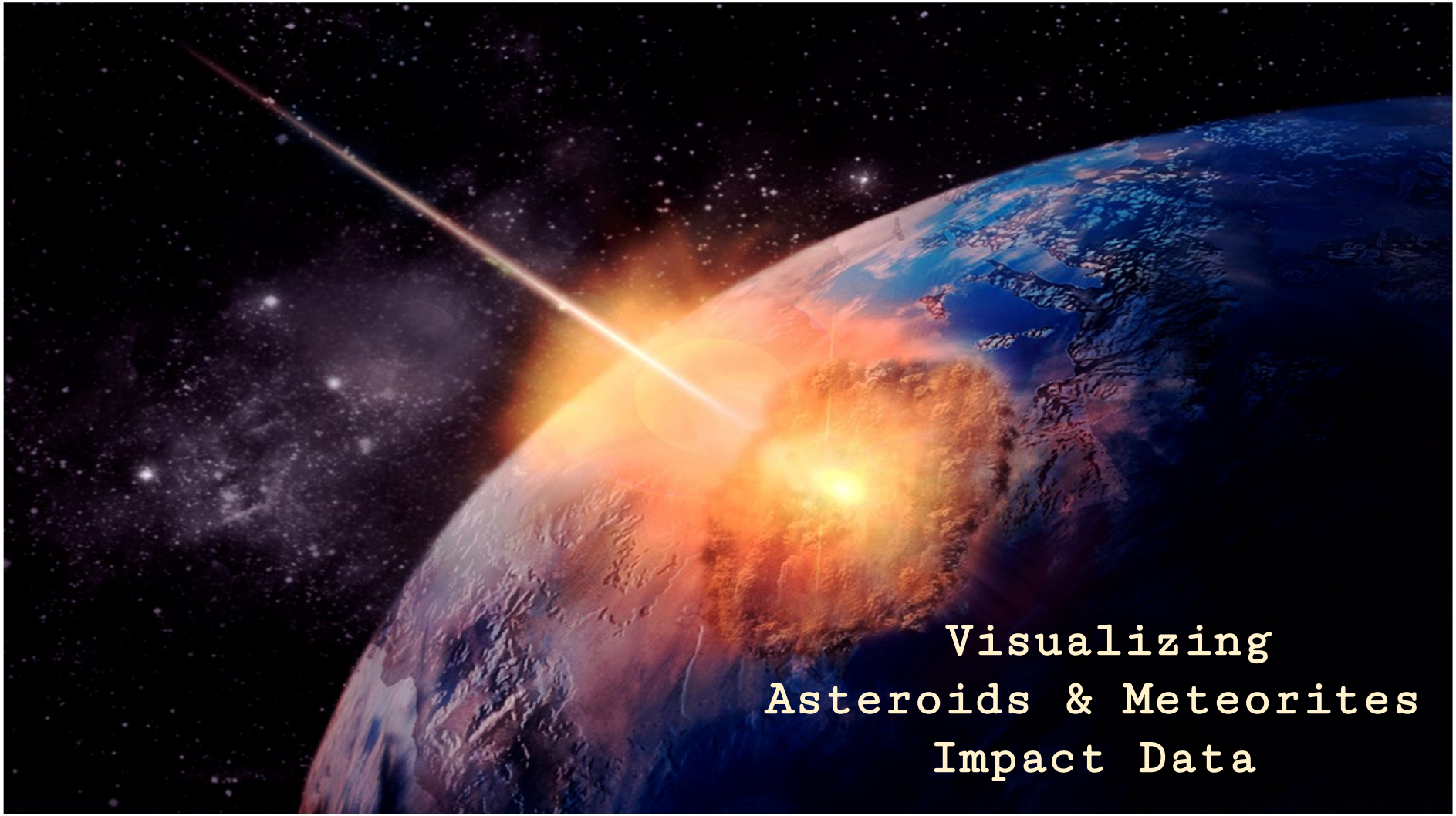

Visualizing
Asteroids & Meteorites
Impact Data

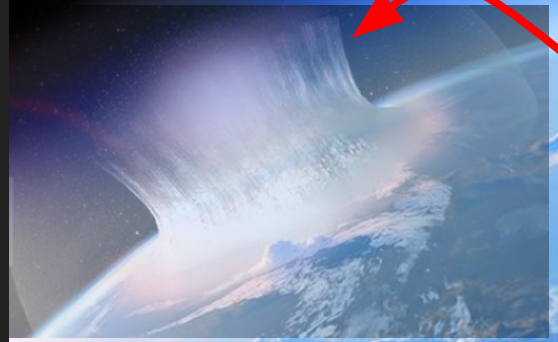

Motivation
We analyze NASA asteroid and meteorite data to visualize where impacts have occurred on Earth, and if more will occur in the future.

