



# F-Praktikum Review HS1 Radioastronomie

**Dr. Volker Heesen (Hamburger Sternwarte)**

**With contributions from Dieter Engels, Giulia Lusetti and Marcus Brüggen**



# Radioastronomy F-Praktikum experiment at Hamburg Observatory

- Learn radio astronomy basics
- Single-dish telescope
- Understand flux density, intensity, brightness temperature
- Simple dark matter detection experiment



© Dieter Engels



# Short history of the KRT3

## KRT3: Kleines Radioteleskop (3-m parabolic dish)

- Since 2015 in existence initiated by Dr. Dieter Engels
- Upgraded in 2019 to new telescope and software
- State-of-the-art data acquisition with PYTHON analysis
- 100 Students have performed the F-Praktikum experiment





# Experimental setup on the roof of the main building ('Library')

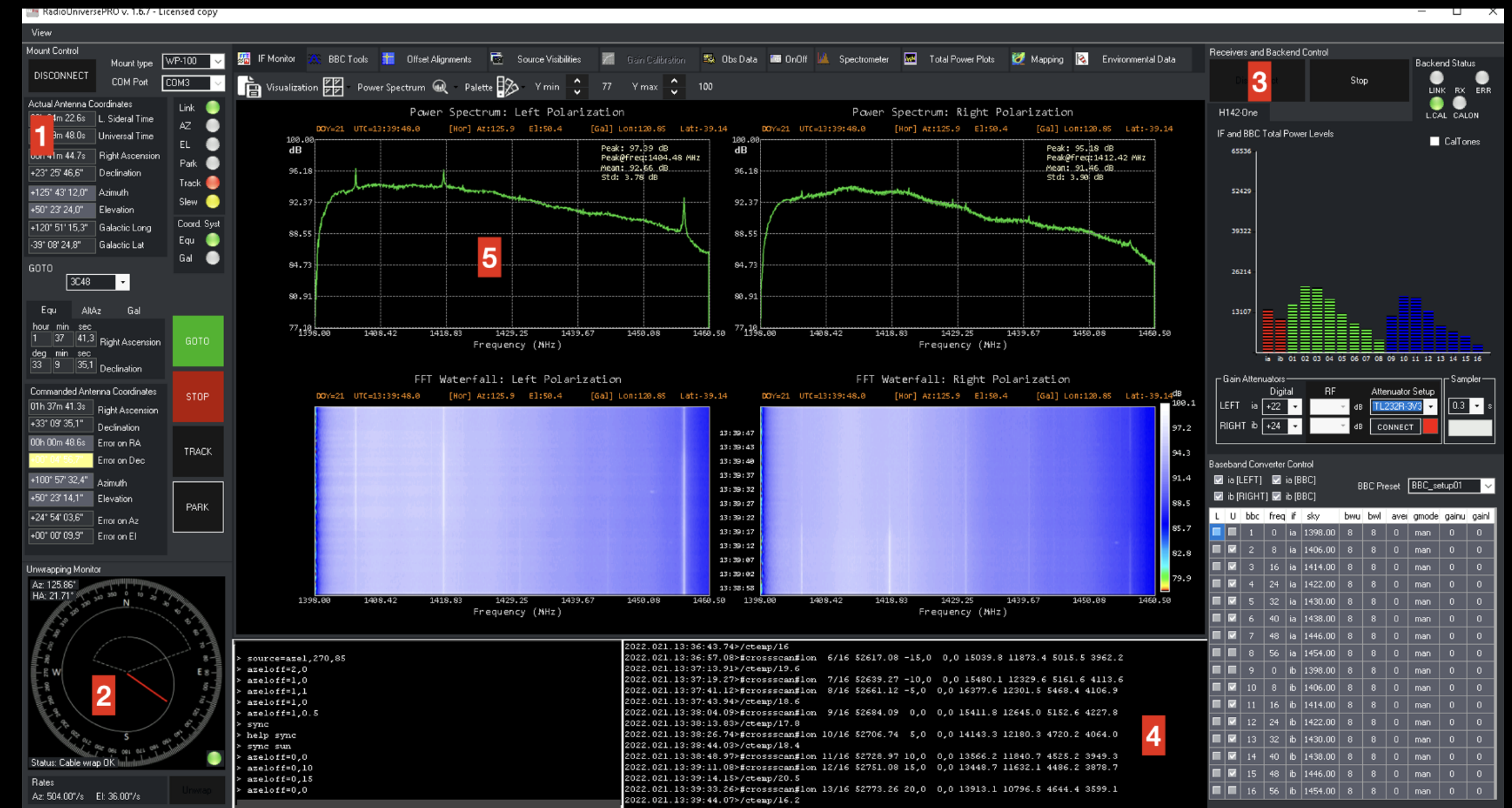
- Take away points for students
  - low-noise amplifiers have to be directly at receiver horn
  - radio light consists of two circular polarisations
  - noise generator for absolute calibrations
  - antenna can be a simple mesh due to long wavelength





