

TESS Transit light curve

Supachai Awiphan

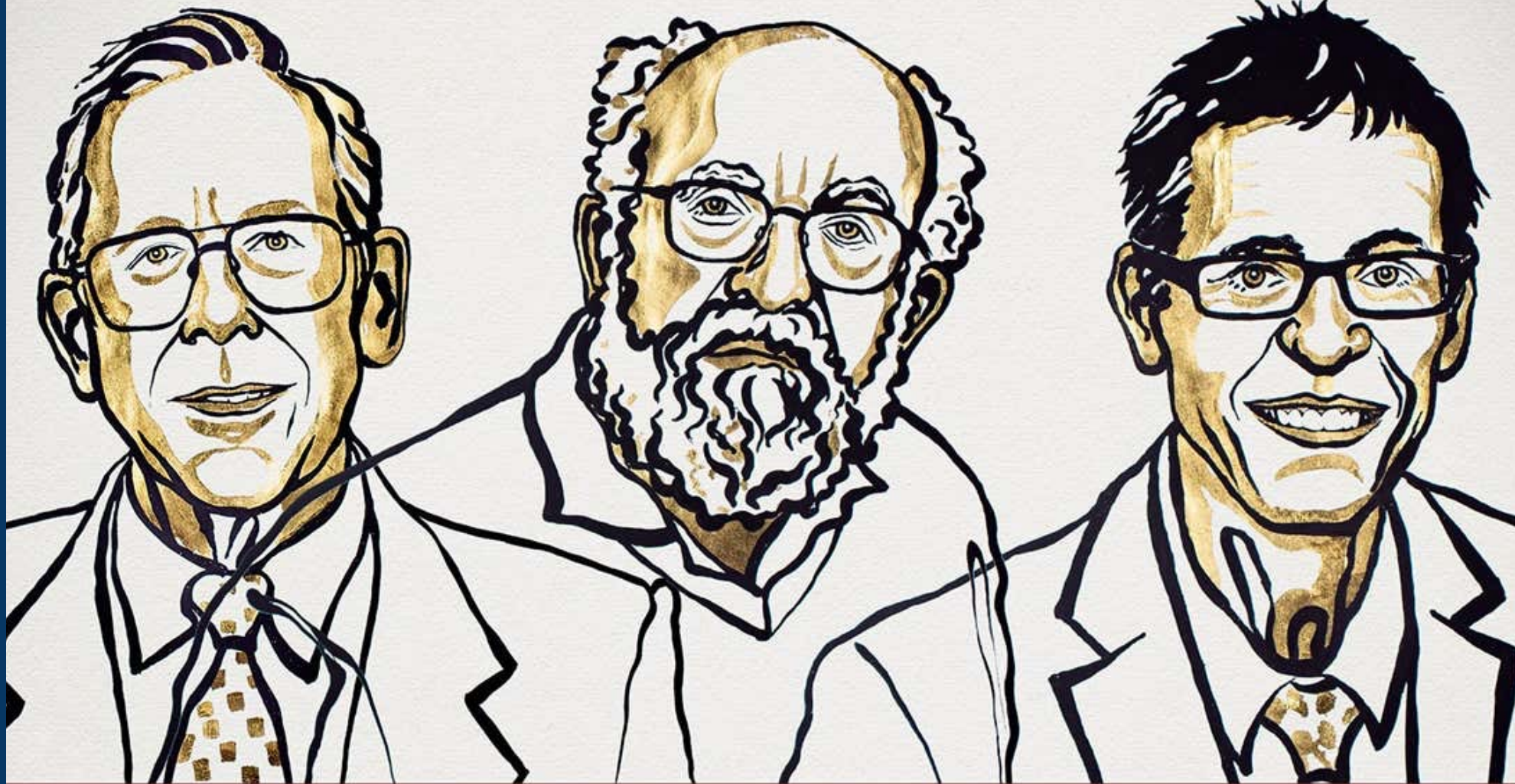
NATIONAL ASTRONOMICAL RESEARCH
INSTITUTE OF THAILAND







NOBEL
PRIZES
IN
PHYSICS
2019



James
Peebles

Michel
Mayor

Didier
Queloz

You are
6,022 light-years
from Earth

Milky Way Galaxy

