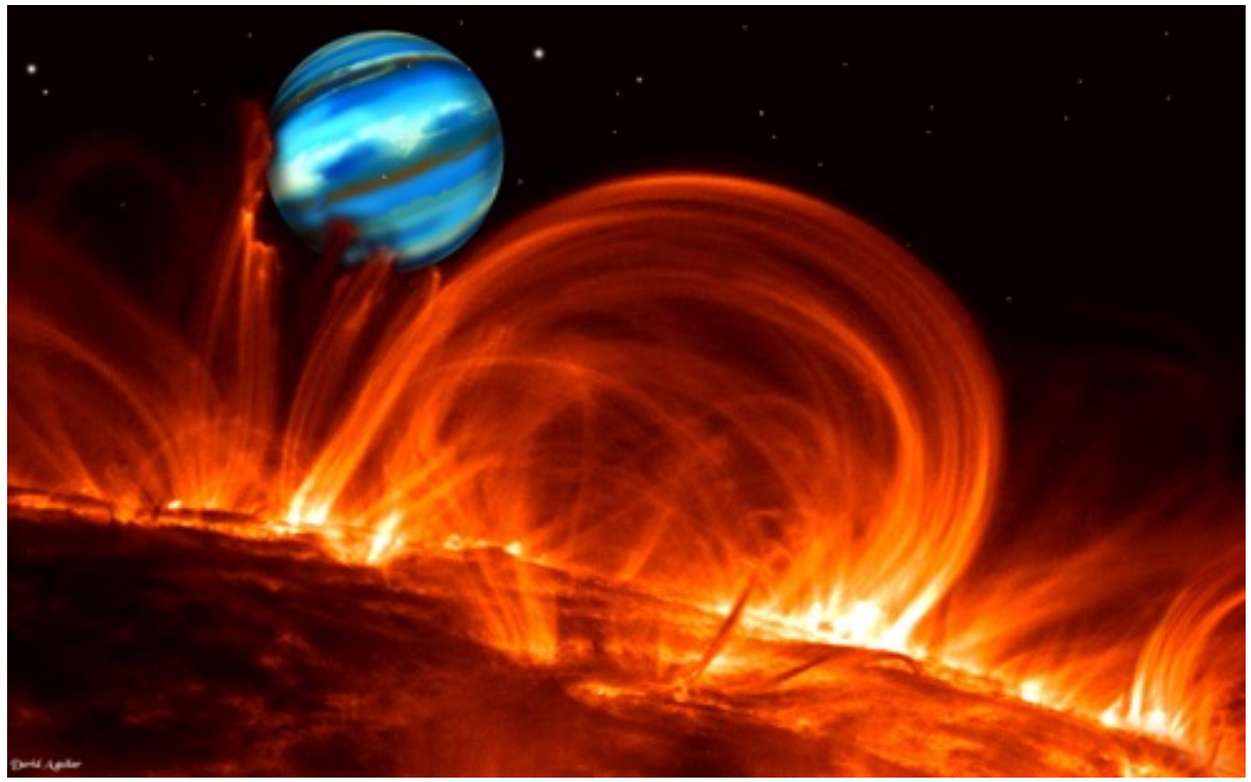
MACHINE LEARNING WORKSHOP UTSC

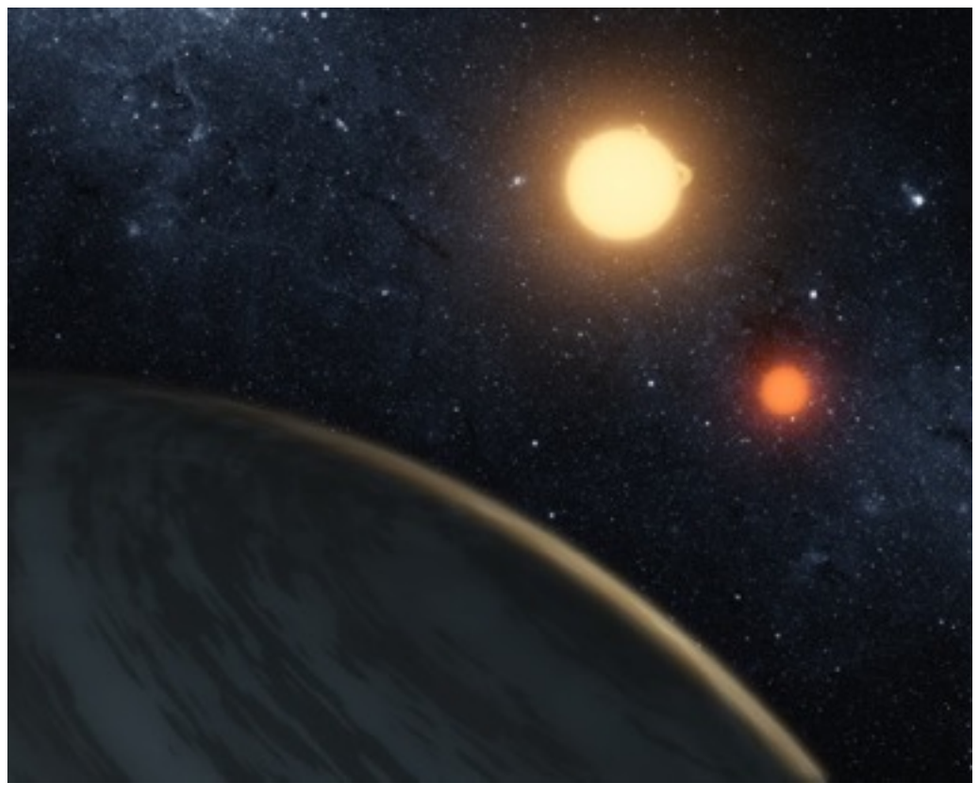
AUTOMETIC SELECTION OF TRANSIT SIGNALS