# Preparatory work and radio continuum emission

- Students use telescope and
  - determine antenna pointing correction
  - fit Gaussian function to derive angular resolution
  - calculate system temperature and background radiation
  - measure map noise level

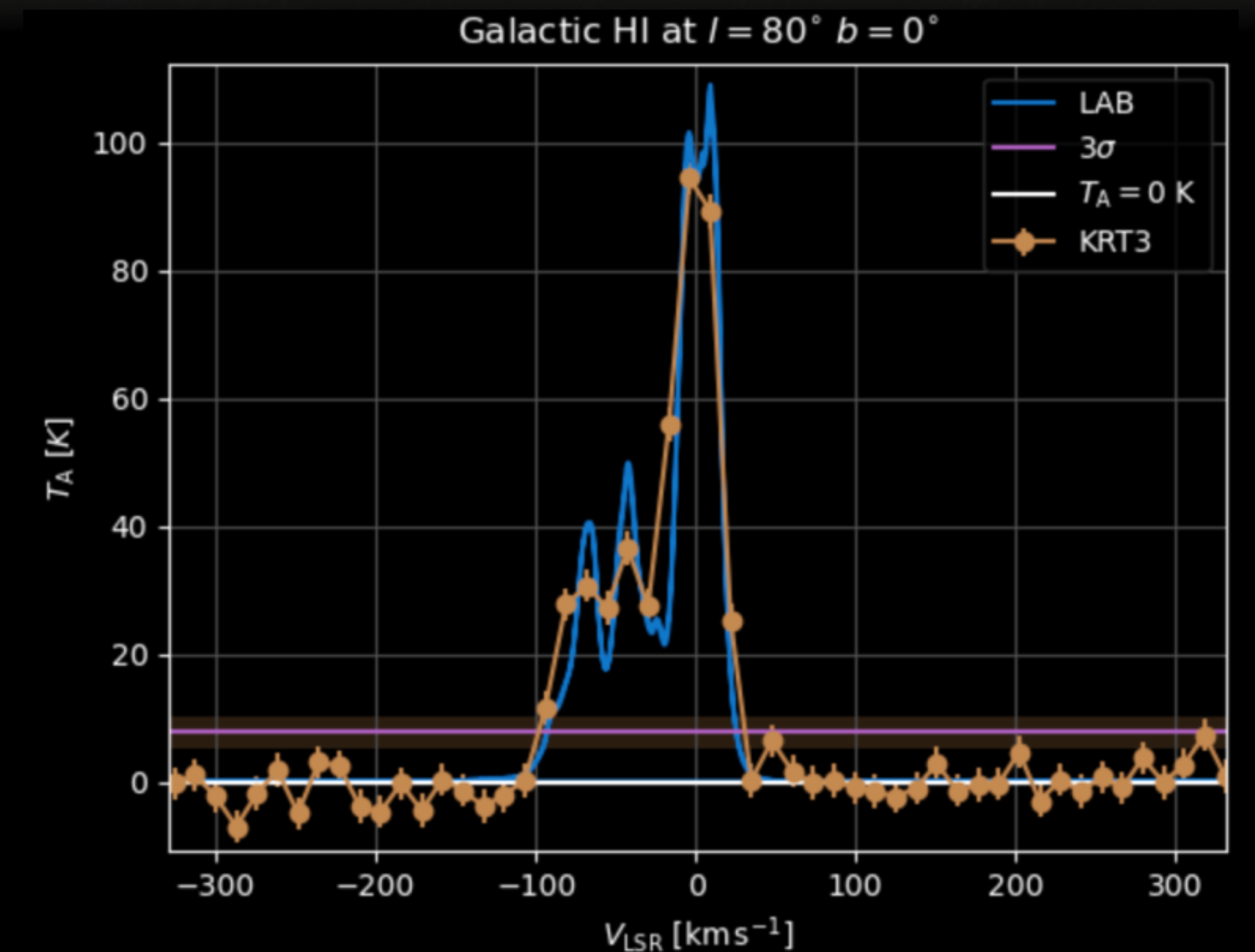


Screenshot of RadioUniversePRO



# Analysis of spectral line data and HI line emission

- Preparatory exercise
  - use Doppler effect to calculate radial velocity
- Interactive PYTHON script
  - subtract baseline temperature
  - estimate rms noise from line-free channels
  - measure maximum velocity with error
- Calculate galactic rotation speed