3,652 solar systems | 4,877 confirmed planets

o Sun

FILTER



Planet
Type



Missions



Observatory

Current filter: All Planet Types

Telescope Bearing
↔ 336.55°NW
↑ 49.39°

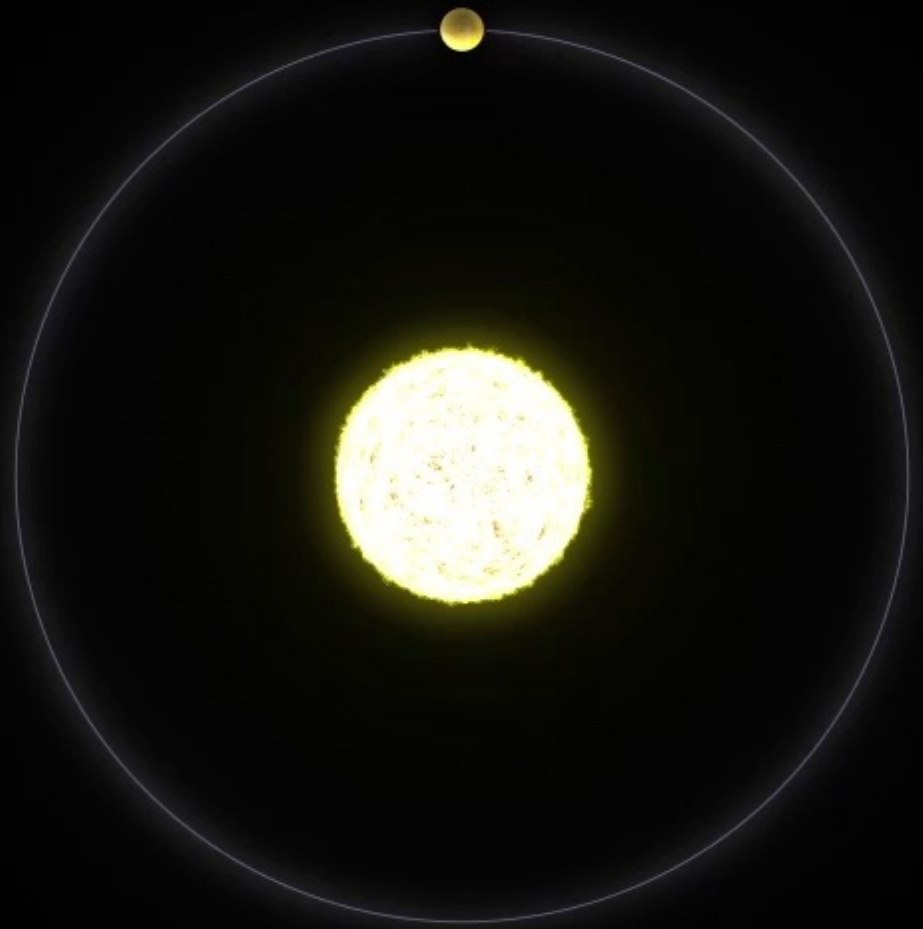
Taguig, Metro Manila, Philippines

CHANGE LOCATION



LIGHT

