Example of a DRM for a starshade with JWST

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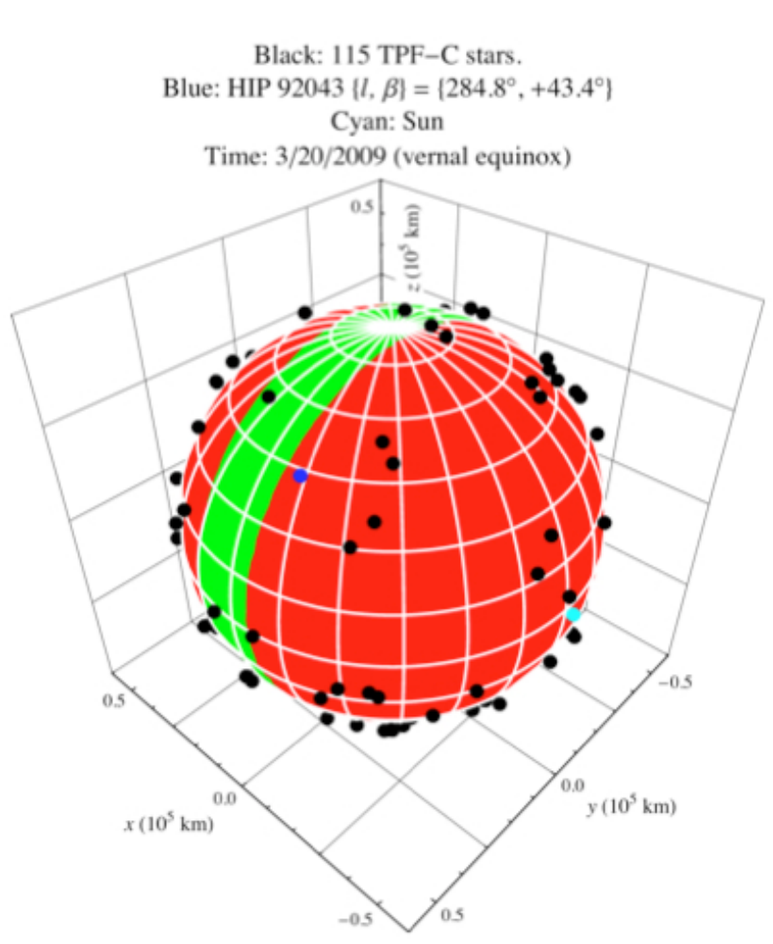


