NASA Exoplanet Archive: How-To Guide

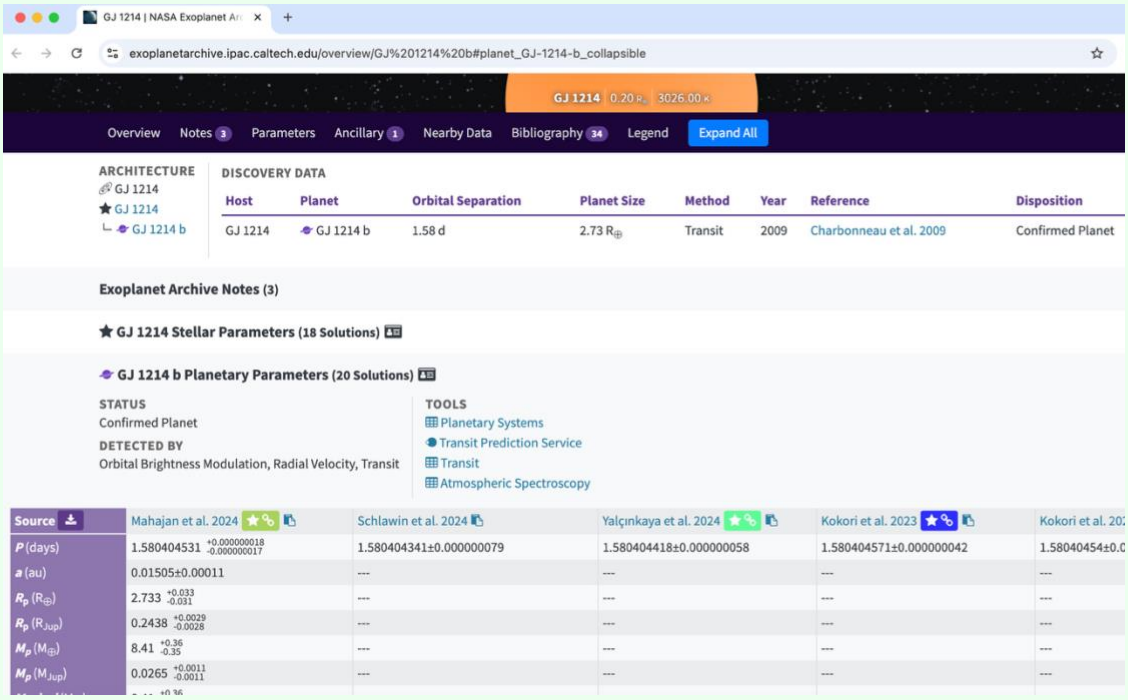
The NASA Exoplanet Archive holds a database of information for exoplanets. Note that this does not (currently) include atmospheric data, but it does include bulk properties such as mass and radius which we will need to model atmospheres.

You can access the NEA website here: https://exoplanetarchive.ipac.caltech.edu/

Looking up individual planets:

To look up an individual planet, you can type its name in the search box (under "Explore the Archive"), and details of that planet will appear in a new tab (pop-ups need to be enabled in your browser).

Here is what comes up for the sub-Neptune GJ 1214 b:



A few notes:

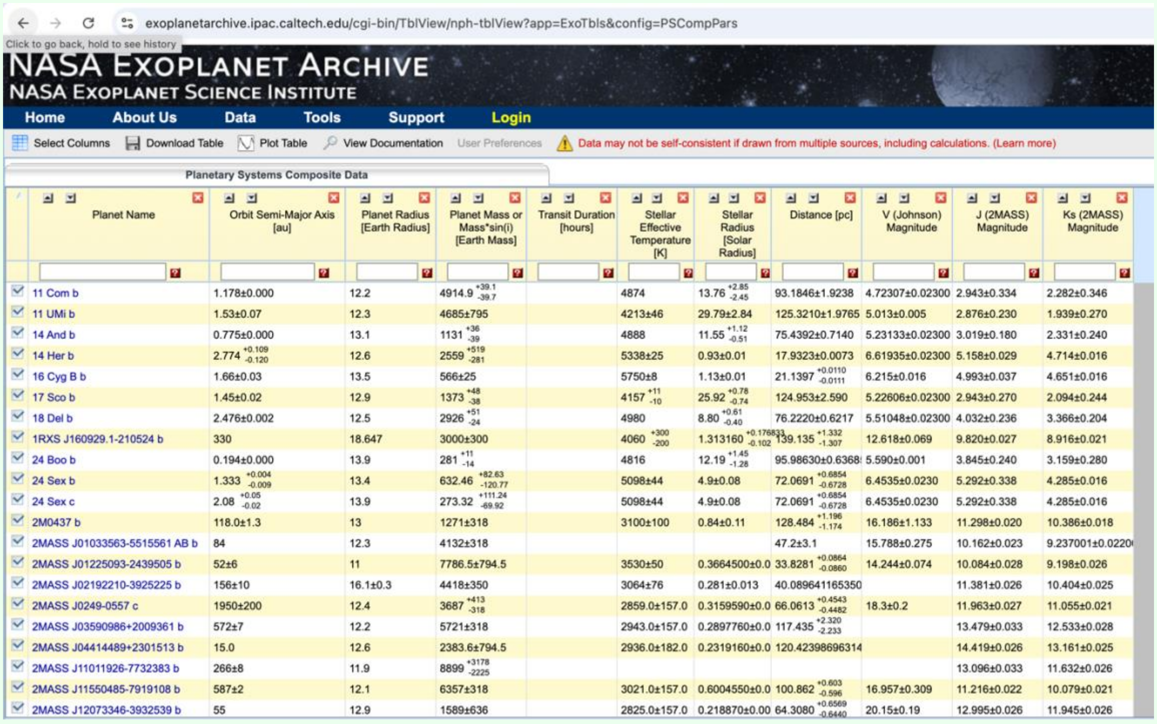
- For each planet in the system (and the star, we'll look at that later on), information is structured in columns. Each column corresponds to a different publication, which may have used different observations and/or reanalysed old observations to derive the planetary parameters. Ideally, the papers will agree… but sometimes they don't!
- The paper shown in the left-most column is the one 'preferred' by the archive.
- Each row in the table corresponds to a different property, e.g. GJ 1214 b's radius is 2.733 Earth radii, or 0.2438 Jupiter radii.

Looking up and filtering all exoplanets

When selecting a sample of targets, it will be useful to start with the full list of known exoplanets and filter them to narrow down a suitable target list.

You can download this data as a csv file and read it using Excel and/or Python. To do this, go to the NASA Exoplanet Archive homepage and select the “Data” tab at the top of the page. From the menu that appears, click on “Planetary Systems Composite Data” (in the left-hand column).

This will open a table view of all the exoplanets in the database. To select which columns you want to see, you can use the “select columns” button at the top. For example, useful values may include the planet’s radius, mass, semi-major axis and transit duration, and the host star’s effective temperature, radius distance and V/J/Ks magnitudes. Here’s what the table looks like:



Planet Name	Orbit Semi-Major Axis [au]	Planet Radius [Earth Radius]	Planet Mass or Mass*sin(i) [Earth Mass]	Transit Duration [hours]	Stellar Effective Temperature [K]	Stellar Radius [Solar Radius]	Distance [pc]	V (Johnson) Magnitude	J (2MASS) Magnitude	Ks (2MASS) Magnitude
11 Com b	1.178±0.000	12.2	$4914.9^{+39.1}_{-39.7}$		4874	$13.76^{+2.85}_{-2.45}$	93.1846±1.9238	4.72307±0.02300	2.943±0.334	2.282±0.346
11 UMi b	1.53±0.07	12.3	4685±795		4213±46	29.79±2.84	125.3210±1.9765	5.013±0.005	2.876±0.230	1.939±0.270
14 And b	0.775±0.000	13.1	1131^{+36}_{-39}		4888	$11.55^{+1.12}_{-0.51}$	75.4392±0.7140	5.23133±0.02300	3.019±0.180	2.331±0.240
14 Her b	$2.774^{+0.109}_{-0.120}$	12.6	2559^{+519}_{-281}		5338±25	0.93±0.01	17.9323±0.0073	6.61935±0.02300	5.158±0.029	4.714±0.016
16 Cyg B b	1.66±0.03	13.5	566±25		5750±8	1.13±0.01	$21.1397^{+0.0110}_{-0.0111}$	6.215±0.016	4.993±0.037	4.651±0.016
17 Sco b	1.45±0.02	12.9	1373^{+48}_{-38}		4157^{+11}_{-10}	$25.92^{+0.78}_{-0.74}$	124.953±2.590	5.22606±0.02300	2.943±0.270	2.094±0.244
18 Del b	2.476±0.002	12.5	2926^{+51}_{-24}		4980	$8.80^{+0.61}_{-0.40}$	76.2220±0.6217	5.51048±0.02300	4.032±0.236	3.366±0.204
1RXS J160929.1-210524 b	330	18.647	3000±300		4060^{+300}_{-200}	$1.313160^{+0.176833}_{-0.102}$	$139.135^{+1.332}_{-1.307}$	12.618±0.069	9.820±0.027	8.916±0.021
24 Boo b	0.194±0.000	13.9	281^{+11}_{-14}		4816	$12.19^{+1.45}_{-1.28}$	95.98630±0.6368	5.590±0.001	3.845±0.240	3.159±0.280
24 Sex b	$1.333^{+0.004}_{-0.009}$	13.4	$632.46^{+82.63}_{-120.77}$		5098±44	4.9±0.08	$72.0691^{+0.6854}_{-0.6728}$	6.4535±0.0230	5.292±0.338	4.285±0.016
24 Sex c	$2.08^{+0.05}_{-0.02}$	13.9	$273.32^{+111.24}_{-69.92}$		5098±44	4.9±0.08	$72.0691^{+0.6854}_{-0.6728}$	6.4535±0.0230	5.292±0.338	4.285±0.016
2M0437 b	118.0±1.3	13	1271±318		3100±100	0.84±0.11	$128.484^{+1.196}_{-1.174}$	16.186±1.133	11.298±0.020	10.386±0.018
2MASS J01033563-5515561 AB b	84	12.3	4132±318				47.2±3.1	15.788±0.275	10.162±0.023	9.237001±0.0220
2MASS J01225093-2439505 b	52±6	11	7786.5±794.5		3530±50	0.3664500±0.0	$33.8281^{+0.0864}_{-0.0860}$	14.244±0.074	10.084±0.028	9.198±0.026
2MASS J02192210-3925225 b	156±10	16.1±0.3	4418±350		3064±76	0.281±0.013	40.089641165350		11.381±0.026	10.404±0.025
2MASS J0249-0557 c	1950±200	12.4	3687^{+413}_{-318}		2859.0±157.0	0.3159590±0.0	$66.0613^{+0.4543}_{-0.4482}$	18.3±0.2	11.963±0.027	11.055±0.021
2MASS J03590986+2009361 b	572±7	12.2	5721±318		2943.0±157.0	0.2897760±0.0	$117.435^{+2.320}_{-2.233}$		13.479±0.033	12.533±0.028
2MASS J04414489+2301513 b	15.0	12.6	2383.6±794.5		2936.0±182.0	0.2319160±0.0	120.42398696314		14.419±0.026	13.161±0.025
2MASS J11011926-7732383 b	266±8	11.9	8899^{+3178}_{-2225}						13.096±0.033	11.632±0.026
2MASS J11550485-7919108 b	587±2	12.1	6357±318		3021.0±157.0	0.6004550±0.0	$100.862^{+0.603}_{-0.596}$	16.957±0.309	11.216±0.022	10.079±0.021
2MASS J12073346-3932539 b	55	12.9	1589±636		2825.0±157.0	0.218870±0.00	$64.3080^{+0.6569}_{-0.6440}$	20.15±0.19	12.995±0.026	11.945±0.026

Note that for each planet in this table, the data can be drawn from multiple papers and are not necessarily consistent (e.g. the mass and the radius could each come from a different paper). At this stage this is fine, but when finalising JWST targets it’s good practice to check where these numbers have come from and whether they seem reliable.

To download the data from your chosen columns, hover over the “Download Table” button at the top, and click “Download Table” from the menu which appears. I recommend sticking to the default CSV format. Note that the downloaded file contains several header lines which you’ll need to deal with if reading in with Python.