Introduction

Comet (icy rock)

Asteroid (rock orbiting between Mars and Jupiter)

Meteor (burned up rock from the Earth's atmosphere.



Meteorite (rocky metal which strikes Earth's surface.

Asteroids

Asteroids are rocky worlds revolving around the sun that are too small to be called planets.

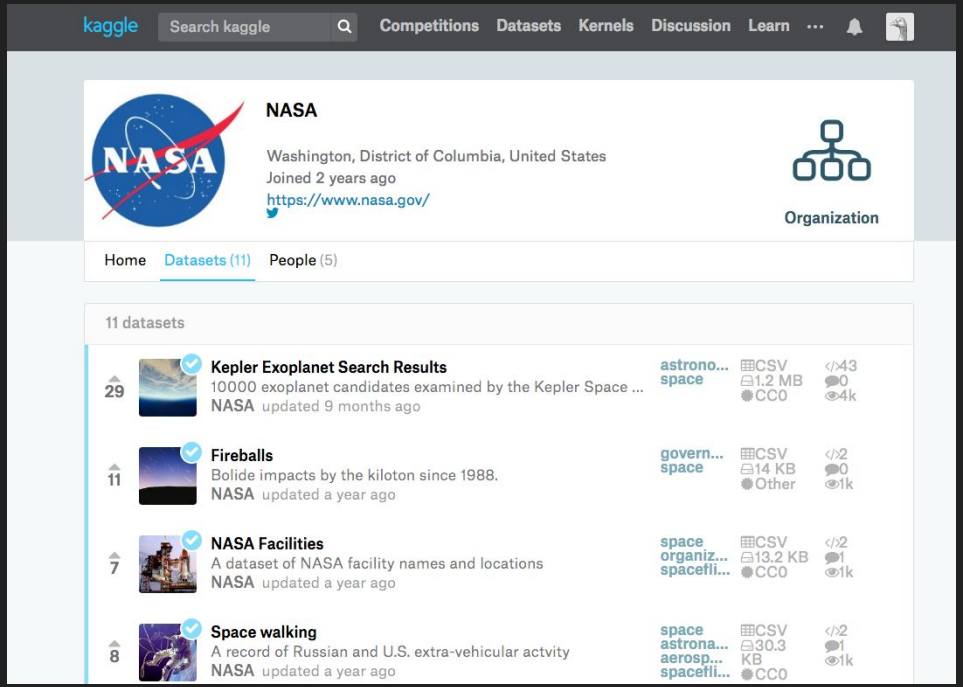
Meteorites

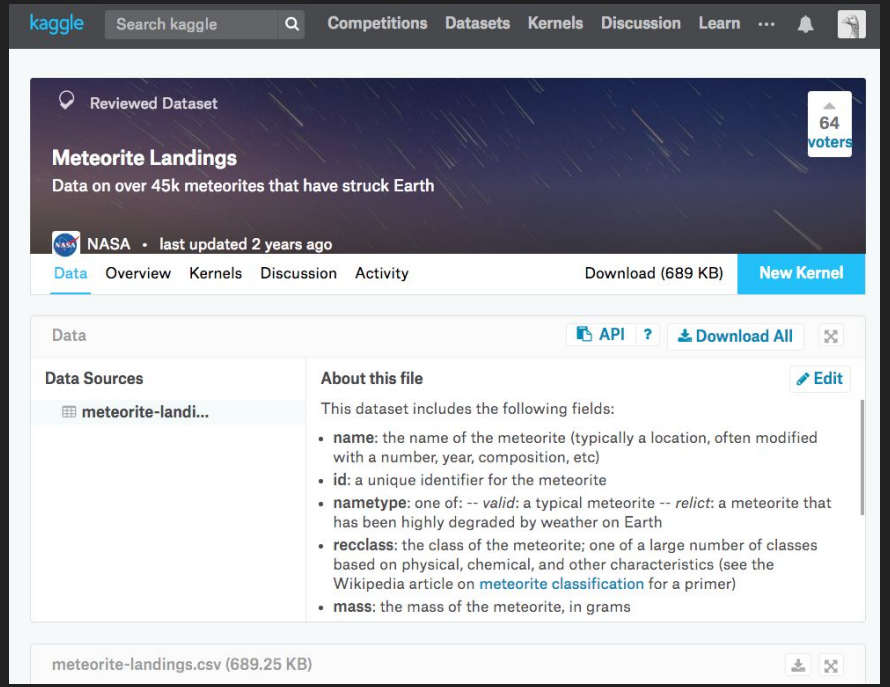
A meteorite is a piece of iron, stone, or stony-iron composite that has fallen to Earth from outer space.