Setting up the DRM

- JWST + Starshade
  - NIRCam imaging
  - NIRSpec spectroscopy

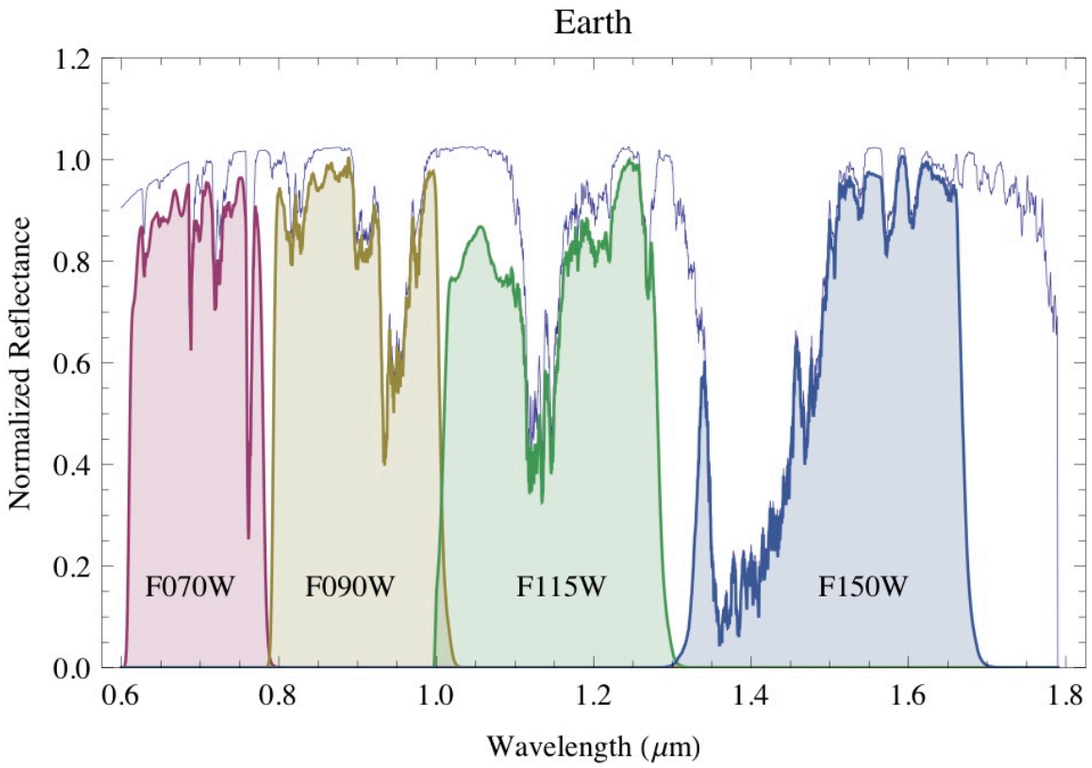
- Exposure time model