PLANETS AROUND OTHER STARS



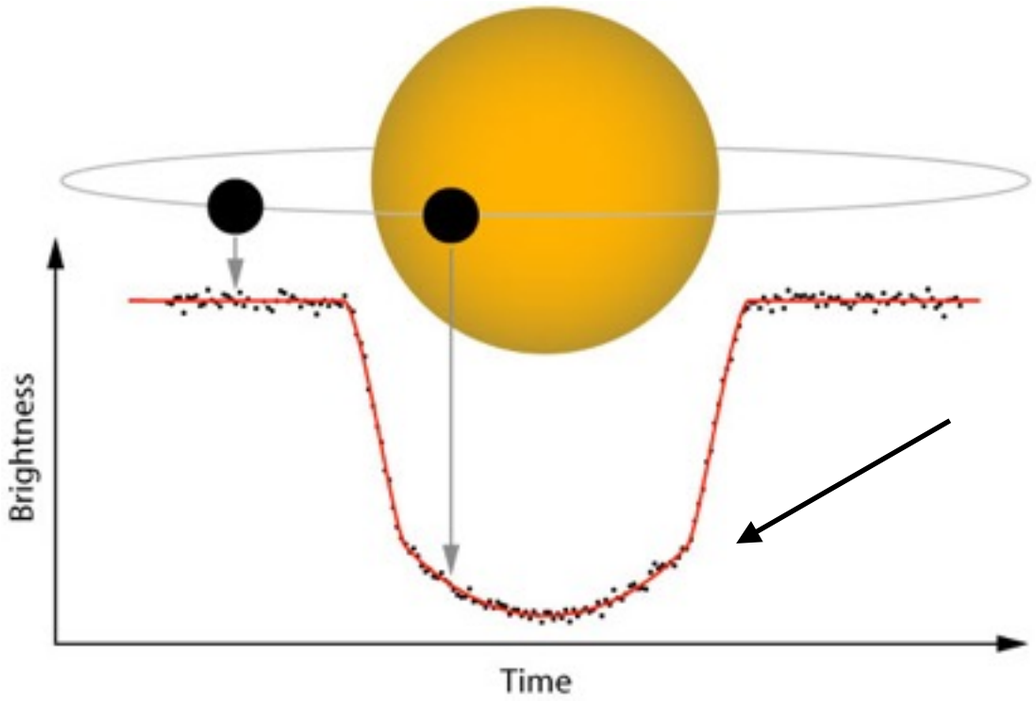
Credit: http://www.cfa.harvard.edu/pao/wallpaper.htm