Meteor crater in Arizona. A 160 Foot meteorite made this crater 50 thousand years old.

Getting the CSV Data from Kaggle

http://www.kaggle.com/nasa/datasets





Meteorite DataFrame

Named after the location on Earth

Valid = looks like a meteorite

Chemical Composition

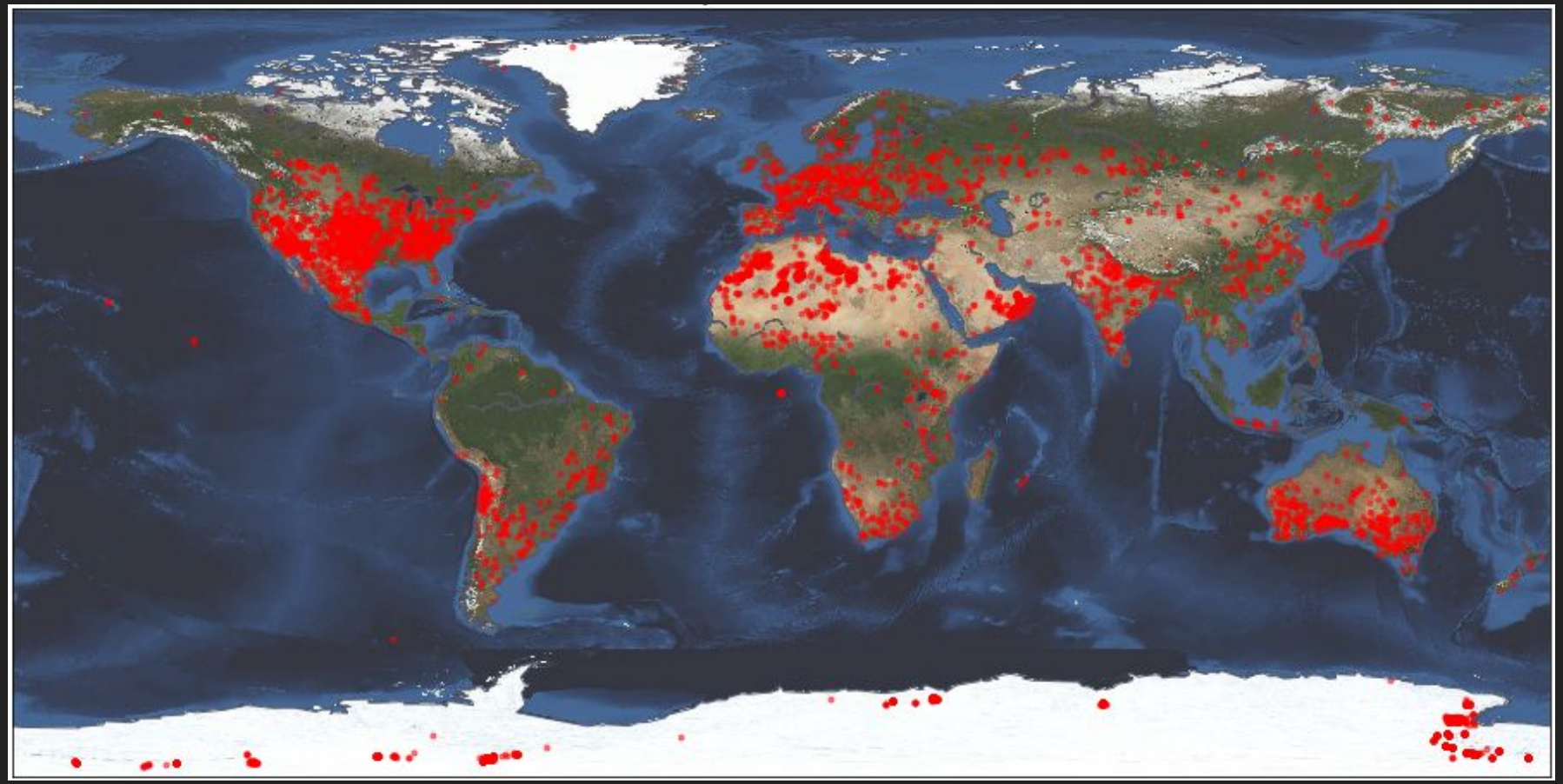
grams

How was it found?

