Freedom in Spectroscopy

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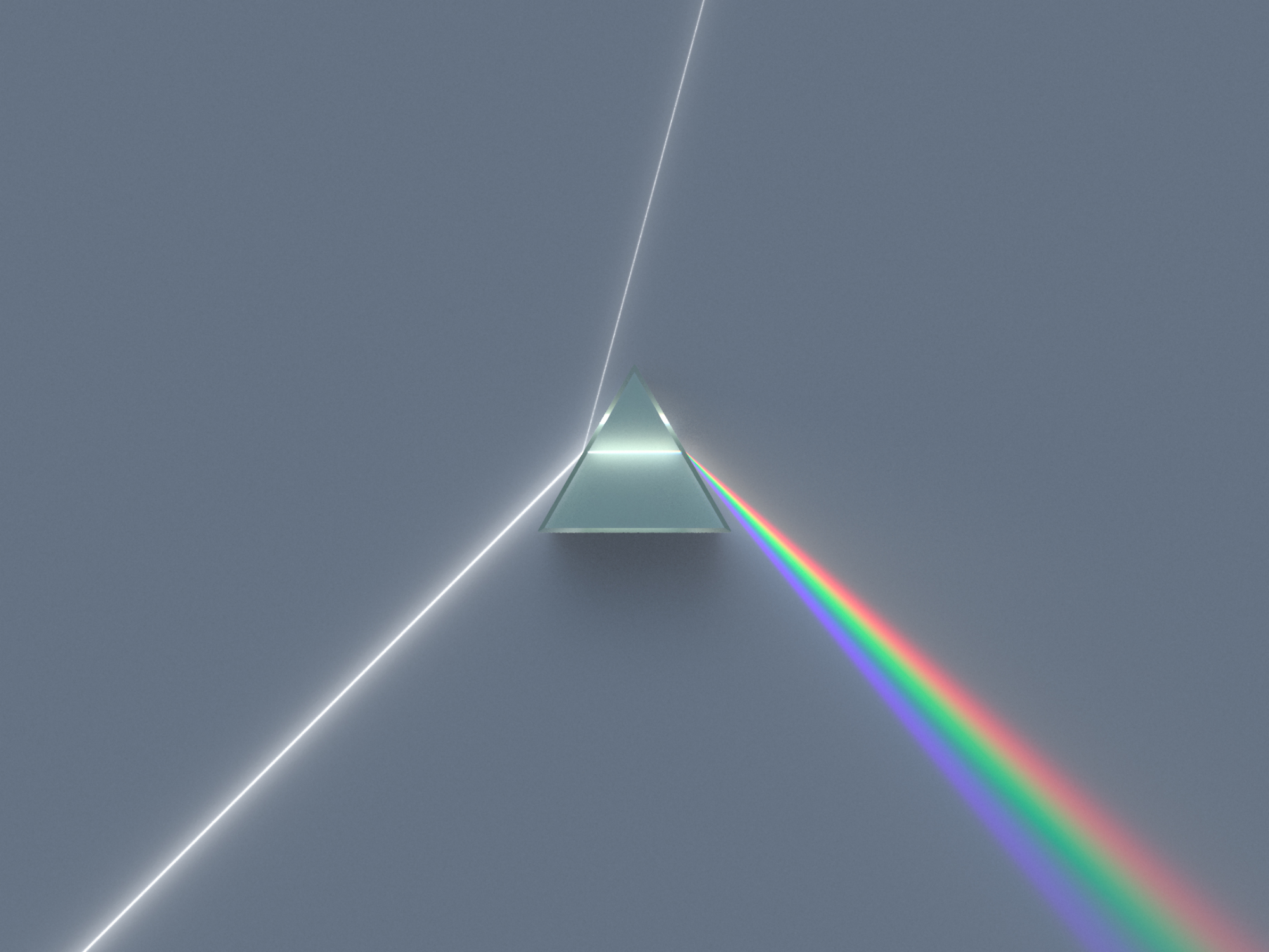
Overview

License

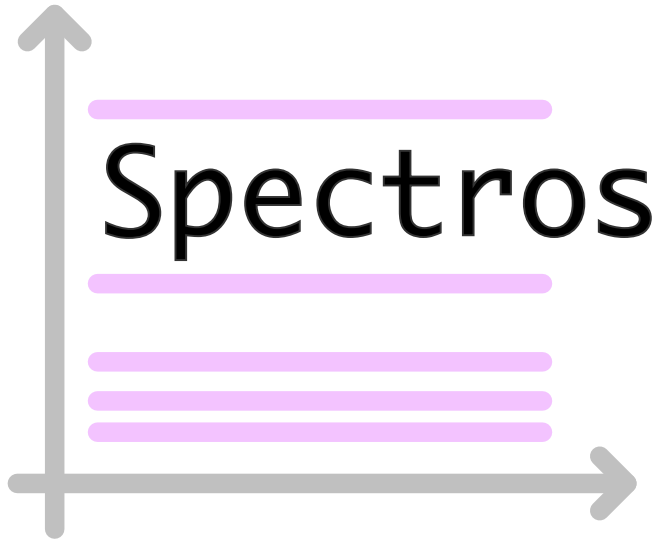
Let’s Start …

if you want to find the secrets of the universe, think in terms of energy, frequency and vibration

- Nikola Tesla



$E=h\nu$



$c=\nu\lambda$

What is Spectroscopy ?

