


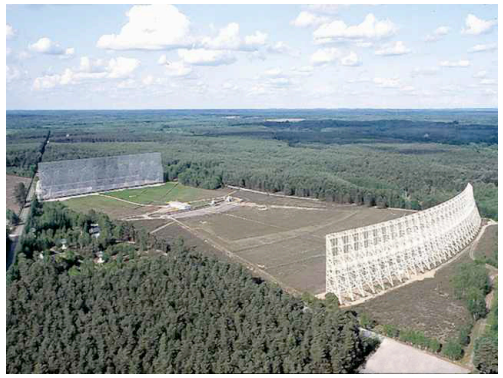

Radio Astronomy

Practicum 2

Writing of mock observing proposal I

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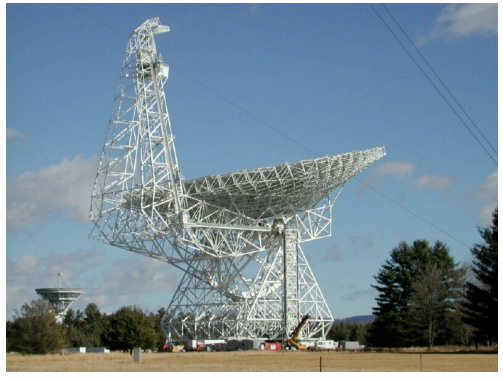

Radio Astronomy
Mock Observing Proposal

Goals of this practicum

- Synthesize the general scientific, technical, instrumental and analysis information you have learned about radio astronomy.
- Deepen your knowledge about the science/ techniques of one specific area of radio astronomical study.
- Gain experience in building a scientific project, working out the details, and defending it (both in writing and verbally).

The scientific cycle of an observer

- Come up with new idea to test.
- Propose for telescope time.
- Receive observations.
- Analyze data.
- Interpret and publish.
- Repeat.

Knowing how to write competitive observing proposals is critical

The written proposal

(20% of total course grade)

- Will be 3-5 pages long.
- Template is provided on wiki.
- Must contain both a scientific and technical justification and be well referenced.
- Original proposal (you can be inspired by other projects you find on the web, but this needs to be your own creation).
- Depending on what topic you chose, you will be assigned a specific guide (either Jason, Michael or Joeri).

The oral presentation

(15% of total course grade)

- Present your proposed project to the rest of the class.
- Normally one doesn't have to do this to get observing time.
- Here however, we want your peers to see the various proposed ideas.
- Also gives an opportunity to test your understanding of the proposed project.

Proposal Template

(Find on course wiki)

Abstract

- ~10 lines (~200 words).
- Need to summarize whole project in an engaging way.

Scientific Justification (~3 pages)

- Give background of the area (give context).
- Present a new idea to be tested with observations.
- Include figures and references to the literature.

Technical Background (~1 page)

- Show that the telescope is capable of providing the required observations and sensitivity.
- Show that the data can be analyzed as required.

Tips for Writing an Observing Proposal

General Tips

- There needs to be a central goal (theory to be tested, result to be achieved).
- Make clear why the goal is interesting and achievable. Also, why is it timely?
- Organization is critical, so make an outline of your ideas before you blindly start writing.
- Each paragraph should have a specific topic/ purpose.
- Start from the broad context of the field to the narrow focus of the proposed observations.

General Tips

- Need to show that the telescope is well suited to the observations in questions.
- Sometimes need to argue that the telescope is *uniquely* capable of performing the required observations.
- Ask yourself: what are the weakly

Some of the Areas You Could Consider

Survey vs. Focused Study

Survey

- Study a large sample of known sources and/or blindly search for new ones.
- Goal is often to understand the global properties of some source class (statistics) and/or find exceptional members of that source class that are particularly interesting in their own right (e.g. the most extreme source according to some metric).

Focused study

- Deep observations of one or a few objects.
- Careful characterization is needed to understand the physics.

Radio only vs. multi-wavelength

- Sometimes the science goals can be achieved with only radio data; sometimes it's essential to complement these with existing (or new) optical, X-ray and/or gamma-ray data.
- Possible to jointly proposed for radio+multi-wavelength data.
- e.g. VLA+Chandra, VLA+XMM-Newton, Arecibo+Fermi, etc.

New vs. archival data

- Sometimes the data you need already exists!
- Sometimes you need to combine new data with old data.
- Sometimes new data is all you need.

Extragalactic

- Active galactic nuclei (AGNe)
- Radio galaxies
- Mapping Magnetic Fields in other galaxies.
- Use HI (21-cm line) to map kinematics of other galaxies.
- Gamma-ray burst afterglows.
- Relics and/or haloes in galaxy clusters.
- Gravitational lenses.
- Cosmic microwave background.
- Epoch of reionization.
- Fast radio bursts.

Galactic

- Microquasars and other X-ray binaries (jets and outflows).
- Supernovae and pulsar wind nebulae.
- Magnetic field of the Milky Way.
- The interstellar medium.
- Masers and star-forming regions.
- Pulsars (pulsar timing; pulsar searches; pulsar astrometry using VLBI).
- Flare stars.
- Search for extra-terrestrial intelligence (SETI).

Solar System

- Radar imaging of planets, the Moon, or near Earth asteroids.
- Solar bursts (Type I, II, III).
- The interplanetary medium.
- Bursts from Jupiter and Saturn.
- Astrometry and tracking of space probes (e.g. use these to study the atmosphere or gravitational potential of a Solar System body).

Choosing the telescope

- Can the telescope even see the source(s) you want to study (too far north/south?).
- Do you need very high angular resolution? (i.e. a single dish, interferometer, VLBI?)
- Do you need very high time resolution?
- Are the required observing frequencies available?
- Do you need the best possible sensitivity (a large telescope) or just lots of observing time (easier to get on a small telescope).
- Do you need to run in parallel with multiple radio (or other) telescopes?

Choosing the "backend"

- The data recorder or "backend" of the telescope can be just as important as the front-end telescope itself (dish and receiver).
- Some backends are specifically designed for extremely high frequency or time resolution.
- Some backends provide interferometric "visibilities" (for making images), while others provide timeseries (e.g. for pulsar research).
- Be aware (and weary) of the data rate. What kind of resources will you need to store and process the data? Maybe you need the Dutch National Supercomputer?! Maybe your laptop can do it?

Questions?