SALSA is an ICT based educational tool for Astrophysics students to study structure and dynamics of Milky Way Galaxy

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Overview

Introduction

ICT based astronomy and astrophysics tools have been developed for decades for undergraduate level use including radio telescopes controllable over the Internet at minimal cost. These radio telescopes can effectively be used to study galactic structure and dynamics. This paper presents an observation to study galaxy dynamics and map its spiral structure which was carried out between galactic coordinate longitudes 6° to 225° and latitudes 0° to 35° with two low cost 2.3 meters Haystack model type radio frequency receiving systems called SALSA radio telescopes at Onsala Space Observatory in Sweden which is maintained by Chalmers University of Technology.

Basic Details of SALSA

SALSA is a part of the European Hands-On Universe project(EU-HOU) [1] designed to bring interactive lessons of astronomy to the classroom [2]. There are two SALSA telescopes with the same specification see Table 5 [3].

Anyone can control these telescopes using Internet browser by log in `https://vale.oso.chalmers.se/salsa/` for free at any time.

SALSA

Parameter	Value
Diameter	2.3 m
Focal length	0.9 m (f/0.37)
Angular resolution	7 degree at 1420 MHz
Frequency range	1420 ± 20 MHz
Frequency resolution	9.375 kHz (2.4 MHz over 256 frequency channel
Noise diode temperature	$\approx$ 100K
System temperature	$\approx$ 500K
Aperture efficiency	$\approx$ 50%
Mount	two-axis azimuth/elevation
Pointing accuracy	$\approx$ 0.2 degree
Travel limits	0-90° vertically, 0-360° horizontally

Table: Specification of SALSA

Components of SALSA

- A 2.3 meter satellite dish on a fully steerable, motorized azimuth-elevation mount
- A rotor controller to run the motors which steer the telescope
- A feed composed of a helical antenna backed by a cavity
- A super-heterodyne receiver providing 10 MHz bandwidth centered on the 1420.4 MHz (21-cm) hydrogen line
- A low-noise amplifier
- A/D conversion on a dedicated PCI card
- Software on a desktop computer to receive and process data from the telescope and control it

Paragraphs of Text

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Bullet Points

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Blocks of Highlighted Text

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Multiple Columns

Heading

1. Statement
2. Explanation
3. Example

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Table

Treatments	Response 1	Response 2
Treatment 1	0.0003262	0.562
Treatment 2	0.0015681	0.910
Treatment 3	0.0009271	0.296

Table: Table caption

Theorem

Theorem (Mass–energy equivalence)

$E = mc^2$

Verbatim

Example (Theorem Slide Code)

```
\begin{frame}
\frametitle{Theorem}
\begin{theorem}[Mass--energy equivalence]
$E = mc^2$
\end{theorem}
\end{frame}
```

Figure

Uncomment the code on this slide to include your own image from the same directory as the template .TeX file.

Citation

An example of the `\cite` command to cite within the presentation:

This statement requires citation [Smith, 2012].

References

John Smith (2012)

Title of the publication

Journal Name 12(3), 45 – 678.

R. Ferlet and C. R. Pennypacker, "The hands-on universe project," in *Organizations and Strategies in Astronomy Volume 6*. Springer Netherlands, 2006, pp. 275–286.

O. S. Observatory, "Welcome to salsa," Website, May 2018. [Online]. Available: https://vale.oso.chalmers.se/salsa/welcome

G. K. Thomas Bensby, *ASTA33 Lab: The rotation curve of the Milky Way*, Lund Observatory, Dec. 2017. [Online]. Available: http://www.astro.lu.se/Education/utb/ASTA33/

H. C. v. d. H. C J Bakker, *Radiogolven uit het wereldruim*. s-Gravenhage : Martinus Nijhoff, 1945.

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