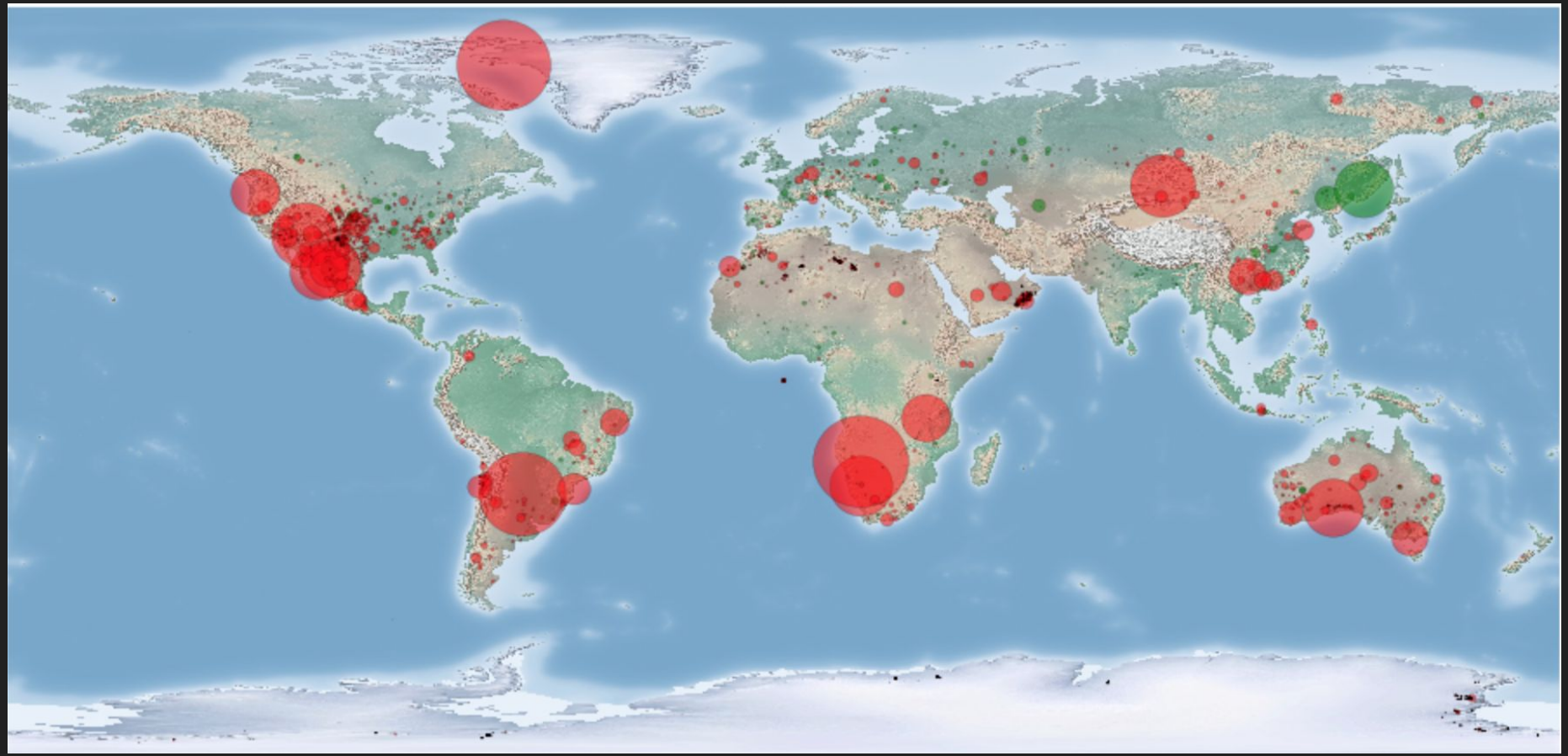
When was the rock found?