Study of Interaction between Matter & Electromagnetic Radiation

- - - - - -

Measurement of Radation Intensity as a function of Wavelength

Resonance

- - - - - -

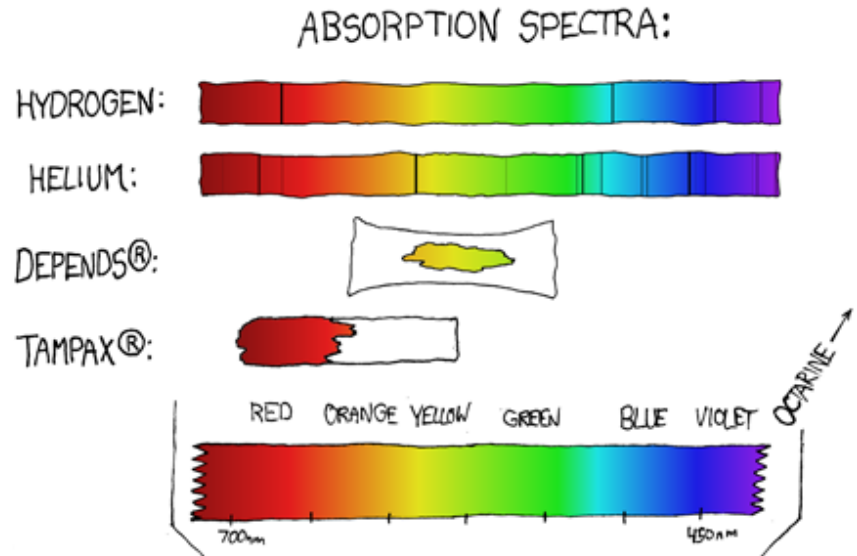
Resonant Frequency

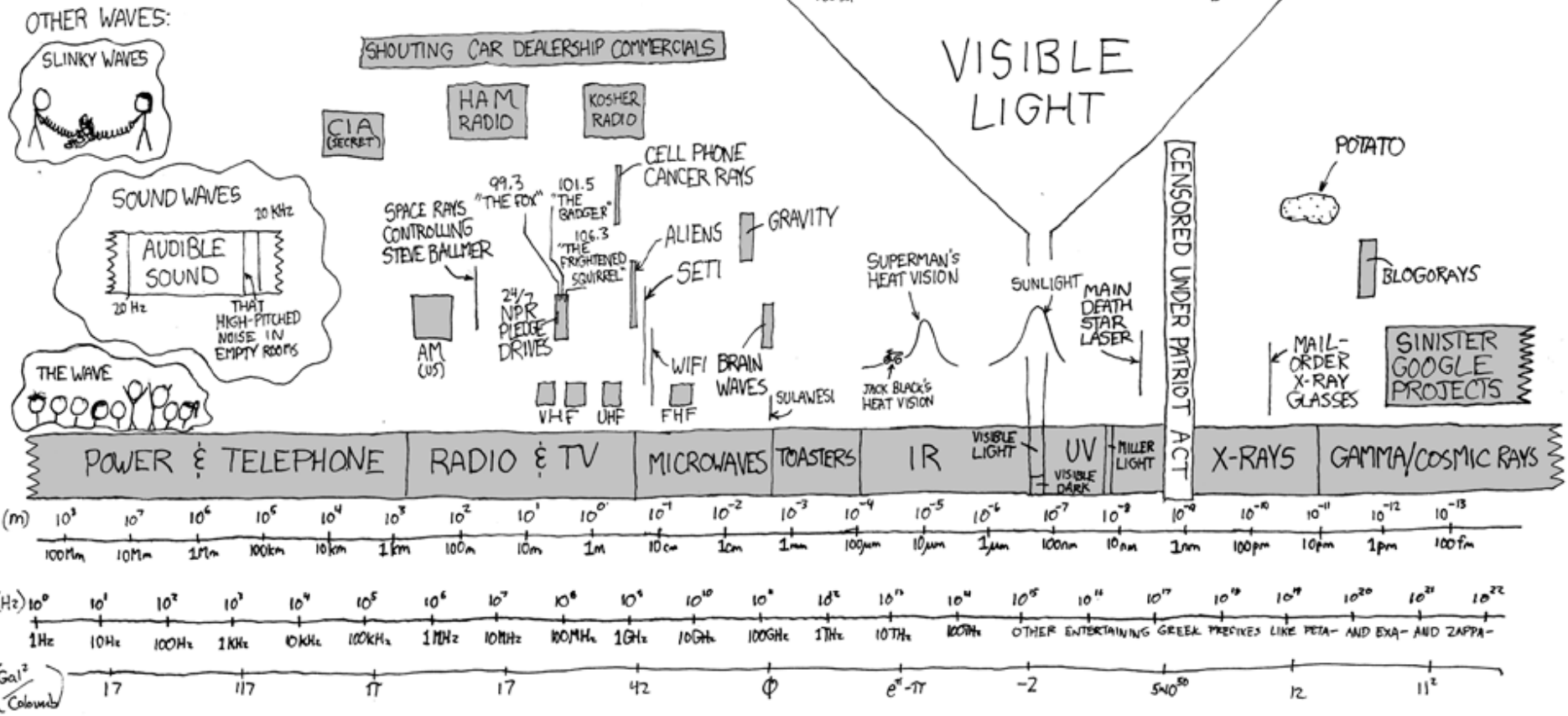
- - - - - -

Spectrum $\equiv$ Collection of Resonant Frequencies

THE ELECTROMAGNETIC SPECTRUM

THESE WAVES TRAVEL THROUGH THE ELECTROMAGNETIC FIELD. THEY WERE FORMERLY CARRIED BY THE AETHER, WHICH WAS DECOMMISSIONED IN 1897 DUE TO BUDGET CUTS.





It is the fundamental part of Nature

$\equiv$

Air, Water, Soil

Types

Depends on:

- *What part of Spectrum (Energy) one is looking at ?*
  - Radio - VLF, LF, HF, VHF, UHF, MW
  - Infrared - Thermal, FIR, MIR, NIR
  - Visible
  - Ultraviolet
  - Ionizing - X rays, Gamma rays
  - ...
- *How much Excitation Energy used ?*
  - Translational Spectroscopy
  - Rotational Spectroscopy
  - Vibrational Spectroscopy
  - Electronic Spectroscopy
  - ...

Types ...

Depends on:

- *What Interaction theory used for study ?*
  - Acoustic
  - Emission
  - Absorption
  - Atomic Mass