TIME



TESS

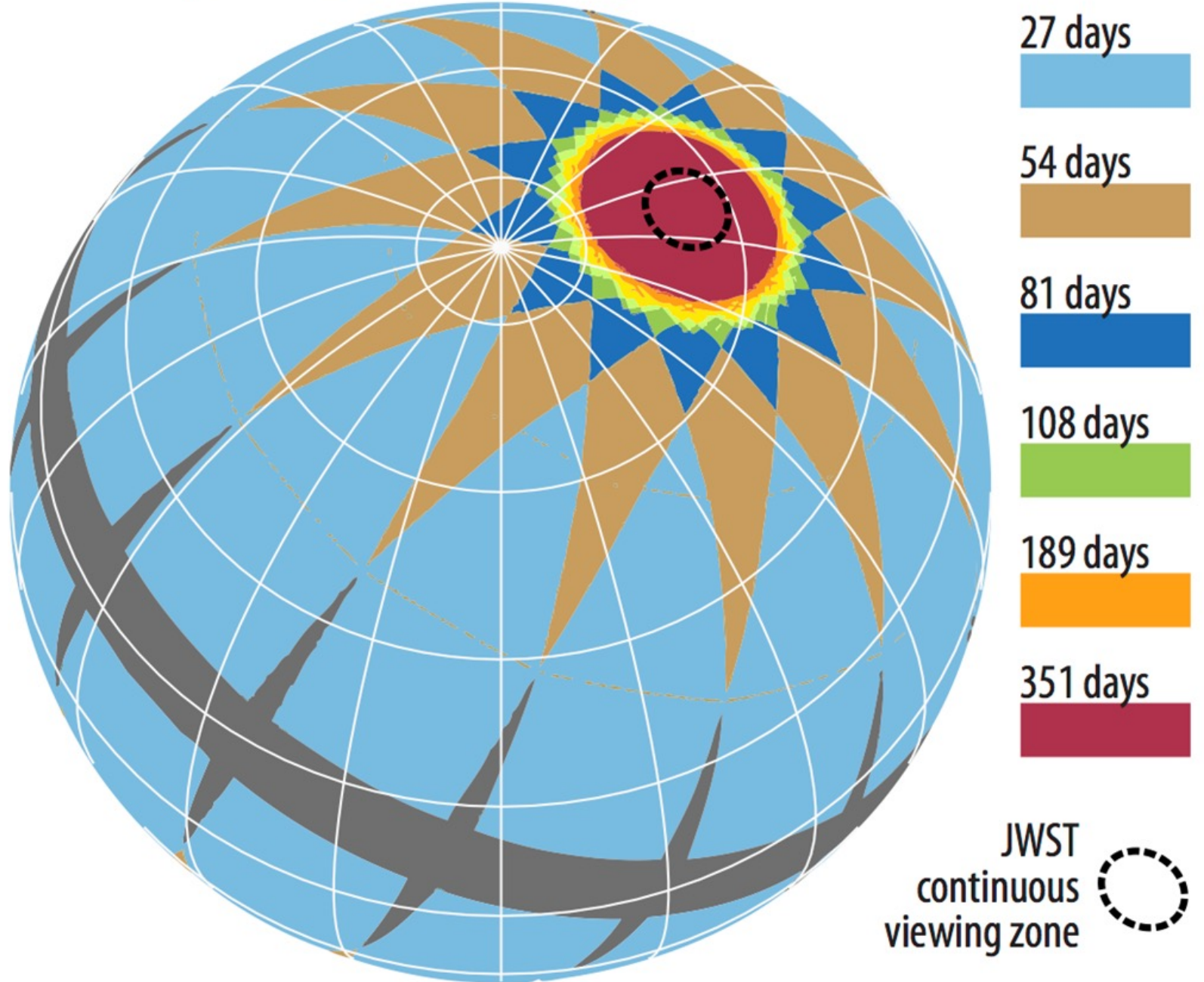
TRANSITING
EXOPLANET
SURVEY
SATELITE



TESS

TRANSITING
EXOPLANET
SURVEY
SATELITE

TESS 2-year sky coverage map



JWST
continuous
viewing zone



TESS

TRANSITING EXOPLANET SURVEY SATELITE

TESS has four identical cameras.