KOI-500 – the most packed multi-systems
Credit: Ian Steadman



Kepler-16b circumbinary planet
Credit: NASA/JPL-Caltech/T.Pyle

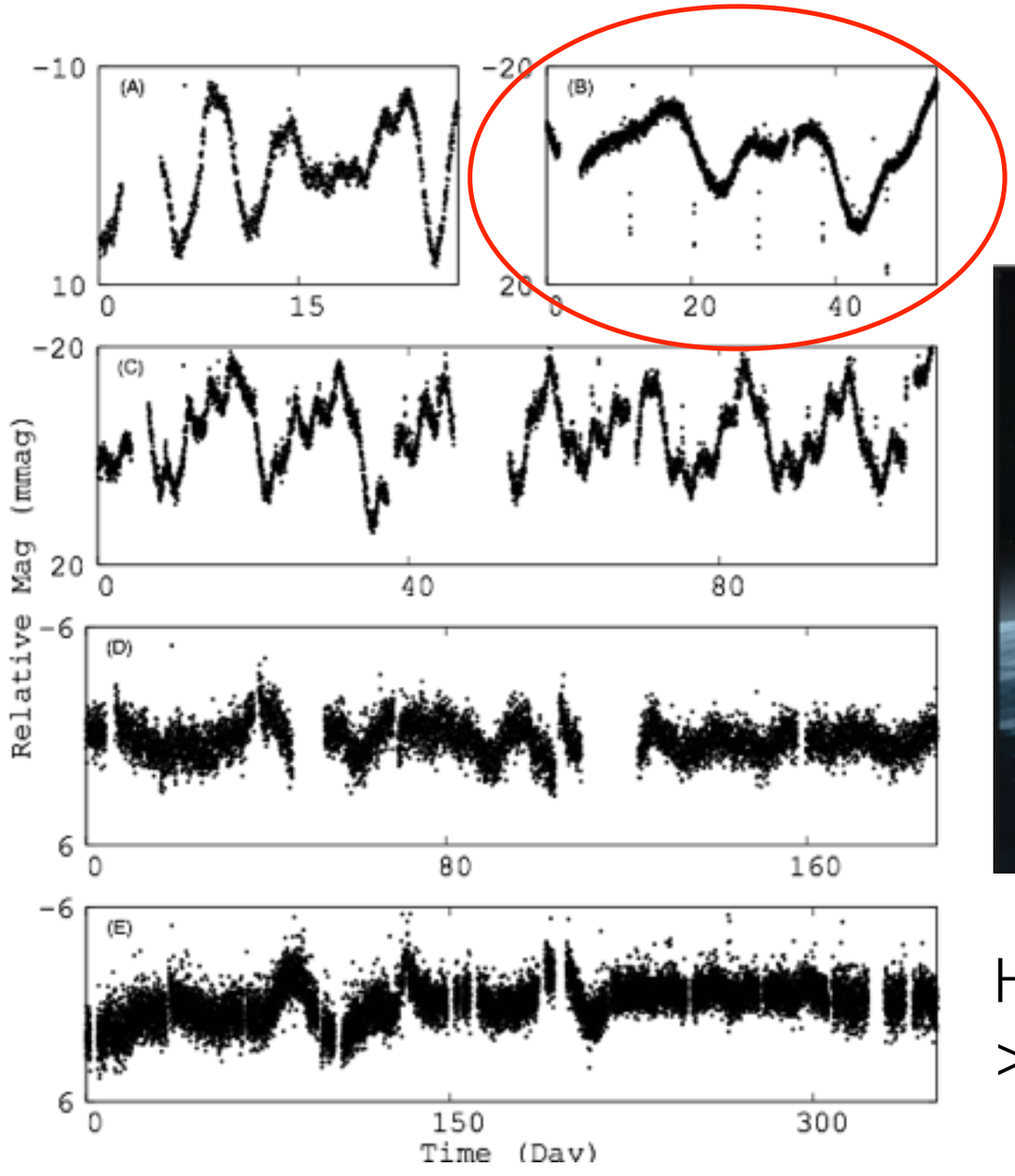
WE CAN FIND EXOPLANETS USING THEIR TRANSIT



Need to identify
this shape in the measurement
of the brightness of the stars

The transit signal of earth is tiny: 1 in 1,0000

THIS CAN BE DONE BY EYE

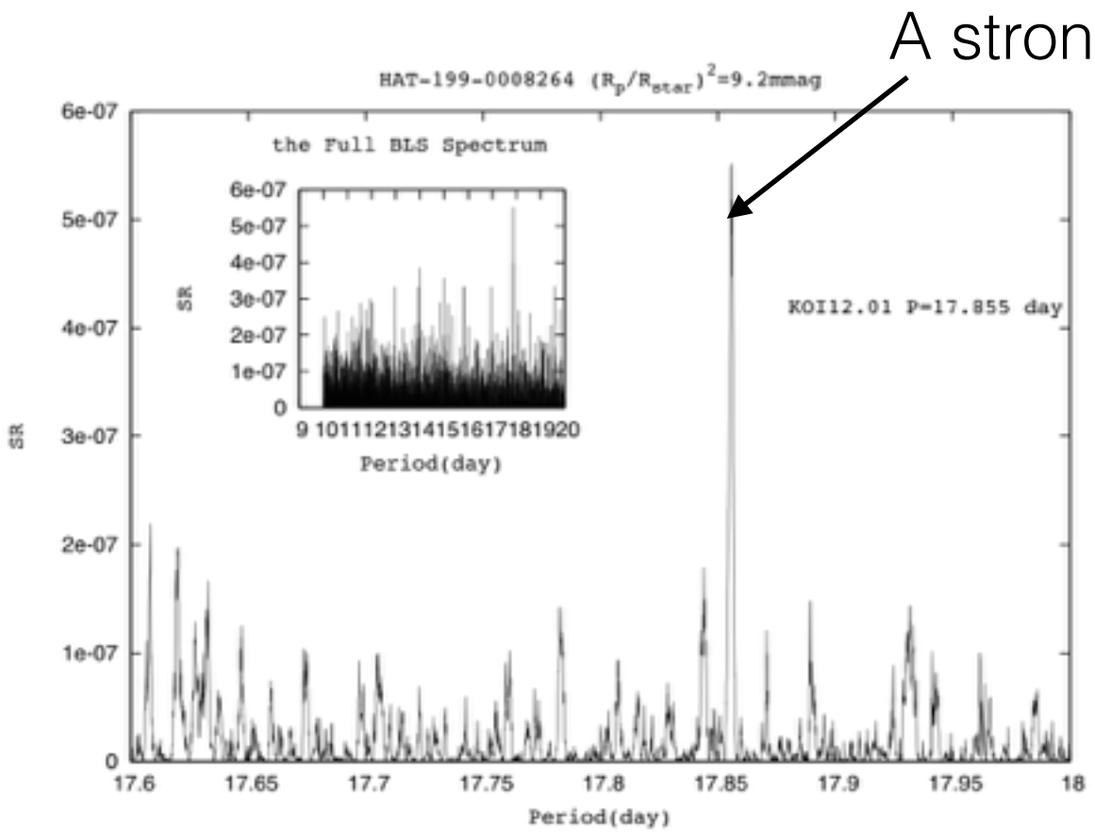


For more details:

However, for per star field
>100,000of stars needed to be examined.

MORE SOPHISTICATED ALGORITHMS CAN BE USED

For example, only the signals show peaks in a periodic spectrum get examined.



However, >1000 stars needed to be examine by eye to ensure the detection is real.

We would like to avoid the human process…

Since it is:

- not repeatable,
- not optimized for interesting events (earth like targets).
- hard to uncover the detection bias

What about teach the machines to do it?

This is a standard classification problem.

In Fact, Efforts has been carried out before

The Kepler team,
found ~4000 planetary candidates,
designed their first Robotic planets search pipeline after four years of operation.

The problem is far from been explored to its fullest.

Image credit: Wikimedia

A better implementation will come handy for the next Big Exoplanet Mission

The **Transit Exoplanet Survey Satellite**
will search the entire sky
for ~20,000 exoplanets:
>1,000,000 bright stars
>100,000,000 total targets

WHAT'S THE AIM OF THE PROJECT

- Step 1: Build up a frame work for transiting planetary candidate selection.
- Step 2: Improve on the previous result making use of what we learnt.
- Main Question: what to optimize?

READING MATERIALS

- http://arxiv.org/pdf/1408.1496v2.pdf
- http://arxiv.org/pdf/1512.06149v1.pdf
- Exoplanet handbook by Michael Perryman, Section 6, 6.1, 6.2.1, 6.2.5, 6.2.7, 6.4.1
- http://www.planethunters.org