  - Molecular
  - Infrared
  - Raman
  - Flourescence
  - Impedance
  - ...

Types ...

Depends on:

- *How one sees & uses it ?*
  - For Communication
  - For Exploratory Analysis
  - For Testing
  - ...
- *What technology used for Measurement ?*
  - Fourier Transform
  - Acousto-Optics
  - Electro-Optics
  - Nuclear Magnetic Resonance
  - ...

Applications

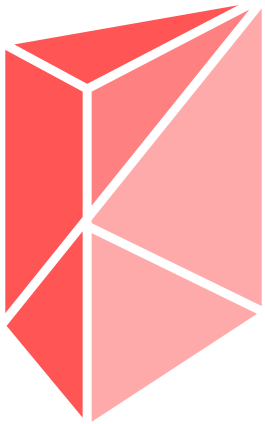
Used primarily in:

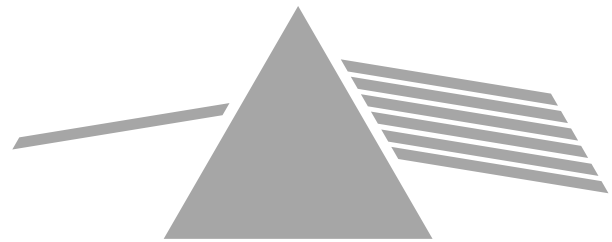
- Material Identification
- Food Inspection (True Fingerprint Id.)
- Drug Inspection (True Fingerprint Id.)
- Remote Sensing
- Space Probes
- ...

Can be coupled with:

- Microscopy
- Telescopy
- Astronomy
- LIDAR
- ...

Spectrophotometer





What is a Spectrophotometer ?

An Instrument that:

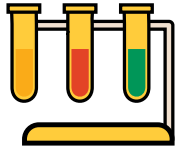
- Helps study the ***Interaction*** between Energy and Matter.
- ***Measures*** Radiation Intensity during such ***Interaction***.
- ***Analyze*** collected Spectrum within the Bandwidth.
- ***Identify species*** of the material under test.

What does a Spectrophotometer Constitutes of ?