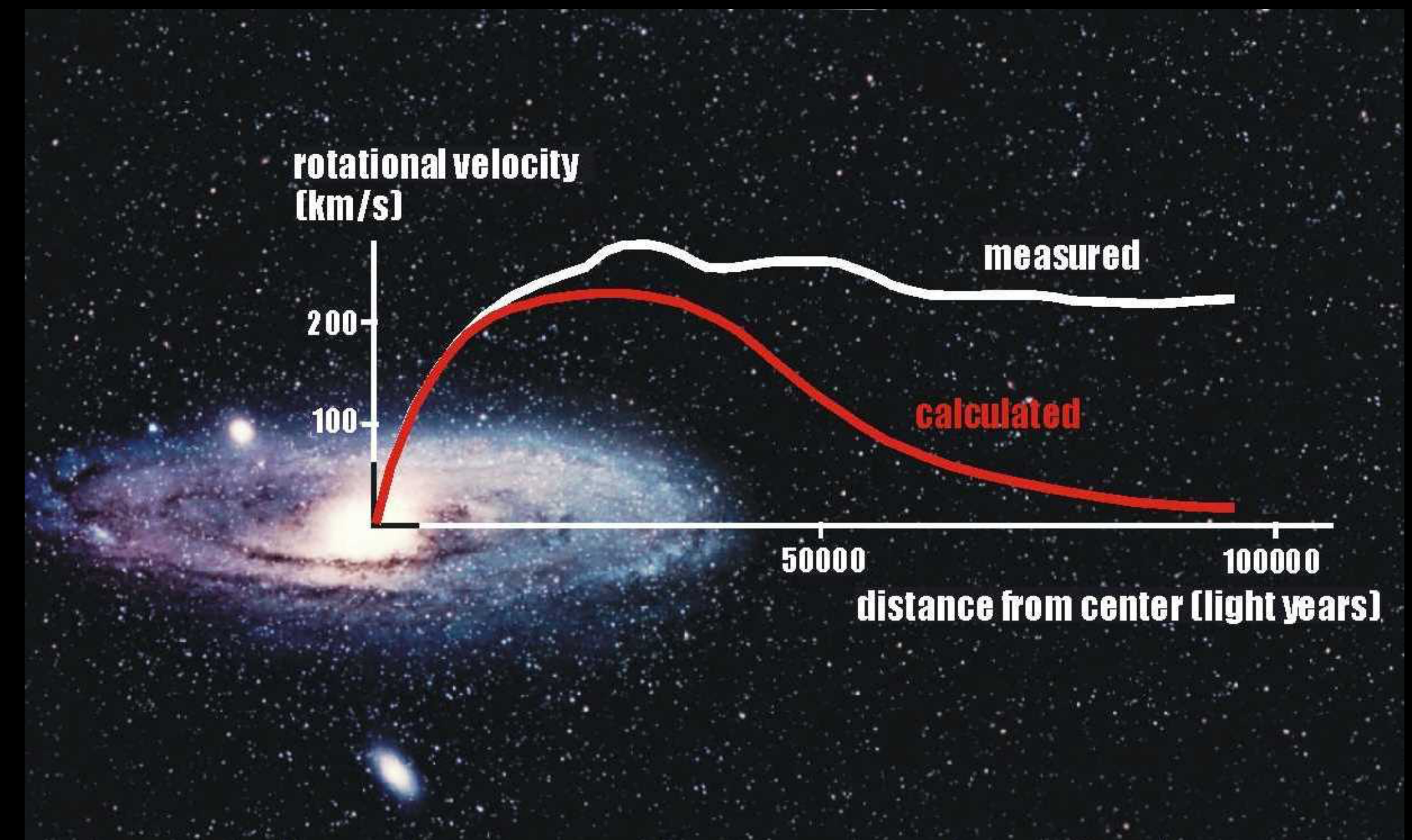
HI line at 80 degree Galactic longitude



# Main results of the experiment

## Galactic rotation curve

- Derive rotation curve of galaxy and compare with literature
- Discuss limitations due to low angular and velocity resolution
- Use assumption of baryonic matter distribution
- Derive galactic dark matter density