- Each has a 24×24 degree field of view
- They are aligned to cover 24×90 degree strips of the sky called “sectors.”
- Each camera has four 2k x 2k CCDs with a pixel scale of 21 arcseconds per pixel.
- The detectors are sensitive from 600-1000nm (blue to the near-IR).

Every sector, the TESS spacecraft will downlink about 200,000 two-minute cadence postage stamps, as well as full frame images binned on board at a 30-minute cadence.

The team has prepared the TESS Input Catalog (TIC) of over 1 billion objects, with a special subset Candidate Target List (CTL) of 200,000 objects for the two-minute cadence observations.

MAGNITUDE, POSITION and TIME

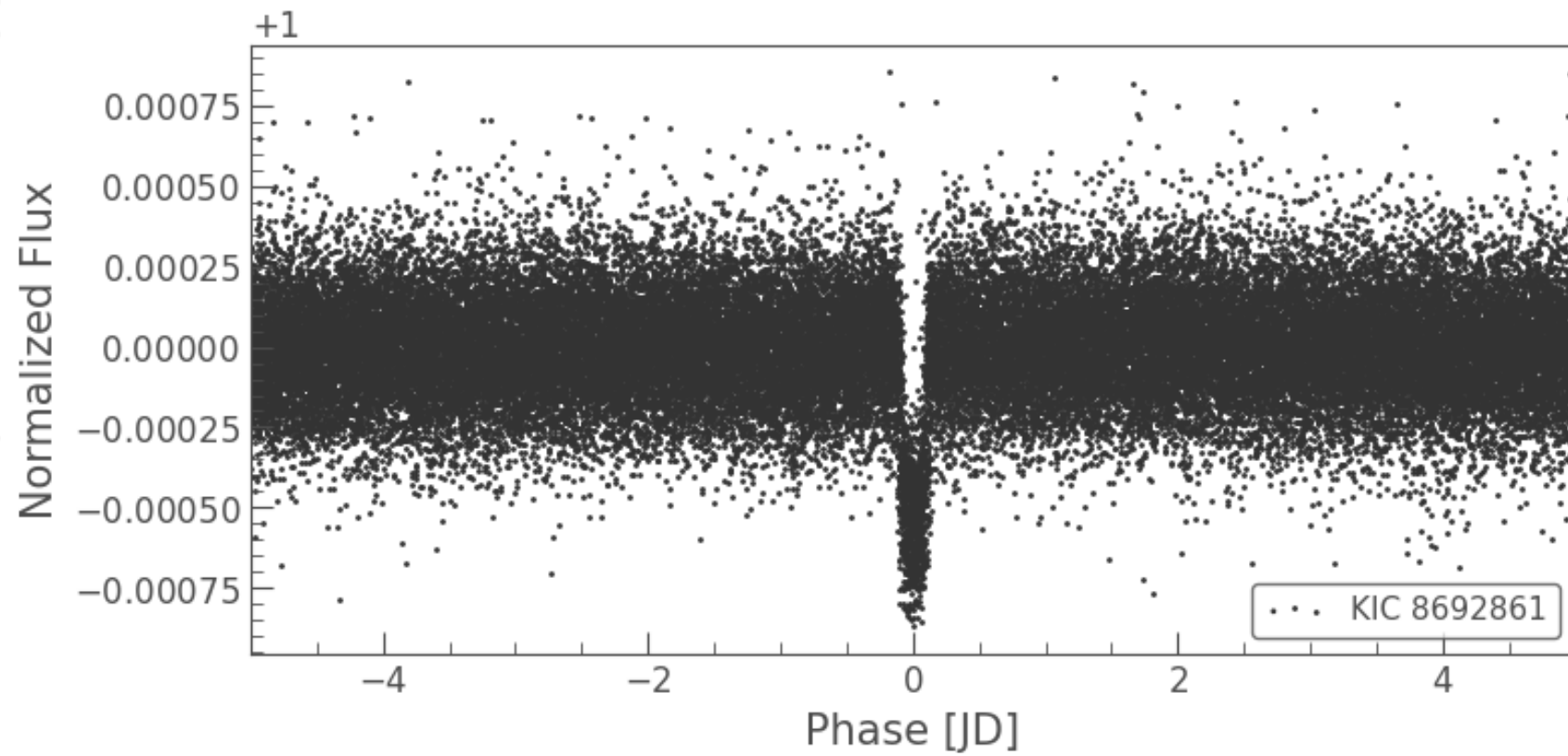


- Magnitude

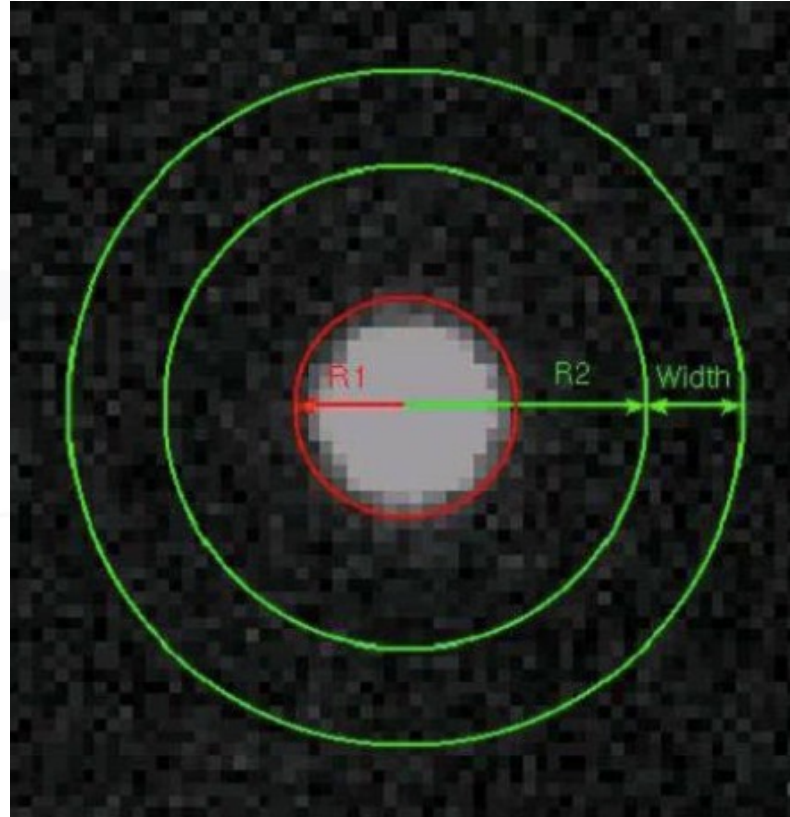
$$m_1 - m_2 = -2.5 \log \frac{I_1}{I_2}$$

- Position (RA, Dec)
- Time
 - Local time
 - Coordinated Universal Time: UTC
 - Julian Date: JD
 - Heliocentric Julian Date: HJD
 - Barycentric Julian Date: BJD

LIGHT CURVE



APERTURE PHOTOMETRY



- R_1 Star radius
- R_2 Inner sky radius
- Width Sky background width

$$Signal_{star} = Signal_{in R_1} - \overline{Signal_{in width}} \times \frac{A_{in R_1}}{A_{in width}}$$