	name	appearance	type	mass	discovery	year	lat	long
0	Aachen	Valid	L5	21.0	Fell	1880.0	50.77500	6.08333
1	Aarhus	Valid	H6	720.0	Fell	1951.0	56.18333	10.23333
2	Abee	Valid	EH4	107000.0	Fell	1952.0	54.21667	-113.00000
3	Acapulco	Valid	Acapulcoite	1914.0	Fell	1976.0	16.88333	-99.90000
4	Achiras	Valid	L6	780.0	Fell	1902.0	-33.16667	-64.95000

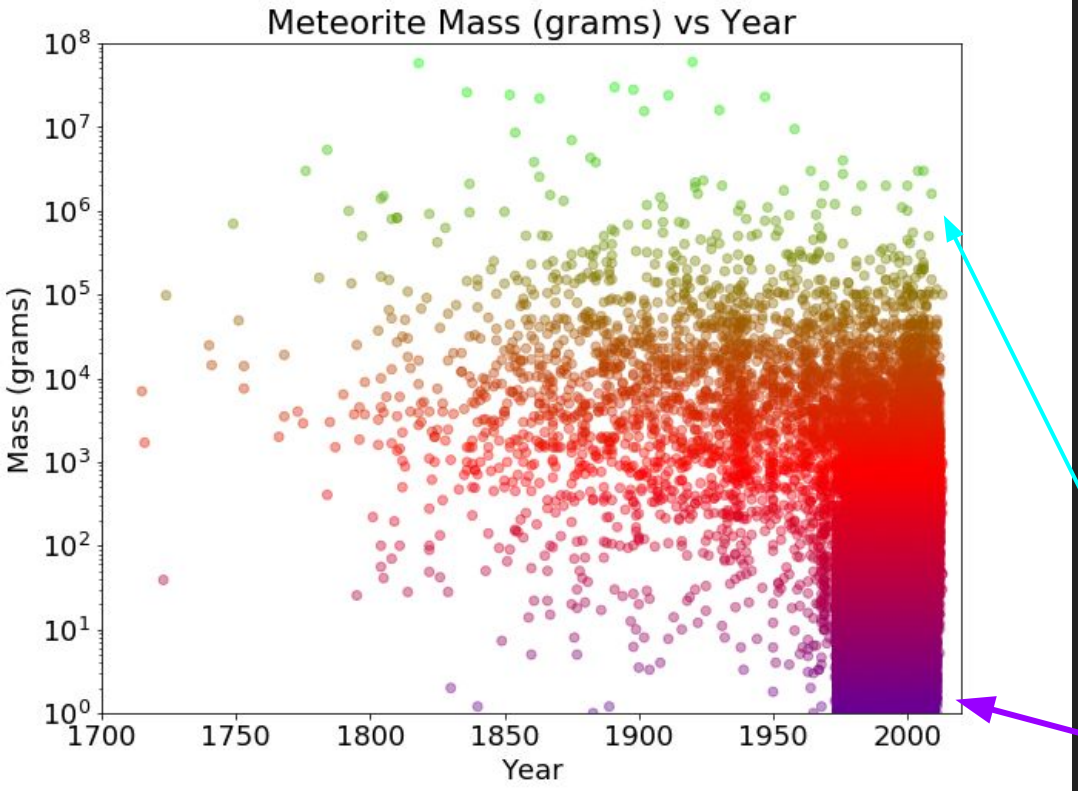
Meteorites Found on Earth



Meteorite Impact by Mass



Meteorite Data Scatter Plot



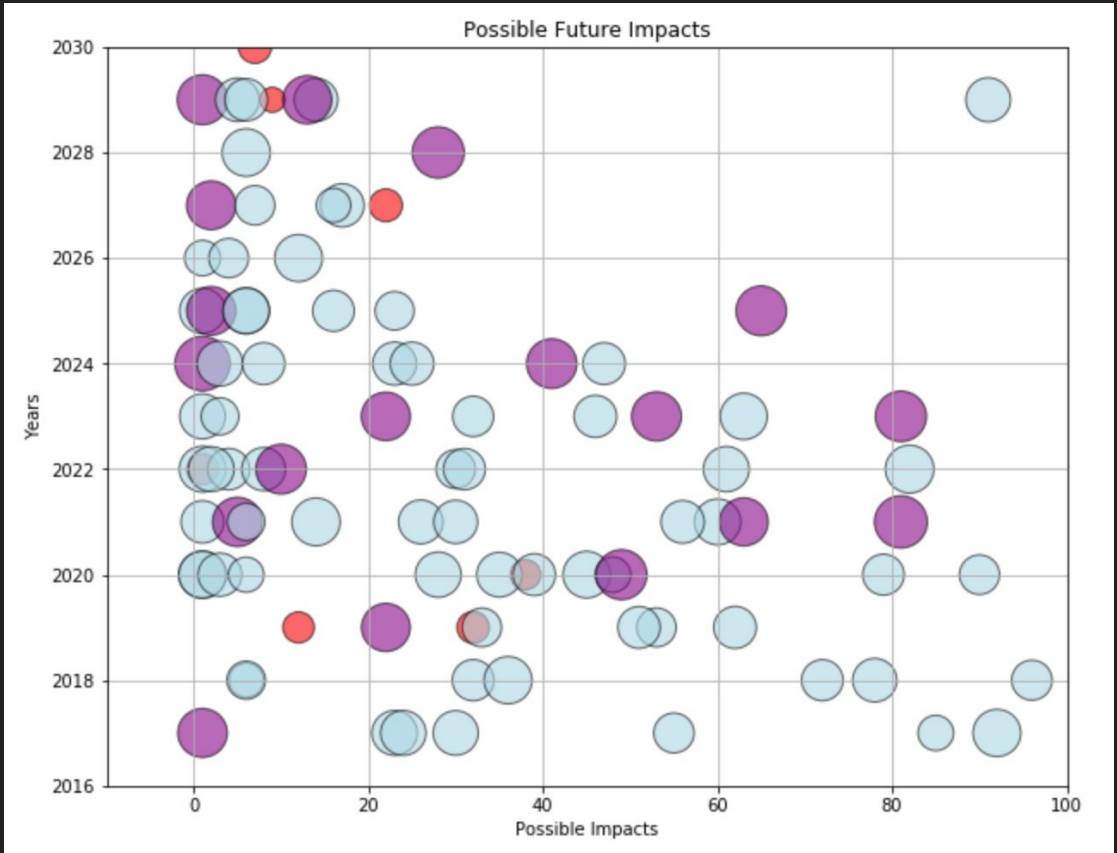
In the 1700's there were only large meteorites discovered with mass of about 10^3 - 10^5 grams or between 2 - 220 lbs. The majority of the meteorites (giant cluster of dots in the center) are heavy meteorites.

Blue dots are heavier meteorites
Purple dots are lighter meteorites

Asteroids DataFrame

		Tracking period in years	Number of ways it can get close to Earth.	Probability of hitting Earth during the entire period	km/s	Brightness of asteroid		Positive is high Risk	Positive is high Risk	0 = no risk 2-4 = some 5> = High Risk
	Object Name	**Period Start**	**Period End**	**Possible Impacts**	**Cumulative Impact Probability**	**Asteroid Velocity**	**Asteroid Magnitude**	**Asteroid Diameter (km)**	**Cumulative Palermo Scale**	**Maximum Palermo Scale**	**Maximum Torino Scale**
0	2006 WP1	2017	2017	1	5.200000e-09	17.77	28.3	0.007	-8.31	-8.31	0
1	2013 YB	2017	2046	23	7.600000e-05	8.98	31.4	0.002	-6.60	-6.96	0
2	2008 US	2017	2062	30	1.600000e-05	18.33	31.4	0.002	-6.48	-6.87	0
3	2010 VR139	2017	2076	24	2.000000e-07	4.99	26.7	0.016	-6.83	-6.95	0
4	2015 ME131	2017	2096	85	2.300000e-08	19.46	19.2	0.497	-3.85	-4.30	0

