2) LFN network (92, 18 and 6 cm) (also Russia, Ukraine, Italy, China), 3) Radiophysical Institute (Nizhny Novgorod, Russia). – **A team** of astronomers and engineers (head of the group – **Dr. I.Šmelds**, other key members – **V.Bezrukovs, D.Bezrukovs, Dr. Jānis Trokšs, Gatis Gaigals**). **The interference fringes at 5 GHz were successively obtained for the first time on April 12, 2012!**

VLBI-station RT-32 (Irbene, VIRAC)

57.553° N, 21.855°E



VLBI-equipment:

Working frequency range:

327, 5'010, 12'000 MHz

Frequency converter:

DBBC

Recording system:

MK-V B,TN-16

Synchronization system:

**Hydrogen Maser "Quartz"
CH-75A, synchronized by GPS**

Low Frequency VLBI Network Project (LFVN)

Radio Telescopes:

- Bear Lakes RT-64
- Pushchino RT-22
- Zimenki RT-15
- St. Pustyn RT-14 (Russia)
- Evpatoria RT-70
- Simeiz RT-22 (Ukraine)
- Noto RT-32
- Medicina RT-32 (Italy),
- Urumqi RT-25 (China),
- **Ventspils RT-32 (Latvia).**

Frequencies:

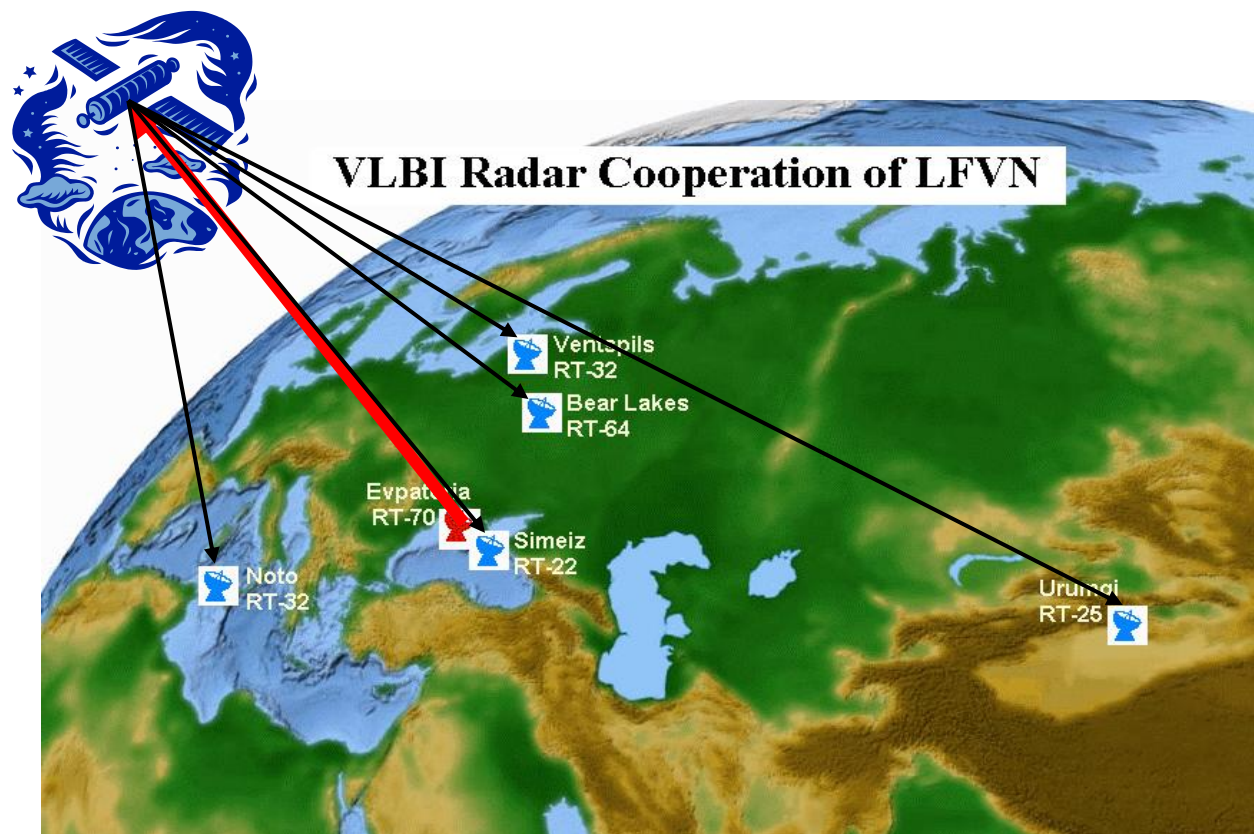
- **92 cm, 18 cm, 6 cm.**

Recording systems:

- **TN16, MK-2, NRTV, MK-V.**

Activities:

- Investigations of solar wind, solar spikes, AGN, OH-masers, active stars and radar research of Earth group planets, **close asteroids and space debris objects.**





Our hopes for near future in astronomical polarimetry

Latvian scientific institutions going to be active in this field – **only VIRAC**.

Scientific directions, goals and methods:

- i) Radio polarimetry of Solar chromosphere and corona, study of the structure of Solar magnetic fields and Solar activity, magnetohydrodynamic modelling;
- ii) Joint with European, Russian, Ukrainian, Chinese and other partners VLBI research of morphology of circumstellar envelopes, interstellar matter, magnetic fields in them;
- iii) VLBI research of active galaxies, with emphasis on magnetic fields;
- iv) Additional (as desirable) optical, infrared, radio, X-ray etc. observations of the objects under study on large telescopes and astronomical satellites, in collaboration with institutions and scientists in other countries;
- v) Maybe some further development of the mathematical theory of polarized radiative transfer (inhomogeneous magnetized medium, curvilinear coordinate systems);
- vi) Improvement of the technical performance of VIRAC 32-m and 16-m antennae, improvement of radio receivers, entering the e-VLBI.



Thank you for your attention!