

Week 3 Review

Dark Matter Halo

A dark matter halo is a hypothetical component of a galaxy that envelops the galactic disk and extends well beyond the edge of the visible galaxy. The halo's mass dominates the total mass. Since they consist of dark matter, halos cannot be observed directly, but their existence is inferred through their effects on the motions of stars and gas in galaxies. Dark matter halos play a key role in current models of galaxy formation and evolution.

Redshift

In physics, **redshift** happens when light or other electromagnetic radiation from an object is increased in wavelength, or shifted to the red end of the spectrum. "Redder" means an increase in wavelength – equivalent to a lower frequency and a lower photon energy. A redshift occurs whenever a light source moves away from an observer.

Indirect Detection Experiments

Search for the products of WIMP annihilation or decay. If WIMPs are Majorana particles (WIMPs are their own antiparticle) then two WIMPs could annihilate to produce gamma rays or Standard Model particle-antiparticle pairs. Additionally, if the WIMP is unstable, WIMPs could decay into standard model particles. These processes could be detected indirectly through an excess of gamma rays, antiprotons or positrons emanating from regions of high dark matter density.

Direct detection experiments

Direct detection experiments typically operate in deep underground laboratories to reduce the background from cosmic rays. These include: the Soudan mine; the SNOLAB underground laboratory at Sudbury, Ontario (Canada); the Gran Sasso National Laboratory (Italy); the Canfranc Underground Laboratory (Spain); the Boulby Underground Laboratory (UK); and the Deep Underground Science and Engineering Laboratory, South Dakota (US).

Particle Shower

During the development of an extensive air shower, the secondary particles of each new generation carry less energy per particle than the generation before. The number of particles increases up to the shower maximum, where the energy of the particles becomes too small to produce new particles. The cascade of secondary particles comprises of three different components: the hadronic, the muonic, and the electromagnetic. The hadronic component in extensive air showers is small (1%), but has a large impact on the shower development, as it feeds the other components. In strong interactions, mainly pions are generated and with smaller cross sections also kaons, protons and neutrons. The charged pions perform most likely further hadronic interactions, whereas the neutral pions decay with high probability into two photons.

What is ROOT?

ROOT is a general purpose graphing program that takes root files in and outputs root files or plots (eps, gif, png, etc). It is based in C++ and is available for Mac OS X, Linux and Microsoft Windows.

What is Pyroot?

Pyroot is the Python wrapper around ROOT. A student can choose to learn ROOT/C++, pyroot, or both. Perhaps those students who are intimidated by C++ will find that python suits them better. Or perhaps they'll become horribly confused. Or perhaps they'll collapse from muscle strain, since the tutorial is now over 80 pages long.

Who created ROOT?

CERN. The official ROOT page is:

<http://root.cern.ch/drupal/>

How can I learn ROOT?

Yearly updated ROOT Tutorials from Bill Seligman, Columbia University:

<http://www.nevis.columbia.edu/~seligman/root-class/>

Comments from Dr. Seligman:

Once a year, at Nevis, I give an all-day hands-on tutorial on the Nevis computer systems and on ROOT to the REU students (and anyone else at Nevis who's interested). I assume that these students have little or no experience with ROOT, UNIX, C++, histograms, or statistics (I have a separate page with references to these topics). My goal is to enable them to make histograms from n-tuples that other people create for them.

If you're programming for the first time, then it will probably take you more than a half day per part. Someone with years of prior experience in ROOT and C++ might barely get through all five parts in two days.

The lessons have time estimates at the top. These are only rough estimates. Don't be concerned about time. The important thing is for you to learn something, not to punch a time clock.

UNIX Command Line:

UNIX is an operating system originally developed by AT&T. Remote Access is provided to the UNIX hosts via an ether-net network, and **SSH** software connects the local computer to the UNIX hosts. Every user has a unique username. When they logon to the system, they are placed in a HOME directory, which is a portion of the disk space reserved just for them. UNIX systems are case sensitive. Nearly all command names and most of their command line switches will be in lowercase.

Logging into UNIX:

Follow the appropriate instructions for your system to access our Unix servers. The tool needed to log into our unix login server is called The Secure Shell or "SSH" for short. The dollar sign prompt (or a

prompt ending with a dollar sign) means that UNIX is now ready to interpret and execute your commands as typed in from your keyboard.

SSH Software

SSH stands for secure shell, which is a category, not a unique program. It is a reliable, safe way to connect remotely to servers, computers, and other devices. SSH offers a reliable and easy way for IT professionals to connect remotely to computers, which dramatically reduces the amount of traveling needed. IT professionals can diagnose and repair connectivity problems through SSH connections. Files can also be transferred, and SSH is popularly used for this purpose as well. File transfers are usually conducted through SSH file transfer, or SFTP. File transfers can also be conducted through the secure copy protocol, or SCP.

To a casual computer user, the typical SSH client might look confusing. To IT professionals, however, this type of client is easy to use. To make this type of connection, a reliable SSH program or client is needed. Once an SSH program has been downloaded and installed, a user can enter the IP address of the machine to which he/she wants to connect and go from there. UNIX®-like operating systems usually have these programs built-in, but Windows® operating systems do not.