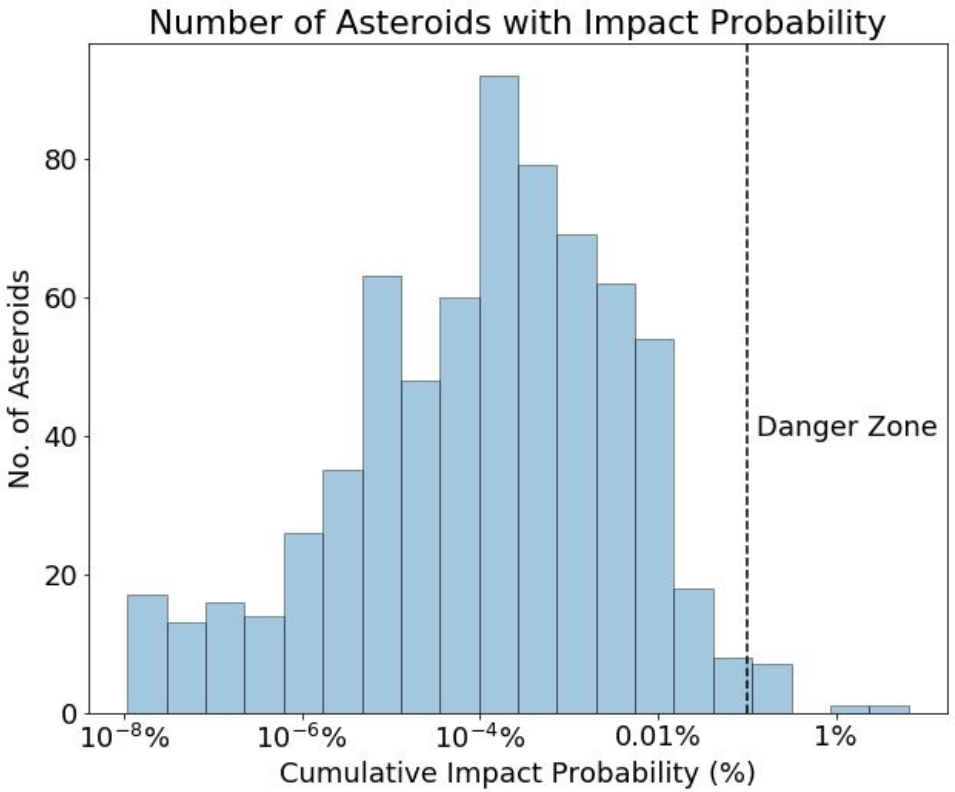
Possible Future Asteroid Impacts



This plot shows the number of ways the asteroids in our data can get close to Earth within the tracking period.

Dark Magenta shows least possibility to enter earth in that year and red marker shows higher chance than other two.

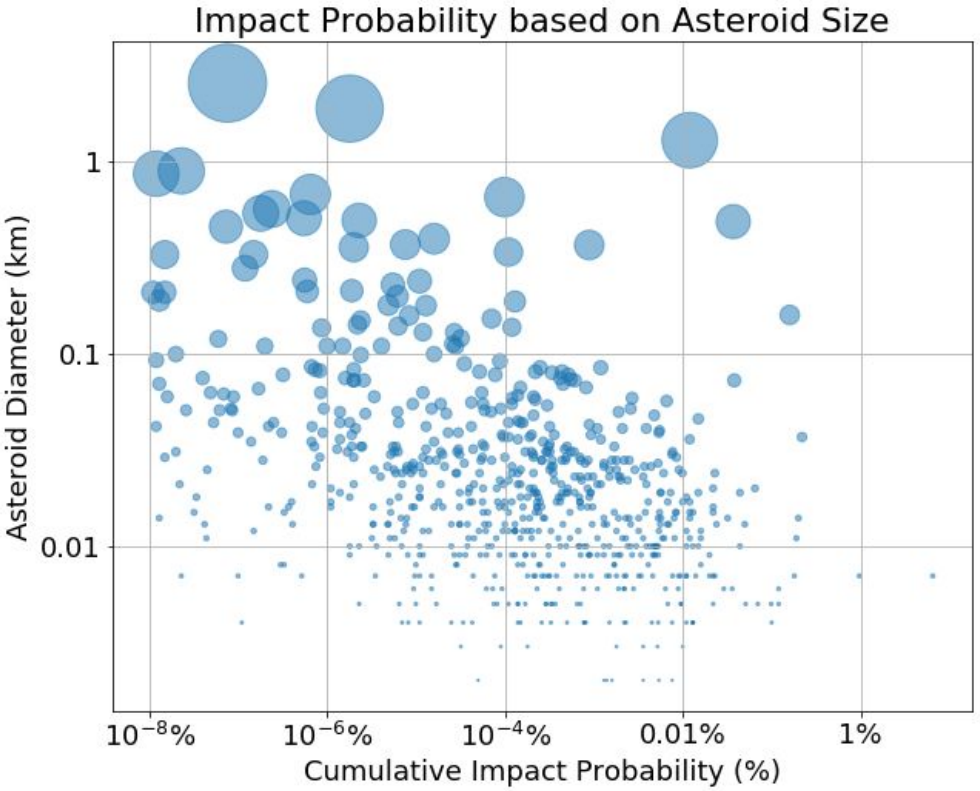
Asteroids Impact Probability



This plot is a histogram which bins the data and counts how many asteroids are in each bin. The x-axis is the cumulative impact probability as a percentage. This means the overall probability that the asteroid will strike Earth. The y-axis is the number of asteroids which have that probability of hitting Earth.

