



# Huib Intema

Research Scientist at Leiden Observatory

From 2019 onwards: Senior Research Fellow at Curtin Institute of Radio Astronomy

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## Overview

I am a radio astronomer working at [Leiden Observatory](#), the astrophysics research institute of [Leiden University](#) in The Netherlands. My area of expertise is low-frequency [radio interferometry](#), studying the Universe at radio frequencies below 1 [GHz](#) with telescopes like the Low-Frequency Array ([LOFAR](#)), the Very Large Array ([VLA](#)) and the Giant Metrewave Radio Telescope ([GMRT](#)). These are technically challenging observations to process, complicated by the need to image and deconvolve hundreds of sources in a typical Field Of View ([FOV](#)) of several degrees in diameter, the abundant presence of man-made Radio-Frequency Interference ([RFI](#)), and the distorting effects of the Earth's [ionosphere](#). Over the course of several years, I have build and refined a set of software tools to process these observations in an efficient and reproducible way, typically yielding high-quality images. These tools are now systematically applied in many different science projects involving low-frequency radio interferometric observations.



My primary astronomical goal is to understand the origin of large-scale diffuse radio emission regions in [clusters of galaxies](#), namely [radio halos](#) and [radio relics](#). Their emission extends over areas of hundreds of kilo-[parsecs](#) – often a Mega-parsec or more – and appears to be unrelated to any individual galaxy in the cluster. Only a fraction of the known clusters harbors this kind of emission, but all of these show signs of recent merging activity. This strongly suggests that the energy required to generate these emission regions comes from the potential energy released in the merger, but the exact physical mechanisms are still debated. Understanding these mechanisms is part of the puzzle in understanding how the largest gravitationally bound structures in the Universe form and evolve.



At Leiden Observatory, I lead a project to characterize, model, suppress the effects of the ionosphere on low-frequency radio observations. This is specifically aimed at improving the quality of current LOFAR images, and to support the development of the low-frequency part of the future Square Kilometer Array ([SKA](#)). I am also a member of the LOFAR Surveys Key Science Project ([LSKSP](#)), aimed at radio imaging the Northern hemisphere at unprecedented resolution and sensitivity using both the High-Band Antennas (HBA; 120-240 MHz) and Low-Band Antennas (LBA; 30-80 MHz).

From 2019 onwards I will be joining the [Curtin Institute of Radio Astronomy \(CIRA\)](#) in Perth, Australia, as a Senior Research Fellow. I will focus on improving data processing for the [Murchison Widefield Array](#) and the future SKA\_LOW, and mining the data of these and other low-frequency telescopes for a range of different astrophysics.

## Education and Experience

2019 - ....	Senior research fellow, Curtin Institute of Radio Astronomy
2015 - 2018	LOFAR/SKA research scientist, Leiden Observatory
2012 - 2015	VLA research associate, NRAO Socorro
2009 - 2012	Jansky fellow, NRAO Charlottesville
2005 - 2009	PhD candidate in radio astronomy, Leiden Observatory
2000 - 2004	Combined BSc/MSc degree in astronomy, Leiden University
1996 - 2000	Technical software engineer, High Tech Automation
1994 - 1996	Engineering degree in electronics, Hogeschool Utrecht
1993 - 1993	Military service, Royal Dutch Army
1989 - 1992	Partial BSc in electronics, Delft University

## Research interests

- Large-scale structure – merging galaxy clusters: Mpc-scale diffuse radio sources (halos, relics), tailed radio galaxies, ICM physics
- Radio sky surveys: low-frequency radio sky, large-area surveys, high-redshift radio galaxies
- Radio interferometry: wide-field calibration and imaging, automated data reduction, algorithm

development, the ionosphere

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## Current projects

- [TGSS ADR](#): GMRT 150 MHz all-sky survey Alternative Data Release (with Jagannathan, Mooley, Frail)
  - [SPAM](#): automated processing of GMRT observations (including direction-dependent calibration)
  - C-SPAM: implementation of SPAM in CASA for processing wide-bandwidth uGMRT and JVLA-lowband observations (with de Gasperin)
  - GMRT follow-up of SZ-selected clusters from the ACT and SPT (with Knowles, Moodley, van Weeren, Datta, Paul)
  - Pulsar and transient searches using TGSS and other catalogs (with Frail, Mooley, van der Horst, Murphy, Kaplan)
  - Ultra-steep spectrum radio halo and relic searches using TGSS (with de Gasperin, Mandal)
  - HzRG searches using TGSS (with Saxena, Duncan, de Gasperin)
  - GMRT 610 MHz imaging of the XXL-North field (with Smolcic, Horellou, Raychaudhury)
  - GMRT imaging of the ATLAS survey fields ELAIS-S1 (with Norris)
  - GMRT Archive Processing Project (GAPP) (with Wadadekar, Ishwara-Chandra)
  - ... and others
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## Publications and Profiles

- [Publication list on ADS](#)
  - [Publication pre-prints on arXiv](#)
  - [PhD thesis at Leiden University Digital Library \(2009\)](#)
  - [Profile on Google Scholar](#)
  - [Profile on ResearchGate](#)
  - [Profile on ORCID](#)
  - [Profile on Scopus](#)
  - [Profile on ResearcherID](#)
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## Supervision

### *Current*

- [Soumyajit Mandal](#): PhD candidate mainly working on LOFAR HBA observations of the Lockman hole (extremely deep survey) and Abell 1914 (merging galaxy cluster).
- [Joshua Albert](#): PhD candidate mainly working on LOFAR HBA observations of the GOODS-North field (survey), and on techniques to improve ionospheric calibration and radio spectral index mapping.
- [Alexandar Mechev](#): PhD candidate mainly working on optimization of the processing pipeline for the LOFAR HBA survey, and porting to distributed computer platforms.
- [Susie Tuntipong](#): MSc candidate working on wide-band radio imaging of NGC253 using uGMRT

to identify HII regions (with Oonk and Tielens).

### Previous

- [Vivienne Kolman](#): MSc candidate working on a high-resolution radio survey of part of the Galactic plane to search for missing SNRs (with de Gasperin).
- [Martijn Oei](#): MSc candidate working on wide-band calibration for uGMRT and studying the properties of radio galaxies as a function of environment in the GAMA fields (with de Gasperin).
- [Dieuwertje van der Vlugt](#): MSc candidate working on JVL A L-band (1-2 GHz) intensity and polarization maps of double radio relic galaxy cluster PSZ1 G108.18-11.53 (with de Gasperin).
- [Gabriella Di Gennaro](#): LEAPS summer student working on JVL A P-band (240-480 MHz) intensity maps of M87 / Virgo A (with de Gasperin).
- [Kasper van Dam](#): MSc candidate working on implementing wide-bandwidth SPAM ionospheric calibration using CASA (with de Gasperin).

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## Teaching

- 2016-2017: [Radio Astronomy](#) MSc course (with [Huib van Langevelde](#))  
Nominated for Faculty of Science Teaching Award

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Visitors (since May 24, 2017):

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