

# 1.1 Orientation

## VIDEO LECTURE

- Orientation<sup>1</sup> (47:18)

## POST-LECTURE READING 1.1

- *Astronomy Today*, 8<sup>th</sup> Edition (Chaisson & McMillan)
- *Astronomy Today*, 7<sup>th</sup> Edition (Chaisson & McMillan)
- *Astronomy Today*, 6<sup>th</sup> Edition (Chaisson & McMillan)

## SUPPLEMENTARY NOTES

### Units Review

#### Standard Units and Conversions

- Length

Unit	Abbreviation
meter	m

- Mass

Unit	Abbreviation
gram	g

- Time

Unit	Abbreviation	Conversion
1 year	yr	365.24 days
1 day		24 hours
1 hour	hr	60 minutes
1 minute	min	60 seconds
1 second	sec or s	

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<sup>1</sup><http://youtu.be/KtJdCgs1Dkk>

- Angle

Unit	Abbreviation/Symbol	Conversion
1 circle		360 degrees
1 degree	deg or °	60 arcminutes
1 arcminute	arcmin or ′	60 arcseconds
1 arcsecond	arcsec or ″	

### Standard Prefixes

Prefix	Symbol	Definition	Scientific Notation
nano	n	0.000000001	$10^{-9}$
micro	μ – Greek letter “mu”	0.000001	$10^{-6}$
milli	m	0.001	$10^{-3}$
centi	c	0.01	$10^{-2}$
kilo	k	1,000	$10^3$
Mega	M	1,000,000	$10^6$
Giga	G	1,000,000,000	$10^9$

- Example: 1 centimeter (or cm) = 0.01 meters (or  $10^{-2}$  m)
- Example: 1 kilogram (or kg) = 1,000 grams (or  $10^3$  g)
- Note: Micrometers (or μm) are also called microns.

## Unit Conversion

Example: How many nm in 1 km?

- Long answer:

$$\begin{aligned}1 \text{ km} &= 1 \text{ km} \times 1 \times 1 \\&= 1 \text{ km} \times \left(\frac{10^3 \text{ m}}{1 \text{ km}}\right) \times \left(\frac{10^9 \text{ nm}}{1 \text{ m}}\right) \\&= 1 \text{ km} \times \left(\frac{10^3 \cancel{\text{m}}}{1 \cancel{\text{km}}}\right) \times \left(\frac{10^9 \text{ nm}}{1 \cancel{\text{m}}}\right) \\&= 1 \times 10^3 \times 10^9 \text{ nm} \\&= 10^{12} \text{ nm}\end{aligned}$$

- Short answer:

$$\begin{aligned}1 \text{ km} &= 1 \cancel{\text{km}} \times \left(\frac{10^3 \cancel{\text{m}}}{1 \cancel{\text{km}}}\right) \times \left(\frac{10^9 \text{ nm}}{1 \cancel{\text{m}}}\right) \\&= 10^{12} \text{ nm}\end{aligned}$$

- Bracket notation:

$$\frac{1 \cancel{\text{km}} \mid 10^3 \cancel{\text{m}} \mid 10^9 \text{ nm}}{1 \cancel{\text{km}} \mid 1 \cancel{\text{m}}} = 10^{12} \text{ nm}$$

Example: How many sec in 1 yr?

- Long answer:

$$\begin{aligned}
 1 \text{ yr} &= 1 \text{ yr} \times 1 \times 1 \times 1 \times 1 \\
 &= 1 \text{ yr} \times \left( \frac{365.24 \text{ day}}{1 \text{ yr}} \right) \times \left( \frac{24 \text{ hr}}{1 \text{ day}} \right) \times \left( \frac{60 \text{ min}}{1 \text{ hr}} \right) \times \left( \frac{60 \text{ sec}}{1 \text{ min}} \right) \\
 &= 1 \text{ yr} \times \left( \frac{365.24 \text{ day}}{1 \text{ yr}} \right) \times \left( \frac{24 \text{ hr}}{1 \text{ day}} \right) \times \left( \frac{60 \text{ min}}{1 \text{ hr}} \right) \times \left( \frac{60 \text{ sec}}{1 \text{ min}} \right) \\
 &= 1 \times 365.24 \times 24 \times 60 \times 60 \text{ sec} \\
 &= 31,556,736 \text{ sec}
 \end{aligned}$$