Once a connection is established through SSH, commands can be executed through the command line interface (CLI). The CLI was the primary means of interaction with most computer systems until the introduction of the video display terminal in the mid-1960s, and continued to be used throughout the 1970s and 1980s on Unix systems and personal computer systems including MS-DOS, CP/M and Apple DOS.

Command Line Interface (CLI)

The interface is usually implemented with a command line shell, which is a program that accepts commands as text input and converts commands to appropriate operating system functions.

Shell

In computing, a shell is a user interface for access to an operating system's services. A shell hides the details of the underlying operating system and manages the technical details of the operating system kernel interface, which is the lowest-level, or "inner-most" component of most operating systems. The UNIX system at MSU uses the Bourne Again Shell (bash)

Bourne Again Shell (bash)

Bash is a Unix shell written by Brian Fox for the GNU Project as a free software replacement for the Bourne shell (sh). Released in 1989,[5] it has been distributed widely as the shell for the GNU operating system and as a default shell on Linux and Mac OS X.

Emacs

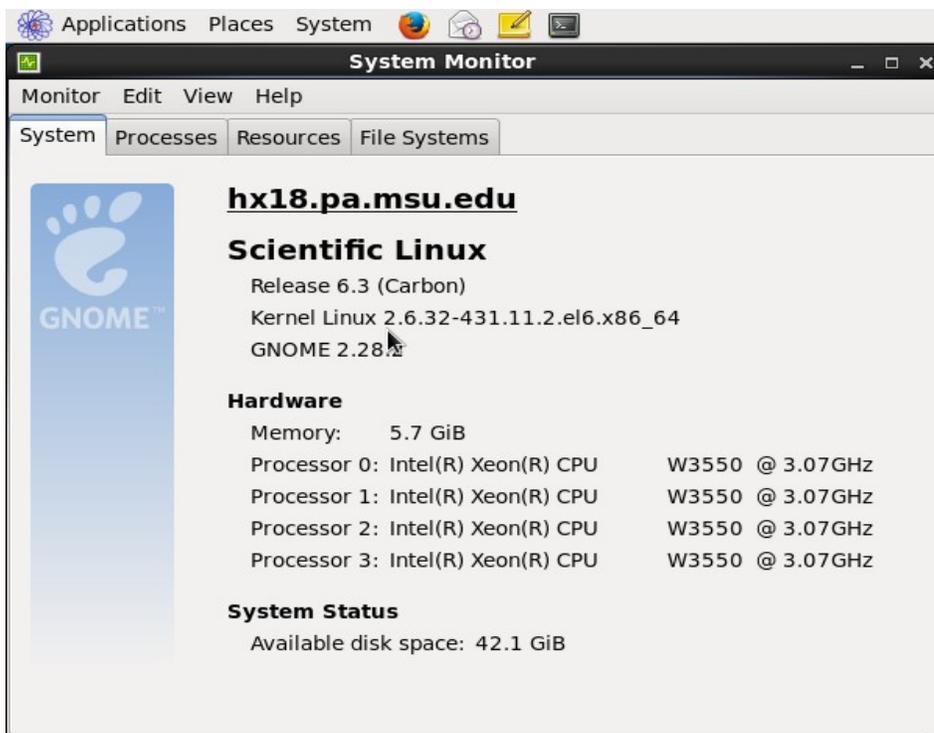
A text editor, similar to notepad. Unix and Unix-like operating systems have the vi editor (or a variant), but many also include the Emacs editor. Editor war is the common name for the rivalry between users of the Vi (Vim) and Emacs text editors. The rivalry has become a lasting part of hacker culture and the free software community.

Gedit

A general purpose text editor?? The features of gedit include multilanguage spellchecking via Enchant and a flexible plugin system allowing the addition of new features, for example snippets and integration with external applications including a Python or Bash terminal. Gedit is default under GNOME, where notepad is default under Microsoft windows.

GNOME

Desktop environment (symbol is the footprint) which is composed entirely of free and open-source software and targets to be cross-platform, i.e. run on multiple operating systems, its main focus being those based on the Linux kernel. GNOME is developed by ,The GNOME Project which comprises both volunteers and paid contributors. GNOME is part of the GNU Project. Initial release 1999. MSU system uses GNOME.



GNU Project

The GNU Project is a free software, mass collaboration project, announced on 27 September 1983, by Richard Stallman at MIT. Its aim is to give computer users freedom and control in their use of their computers and computing devices, by collaboratively developing and providing software that is based on the following freedom rights: users are free to run the software, share it (copy, distribute), study it and modify it. Its design is based on that of Unix; however, in contrast to Unix which was proprietary software, GNU was to be freedom-respecting software (free software) that users can use, share, study and modify. Development was initiated in January, 1984. The goal of making a completely free software operating system was achieved in 1992 when the third-party Linux kernel was released as free software, under version 2 of the GNU General Public License, to be used with the GNU software stack.