APERTURE PHOTOMETRY

$$f(x) = \frac{1}{\sqrt{2\pi\sigma^2}} e^{-\frac{(x-\mu)^2}{2\sigma^2}}$$

$$FWHM = 2\sigma\sqrt{2\ln 2} \approx 2.35\sigma$$

- Two dimensional Gaussian function

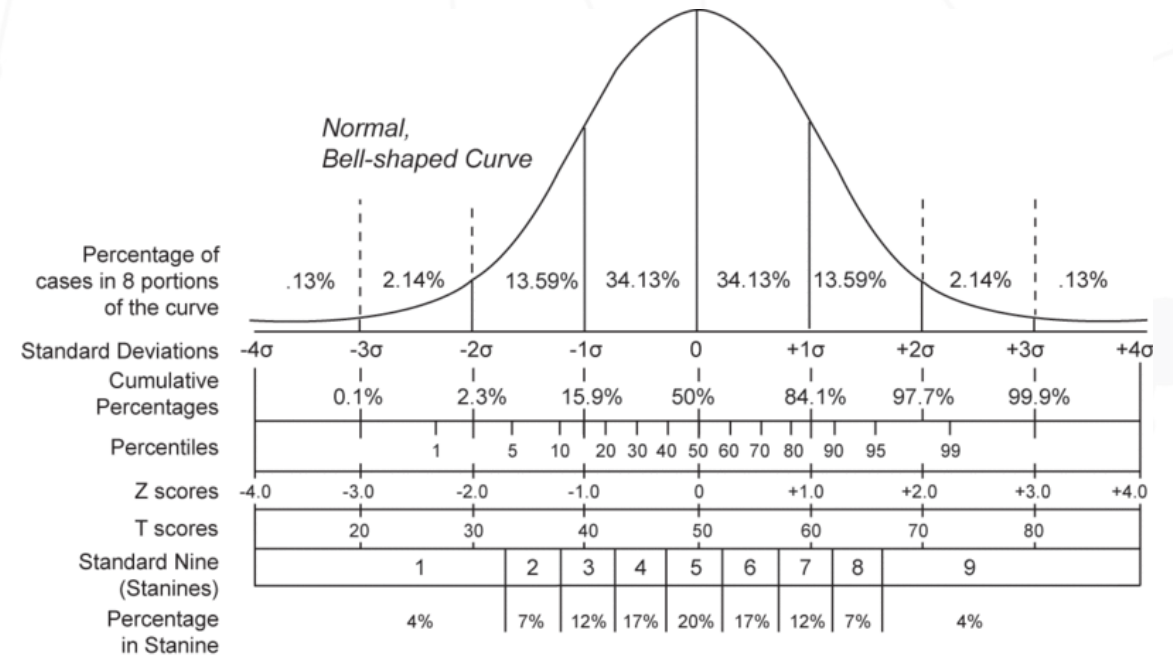
$$f(x, y) = \frac{1}{2\pi\sigma_x^2\sigma_y^2} e^{-\frac{x^2}{2\sigma_x^2}} e^{-\frac{y^2}{2\sigma_y^2}}$$

$$e^{-\frac{r^2}{2\sigma^2}} \Big|_0^\sigma = 0.3935$$

$$e^{-\frac{r^2}{2\sigma^2}} \Big|_0^{2\sigma} = 0.8647$$

$$e^{-\frac{r^2}{2\sigma^2}} \Big|_0^{4\sigma} = 0.9889$$

$$e^{-\frac{r^2}{2\sigma^2}} \Big|_0^{5\sigma} = 0.999996$$



Credit: <http://exoplanet.as.arizona.edu>

GOOGLE COLAB



<https://cmu.to/uEHWB>

A screenshot of a Google Colab notebook interface. The notebook is titled "TESS.ipynb" and has a menu bar with options: File, Edit, View, Insert, Runtime, Tools, Help, and "All changes saved". A file menu is open, showing options like "Locate in Drive", "Open in playground mode", "New notebook", "Open notebook", "Upload notebook", "Rename", "Move", "Move to trash", "Save a copy in Drive", "Save a copy as a GitHub Gist", "Save a copy in GitHub", "Save", "Save and pin revision", "Revision history", "Download", and "Print". Below the menu, there are three code cells. The first cell contains a comment "#Select TESS Sector 02 2018 SPOC exp 120 s" and a variable "search_result[1]". The second cell is titled "Download data" and contains the same comment and a line of code "search_result_data = search_result[1]". The third cell is titled "#Download TESS Sector 02 2018 SPOC exp 120 s" and contains a line of code "10 = search_result_data.download()".