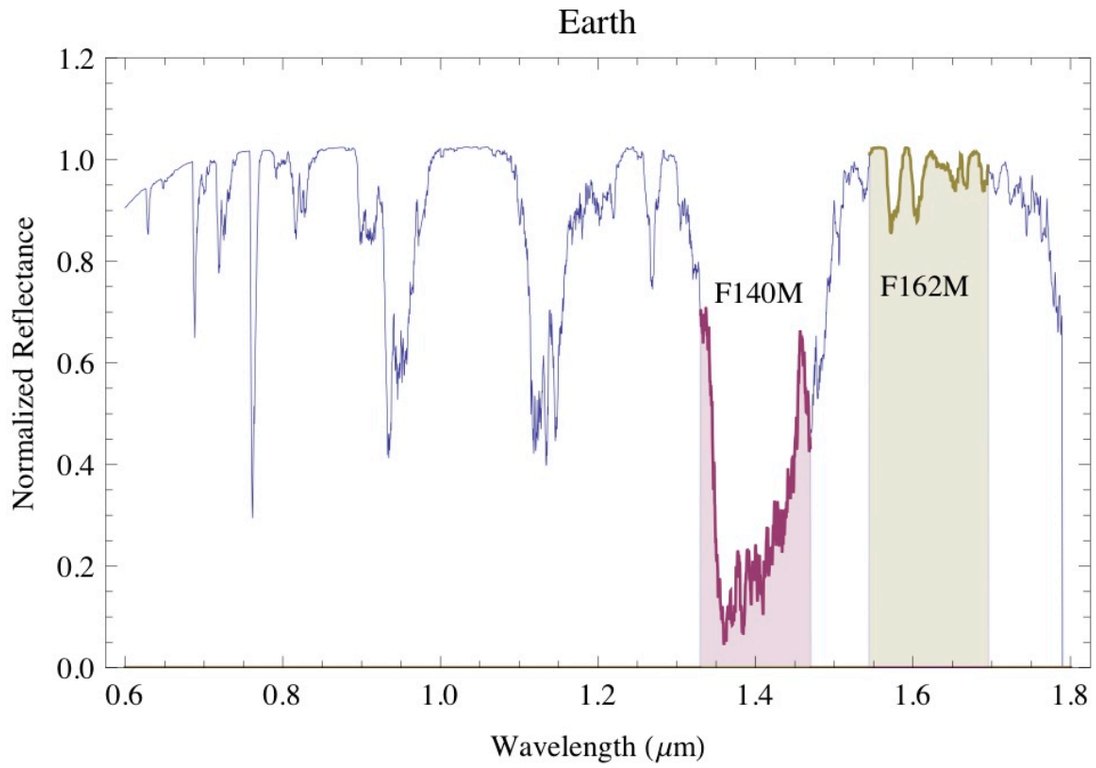
- Observing scenario

- Star catalog

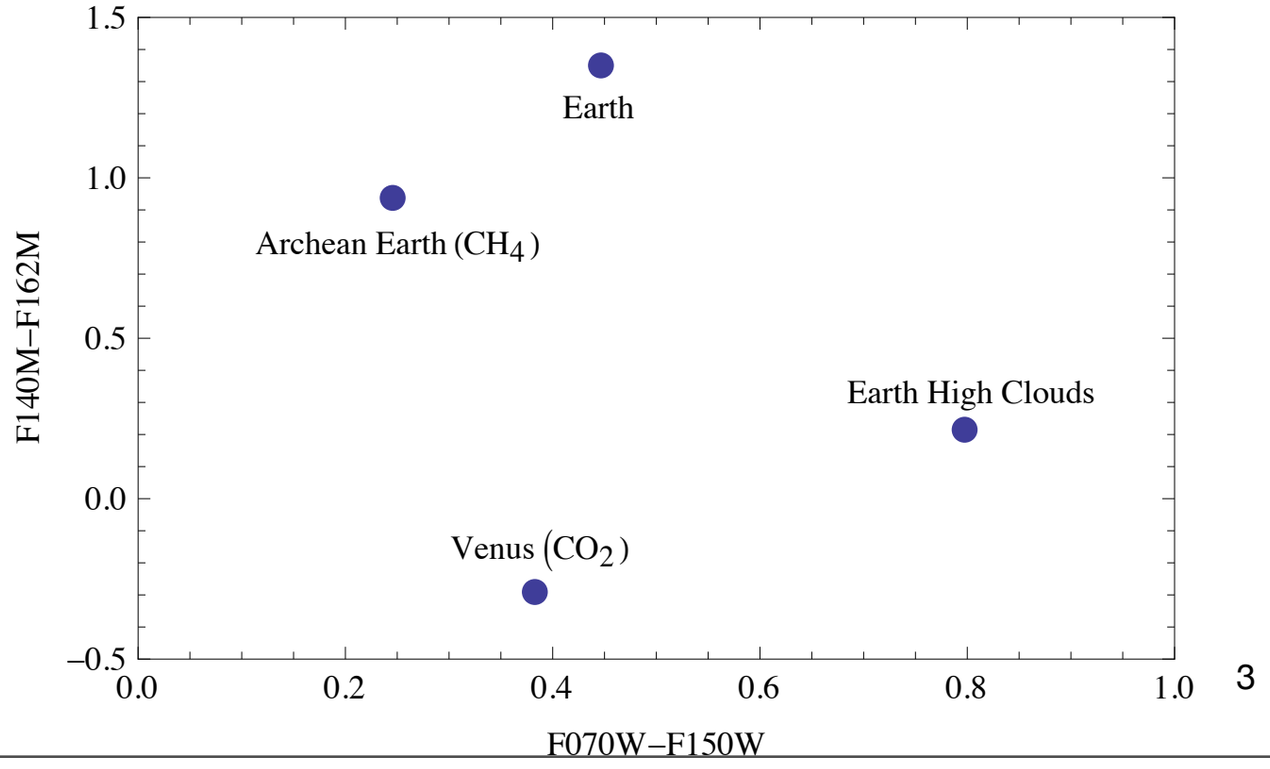
- Brown & Soummer (2010) ApJ 715

Imaging (NIRCam + starshade)