1

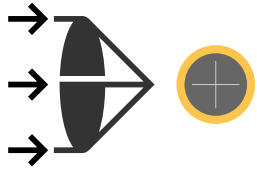
Excitation Source

2



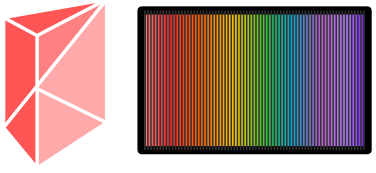
Sample Placement

3



Collimation

4



Dispersion or Diffraction

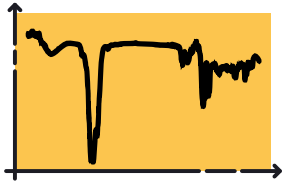
5.a

Electronic Detection

5.b

Manual Observation

6.a

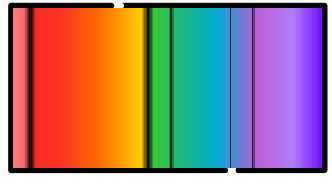


Measured Spectrum

7

8

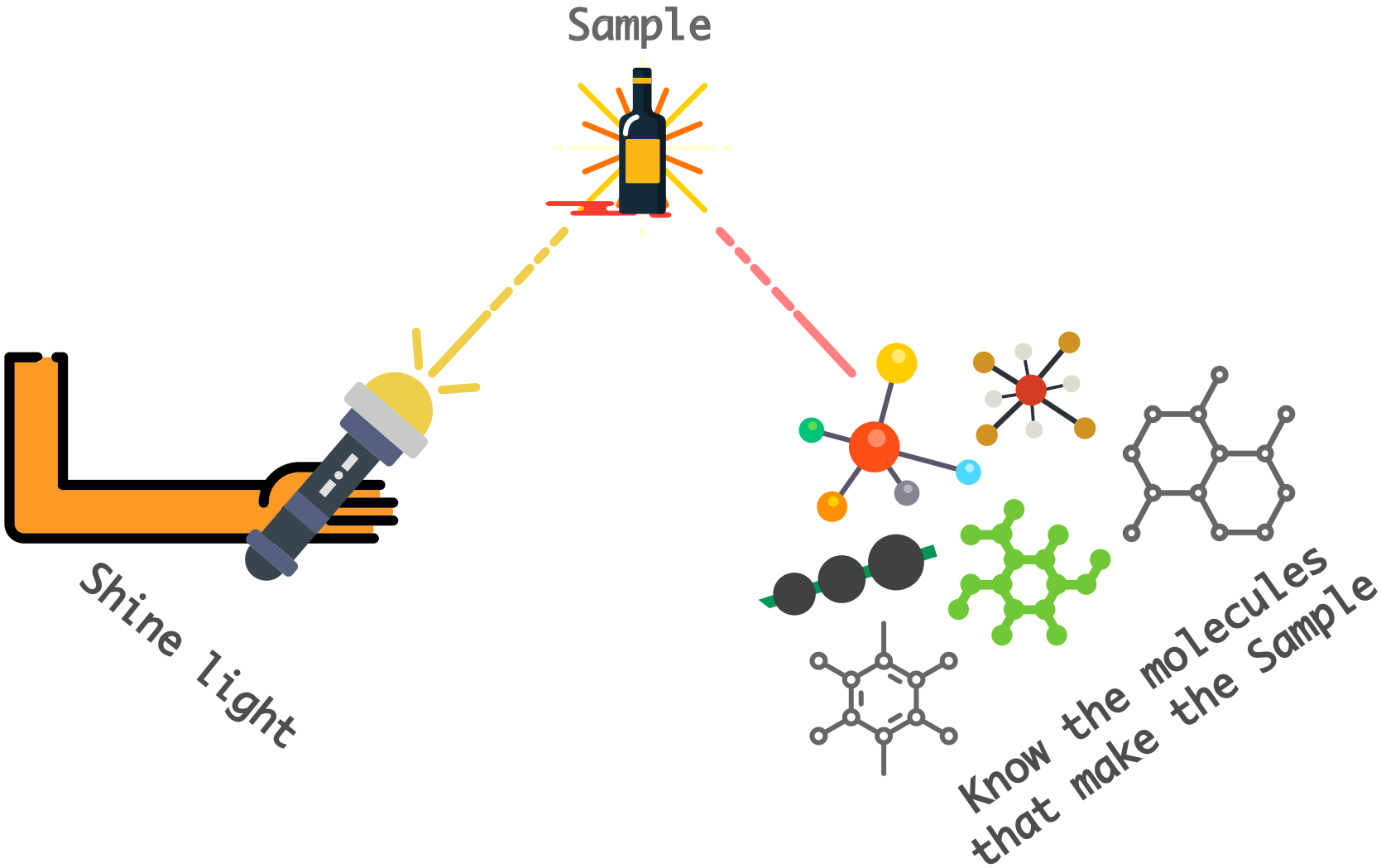
6.b



Observed Spectrum

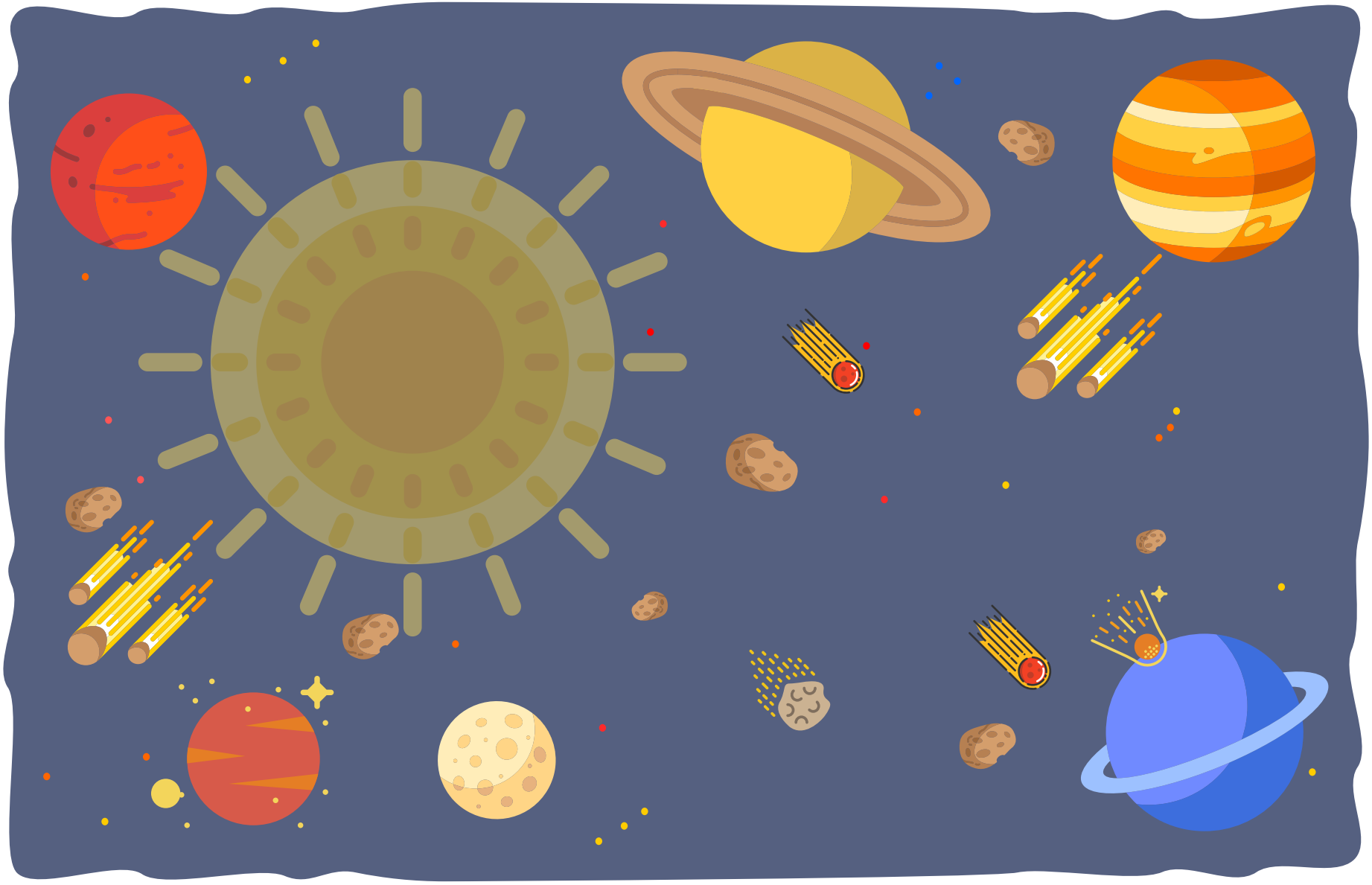
Pal... ! Common make it Simple !...

Ok ! Le me Try :)



So What ???

Some of us interested to know what's in these ... TRULY ! & REALLY



Are you interested in knowing what's there & what they made of ?

Necessity

We Humans always tend to damage Systems, learn from it & again attempt to repair it !

- Don't u want to know the truth ?
- Every instrument at some point of time is a DIY triumph of someone ! Its time to make it open !
- Is it not the right time to make Scientific Instruments Democratic ?
- Is it not the time to make Education more fun through Discovery ?
- Is it not the time to practice Collaboration based Peer Production (***CBPP***) principles ?
- I do want to know what is my food ? without believing the data provided by somebody else !
- Be the inspector yourself ! (***end to end inspection*** is never before democratized)
- Now i can stamp my food with its true nutritional value, which others can verify !
- With ***e2e inspection***, no need of "monitoring" establishments :p

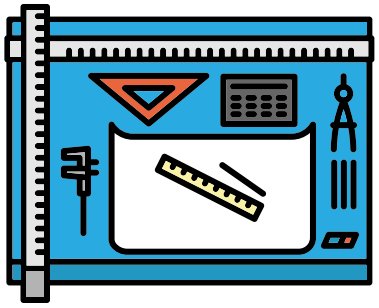
Freeing :)