- Short answer:

$$\begin{aligned}
 1 \text{ yr} &= 1 \text{ yr} \times \left( \frac{365.24 \text{ day}}{1 \text{ yr}} \right) \times \left( \frac{24 \text{ hr}}{1 \text{ day}} \right) \times \left( \frac{60 \text{ min}}{1 \text{ hr}} \right) \times \left( \frac{60 \text{ sec}}{1 \text{ min}} \right) \\
 &= 31,556,736 \text{ sec}
 \end{aligned}$$

- Bracket notation:

$$\frac{1 \text{ yr}}{1 \text{ yr}} \left| \frac{365.24 \text{ day}}{1 \text{ yr}} \right| \left| \frac{24 \text{ hr}}{1 \text{ day}} \right| \left| \frac{60 \text{ min}}{24 \text{ hr}} \right| \left| \frac{60 \text{ sec}}{60 \text{ min}} \right| = 31,556,736 \text{ sec}$$

- Note: 31,556,736 happens to be approximately  $\pi \times 10^7$ , which is how I remember approximately how many seconds are in a year.

Example: How many arcsec in 1 deg?

- Long answer:

$$\begin{aligned}1 \text{ deg} &= 1 \text{ deg} \times 1 \times 1 \\&= 1 \text{ deg} \times \left( \frac{60 \text{ arcmin}}{1 \text{ deg}} \right) \times \left( \frac{60 \text{ arcsec}}{1 \text{ arcmin}} \right) \\&= 1 \text{ deg} \times \left( \frac{60 \text{ arcmin}}{1 \text{ deg}} \right) \times \left( \frac{60 \text{ arcsec}}{1 \text{ arcmin}} \right) \\&= 1 \times 60 \times 60 \text{ arcsec} \\&= 3,600 \text{ arcsec}\end{aligned}$$

- Short answer:

$$\begin{aligned}1 \text{ deg} &= 1 \text{ deg} \times \left( \frac{60 \text{ arcmin}}{1 \text{ deg}} \right) \times \left( \frac{60 \text{ arcsec}}{1 \text{ arcmin}} \right) \\&= 3,600 \text{ arcsec}\end{aligned}$$

- Bracket notation:

$$\frac{1 \text{ deg} \mid 60 \text{ arcmin} \mid 60 \text{ arcsec}}{1 \text{ deg} \mid 1 \text{ arcmin}} = 3,600 \text{ arcsec}$$

- Bracket notation with symbol units:

$$\frac{1^\circ \mid 60' \mid 60''}{1^\circ \mid 1'}$$

## LAB LINK

Material presented in this unit is related to material presented in Lab 1 of *Astronomy 101 Laboratory: Our Place in Space*<sup>2</sup>.

In *Lab 1: Introduction to Skynet*, we:

- Observe astronomical objects with the PROMPT telescopes at the Cerro Tololo Inter-American Observatory in the Chilean Andes and with other telescopes around the world in the Skynet Robotic Telescope Network.
- Adjust the brightness and contrast levels of astronomical images to better view detail in them.
- Measure angles between and across objects in your images.
- Identify objects in your images that are moving through that part of the sky.

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<sup>2</sup><http://skynet.unc.edu/introastro/ourplaceinspace/>

## Video Lab Summaries

- Introduction to Skynet<sup>3</sup> (36:26)
- Morehead Observatory<sup>4</sup> (14:24)
- Remote Operations Room<sup>5</sup> (11:43)
- PROMPT Telescope<sup>6</sup> (5:25)
- Introduction to Afterglow<sup>7</sup> (27:41)

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<sup>3</sup><http://youtu.be/80NfVZkHsQ4>

<sup>4</sup><http://youtu.be/TSHNtCaF3AY>

<sup>5</sup><http://youtu.be/KLZAjjM0x2U>

<sup>6</sup><http://youtu.be/rBwZdKqFGLo>

<sup>7</sup><http://youtu.be/hf-1zVytcuI>