© Queens University



# Current radioastronomy research at Hamburg Observatory

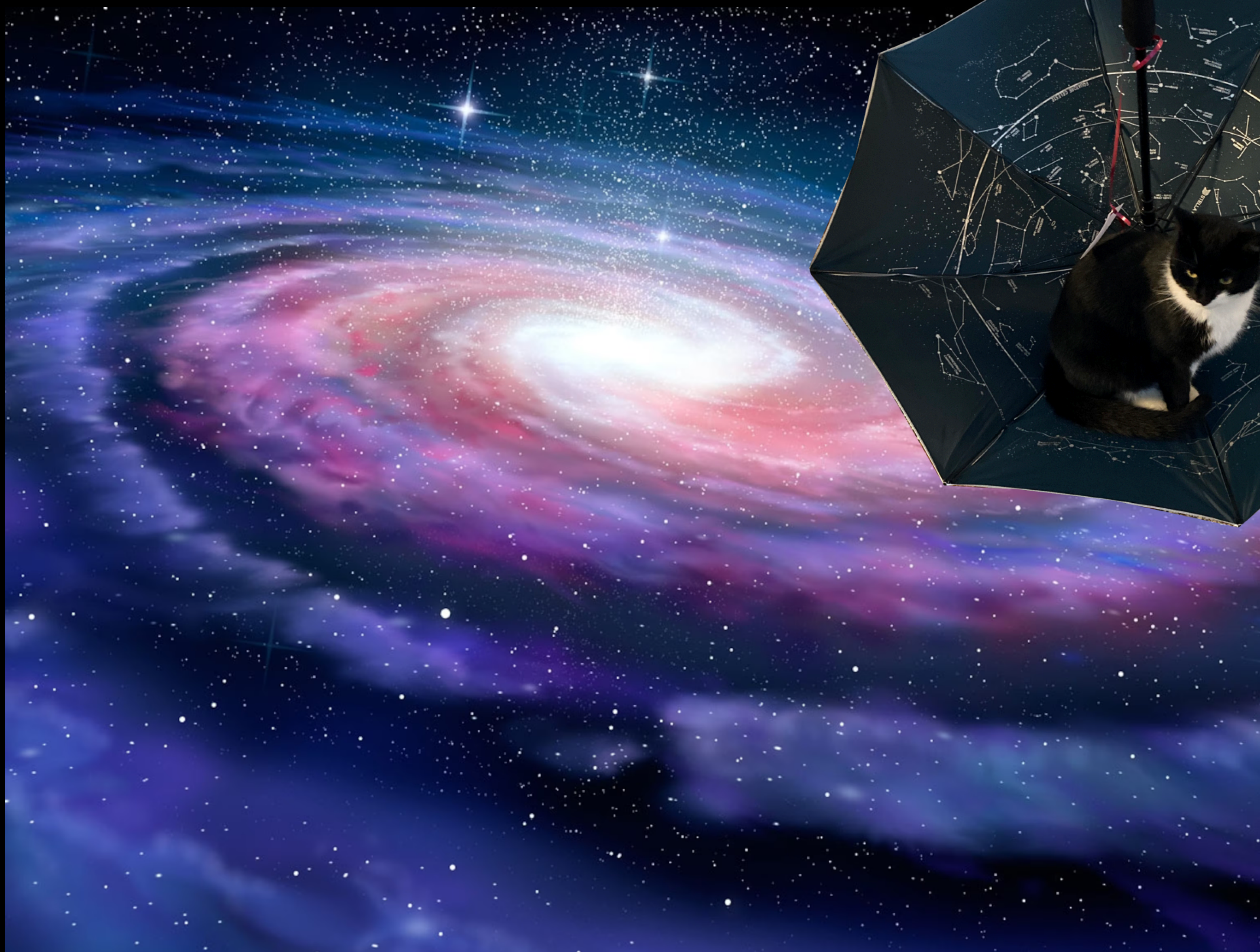
- Radio interferometric observations
- LOw Frequency ARray (LOFAR)
- LOFAR station in Norderstedt as part of a European network
- Dark matter search with annihilating WIMPS
- Quantum Universe research area



*van Haarlem et al. (2013)*







© Alexandr Mitiuc, Dreamstime

Questions?  
Fragen?