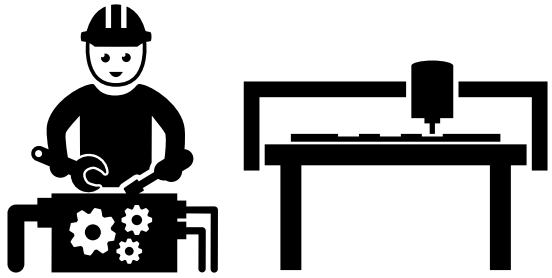
- As open community with collaborative practice
- Using Free Software based CAD/CAE tool for design
- Using Free Hardware designs & tools to make
- Using Free Software OS, libraries to create firmware, software stacks
- Using Free Database stack
- Using Free Data Analysis tools (discipline specific)
- Using Free UX design stacks
- Using Distributed architecture for Sharing Data, Analytics

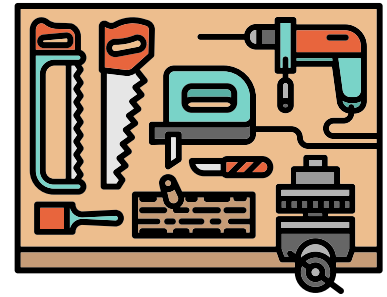
Participation

What kind of guys do we need for Co-operative + Collaborative participation ?

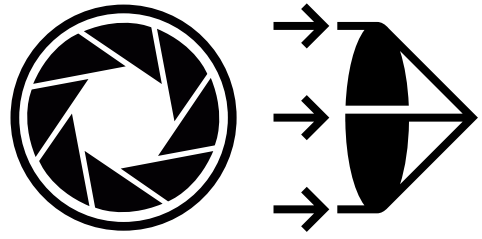
- Mechanical
- Optics
- Electrical
- Electronics
- Software
- Data Sharing & Distribution
- Chemoinformatics(Chemometrics)
- Bioinformatics
- Data Analytics
- Pattern Recoginition & Matching
- Machine Learning



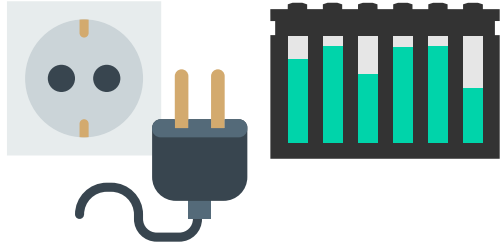




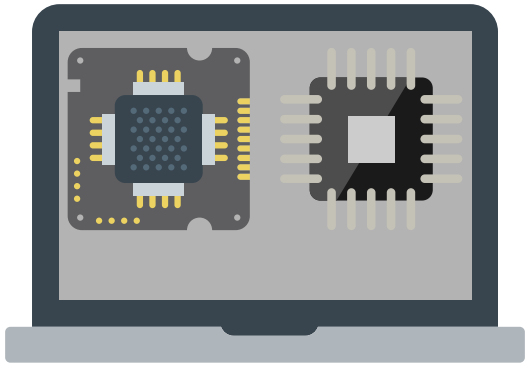
Mechanical - Design & Construction



Optical - Design & Construction

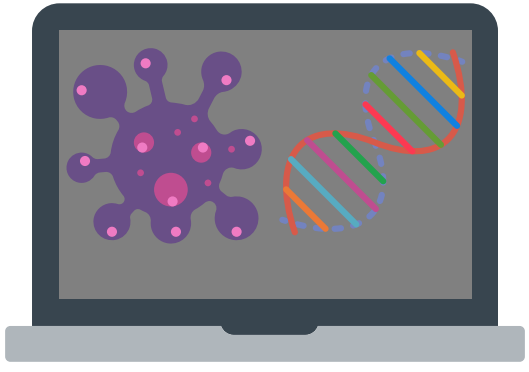


Electrical - Power conditioning

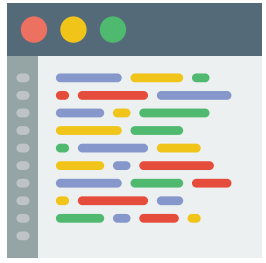
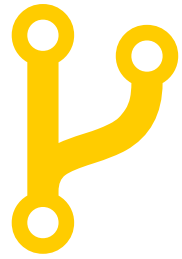
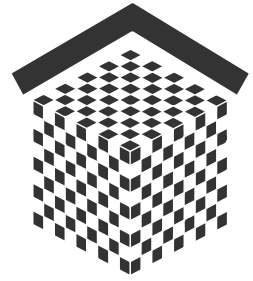
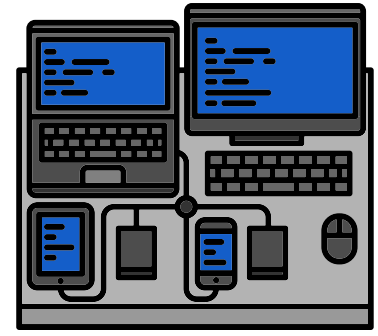


Electronics - Design, Fabrication

Chemoinformatics - Data Analysis
Pattern Matching
Machine Learning

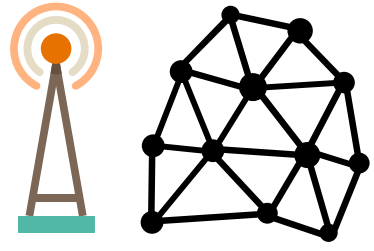


Bioinformatics - Data Analysis
Pattern Matching
Machine Learning

Software - Algo. Dev., UX Design

Data Analytics



Distributed - Data Sharing, Network Systems

Construction

Construction !