The danger zone corresponds to the percentage which is worrisome for a potential collision. **From the plot, we can conclude that there is a low percentage of asteroids striking Earth.**

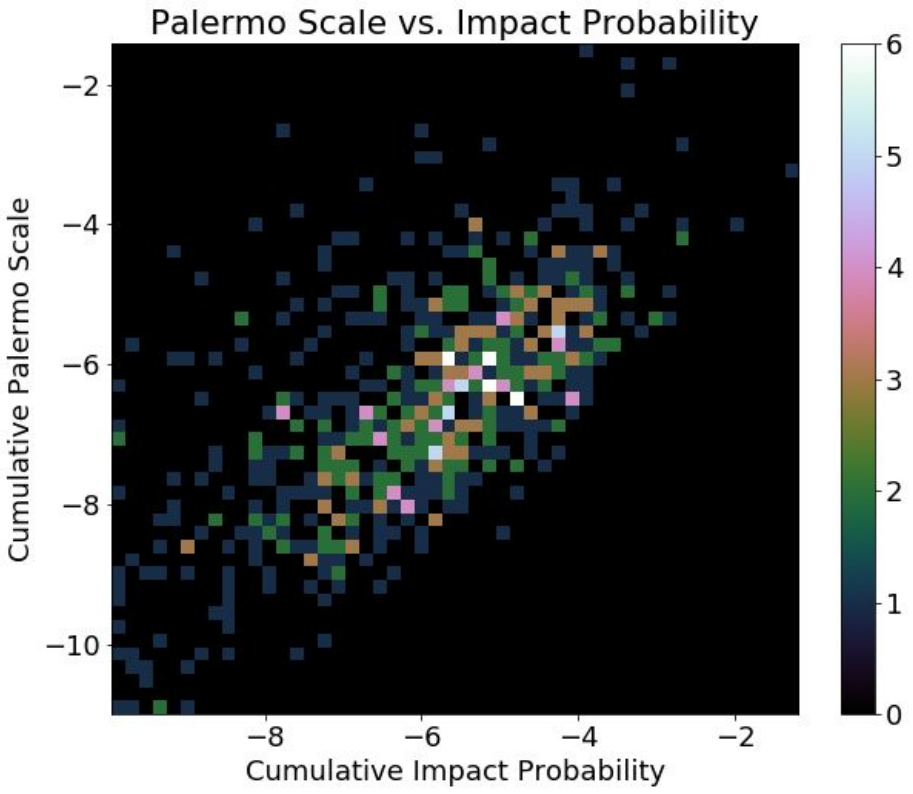
Asteroid Impact Probability by Mass



This scatter plot shows the probability of impacts from asteroids based on their size.

The larger asteroids have a lower probability of colliding with Earth, and there are fewer of them left. Most have already hit something!

Asteroids Data 2D Density Plot



This 2D density plot says that there are x-number of asteroids for each combination of impact probability and Palermo scale, where x refers to the color bar value.

The positive slope shows that the higher the impact probability, the higher the risk of damage.

<u>Palermo Scale:</u>
-2 = normal
n > 0 = high risk of impact

How we made the plot:
https://python-graph-gallery.com/85-density-plot-with-matplotlib/

Conclusion

- Meteorites have struck Earth in the past, and are responsible for killing off the dinosaurs.
- There is 1% chance of an asteroid hitting Earth anytime soon.
- Getting hit by heavier asteroids is not as common because there are less of them!
- Meteorites are worth a lot of money, up to $1,000/gram or more!
- The composition of meteorites tell us how our solar system formed.

The End

Chelyabinsk meteor striking Russia on February 15, 2013. **We did not know this meteorite was going to strike us.**

Specs
Speed - 42501.8 mph
Origin - 66 feet above Earth
Hit - Chelyabinsk
Damage - 2k injured, 7k damaged buildings.