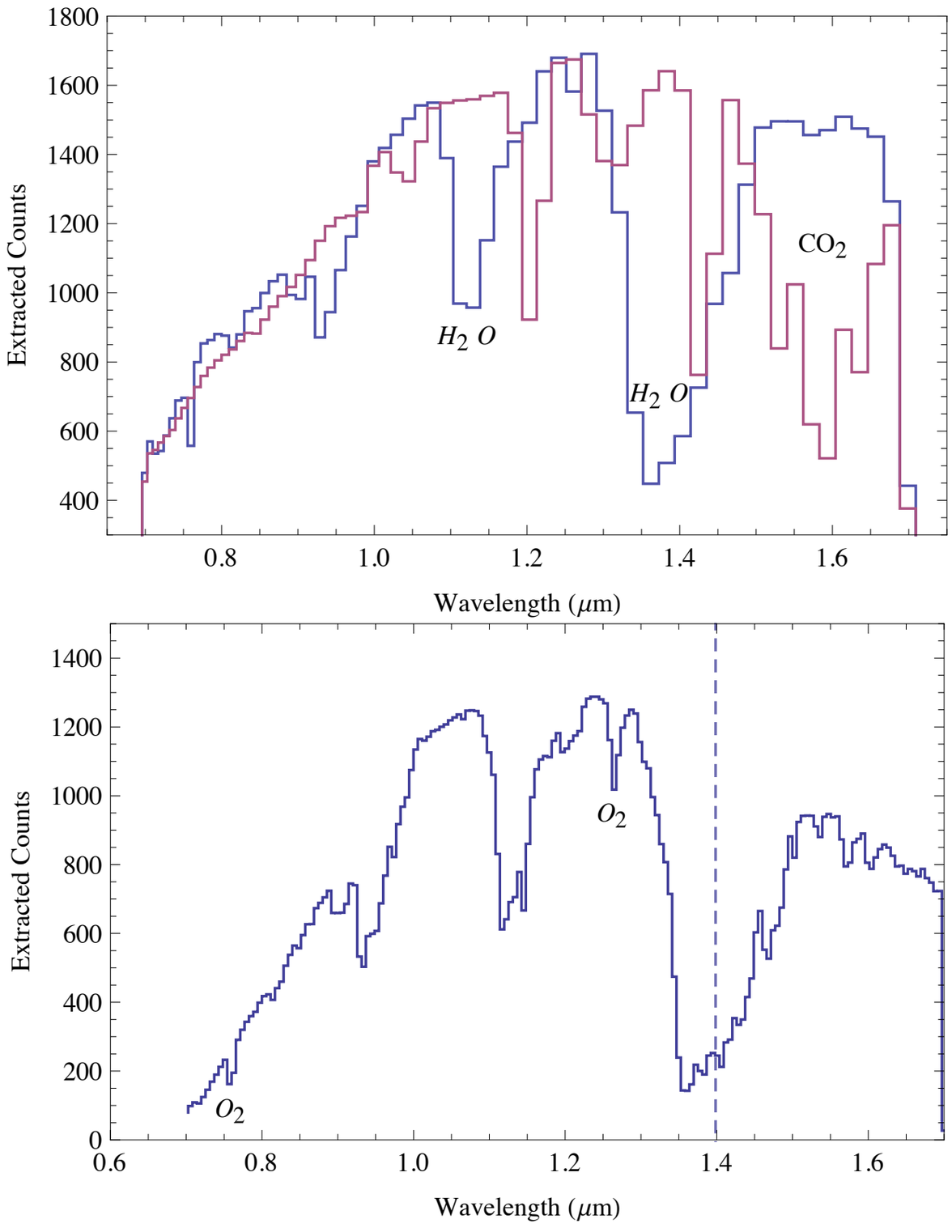


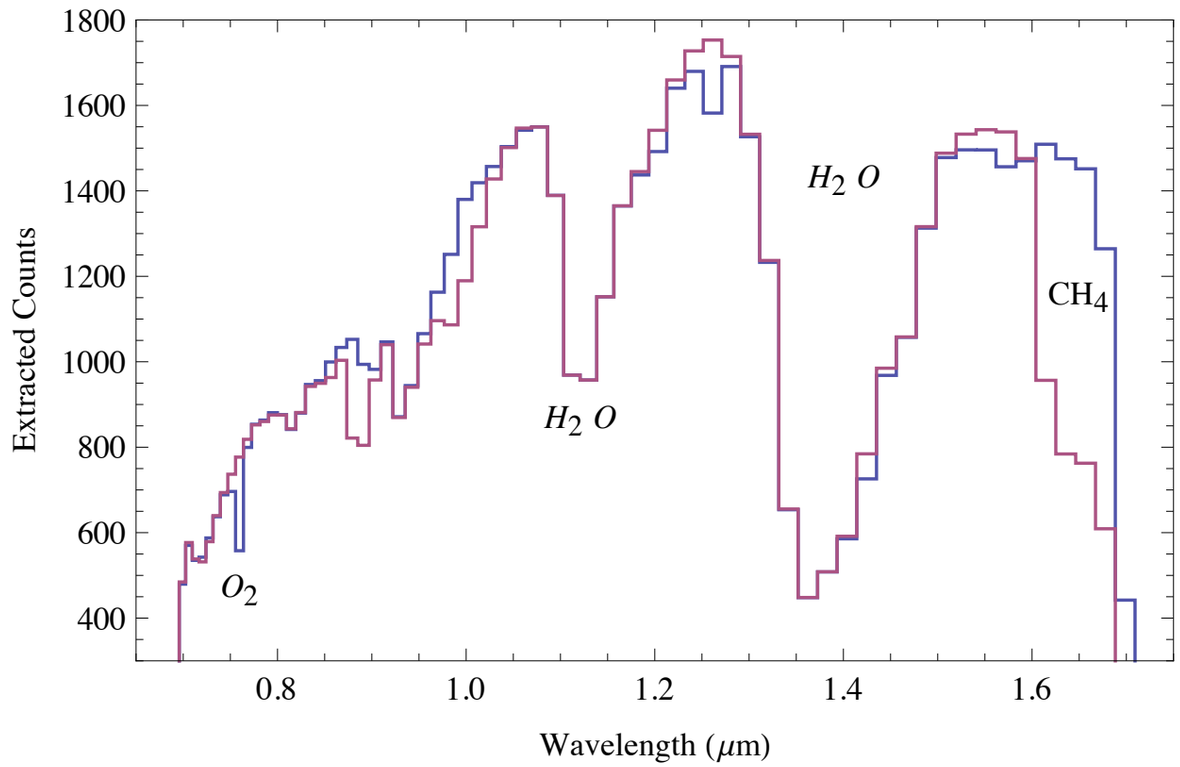


detection of Earth twin at 10pc in ~10^5s (20-80h)



Spectroscopy (NIRSpec + starshade)





5 sigma detection of water features in $<10^5$s for Earth twin at 10pc

3 sigma detection of oxygen features in $\sim 10^6$s for bright Super Earth

Observing sequence

- Fine-alignment time for the starshade (10h)
- Initial limiting search observation (LSO) exposure with preferred filter down to the limiting magnitude Δmag0 = 26
- Time for data downlink, science analysis and decision to followup, rescheduling with target of opportunity (7 days)
- Fine-Alignment time for the starshade (10h)
- Followup images with NIRCam in the 4 other filters
- Time for data downlink, science analysis and decision to followup, rescheduling with target of opportunity (7 days)
- Fine-alignment time for the starshade (10h)
- Spectroscopic followup with NIRSpec

Scheduling concept

- Image with NIRCam
- downlink data (DSN contact), pipeline and deliver to observer (1 day)
  - baseline is 5 days for regular observations, can do in less than 1 day for WFS