Construction depends on Architecture that deals with

Energy & Material interaction in best possible ways.

It contributes to:

- Selection of Components that influence the energy flow
- Geometry to guide the energy flow between the components
- Sensitivity & Resolution of the instrument
- Repeatability, Accuracy & Precision of the measurement
- Specify the Efficiency of the instrument

Sweet corner for Makers, Hardware hackers, Designers, Architects ... ! **:)**

Where to Start ?

- Usage Scenario
- Application based on Scenario
- Spectral Bandwidth based on Application
- Interaction mechanism based on Application
- Geometry based on Interaction
- Components based on Geometry, Interaction mechanism

Want to know ?

What I did so far ?

Scavenging for packages

Purchase the "factory" food you are interested in

or

Free load your friends purchase

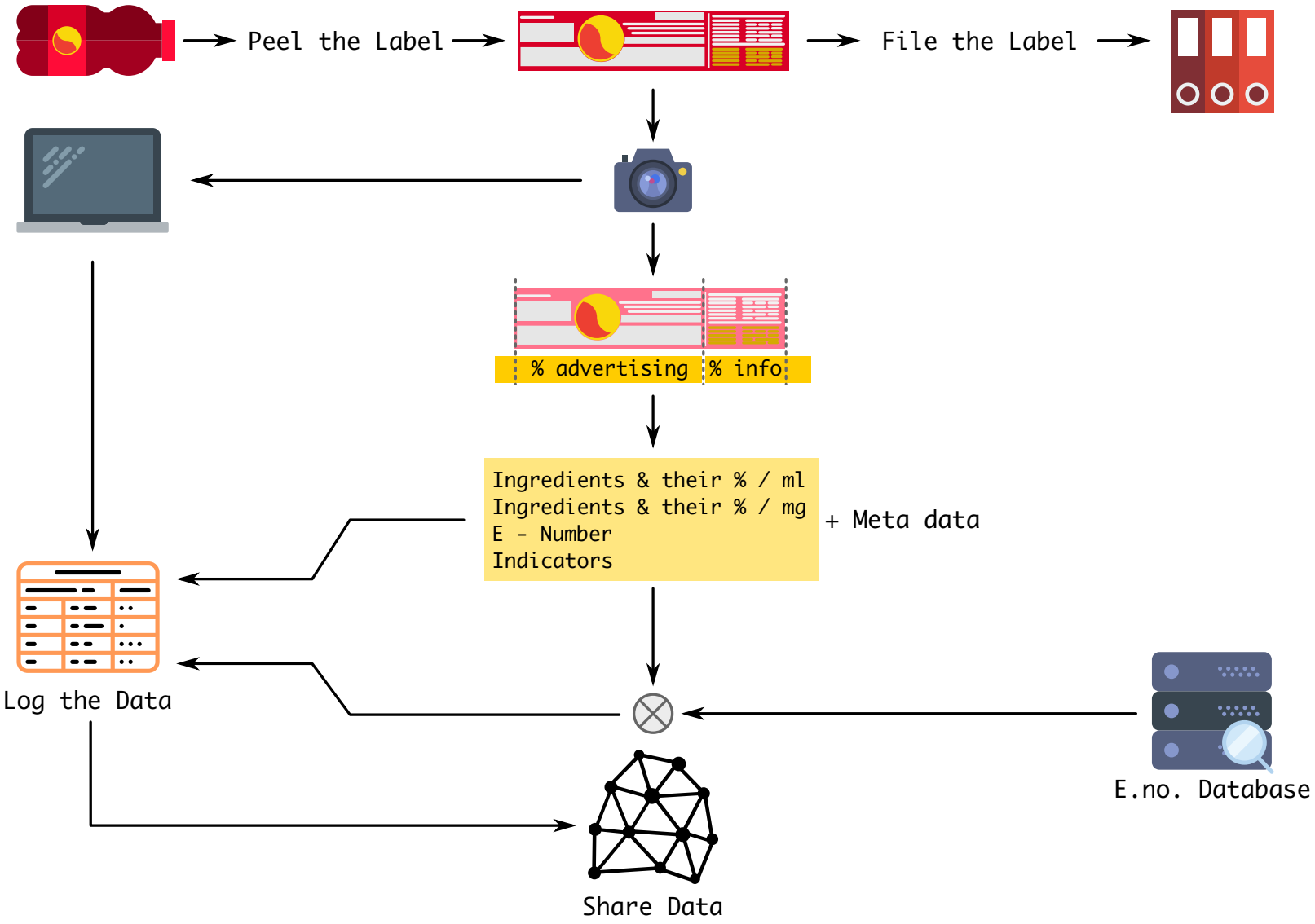
or

Hit the recycle shops

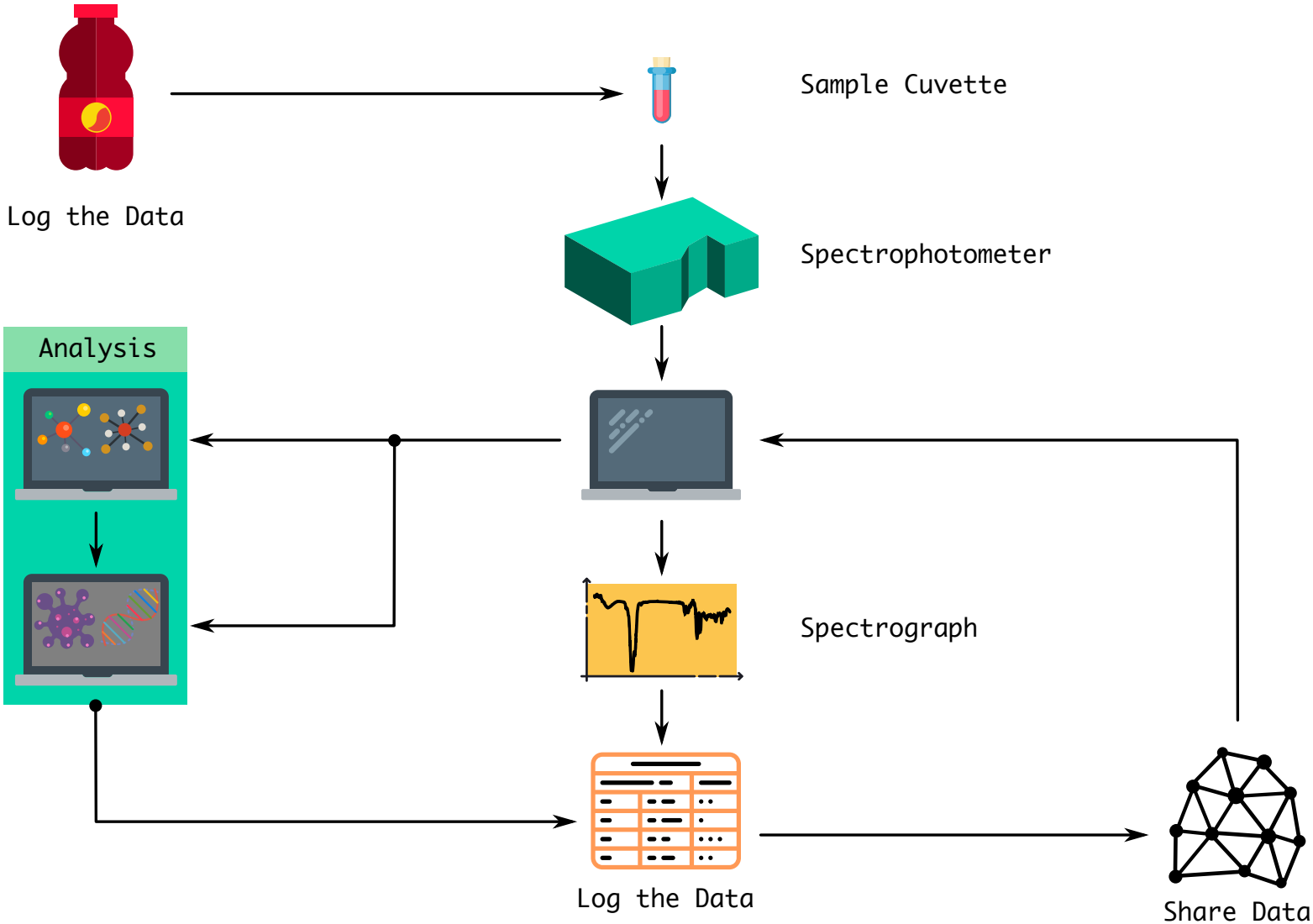
or

Hit the sidewalk

Collect Spatial Information



Collect Spectral Information



Sharing & Analysis

Mutually share data through distributed internet

↓

Synchronize local DB

↓

Run analysis with acquired Data

↓

Share it back to the distributed internet

How about doing that Collectively ?
guyssss ...

Any Values ?

- Educational (Learning, Discovery & Doing)
- Ecological (Food & Environment)
- Democratic (Distributed Participation in Sharing)
- Economic

Any other Attempts ?

Communities:

- OpenWetWare - Urinome project
- Spectruduino
- Hackaday RamanPi by flatcat
- Public Lab DIY spectrometer

Credits

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