- observer looks at the data, decision to follow-up (2 days)
- observer prepares and submits proposal to the system (1 day)
- Target of Opportunity is activated (3 days)
  - req is 1 day for time-critical events. can fit in 2-4 days with event driven with minimum additional tax

Star catalog

	HIP	∈26?	Type	Lum	Dist	Ecl Long	Ecl Lat	Filter	Log exp time	Log max time	c_1	C_∞	p	Log rate
1	71 681	yes	K1 V	0.61	1.35	239.	-43.	F070W	3.2	6.1	0.80	1.0	0.24	-5.2
2	8102	yes	G8 V	0.47	3.65	17.8	-25.	F115W	4.0	6.1	0.76	1.0	0.23	-5.3
3	71 683	yes	G2 V	2.2	1.35	239.	-43.	F070W	2.4	6.1	0.55	1.0	0.17	-5.3
4	3821	yes	G0 V	1.2	5.95	40.2	47.	F115W	3.9	6.1	0.59	1.0	0.18	-5.4
5	99 240	yes	G6/8 IV	1.5	6.11	288.	-45.	F115W	4.1	6.2	0.56	1.0	0.17	-5.5
6	108 870	yes	K4/5 V	0.20	3.63	310.	-41.	F150W	4.5	6.1	0.65	1.0	0.19	-5.5
7	22 449	yes	F6 V	2.6	8.03	71.9	-15.	F115W	3.9	6.2	0.39	0.96	0.12	-5.6
8	19 849	yes	K0/1 V	0.41	5.04	60.2	-28.	F115W	4.7	6.2	0.64	1.0	0.19	-5.6
9	15 510	yes	G8 III	0.71	6.06	27.2	-58.	F115W	4.7	6.2	0.63	1.0	0.19	-5.6
10	2021	yes	G1 IV	3.9	7.47	301.	-65.	F070W	4.2	6.2	0.34	0.92	0.10	-5.7
11	27 072	yes	F6.5 V	2.3	8.97	84.8	-46.	F115W	4.5	6.2	0.41	0.98	0.12	-5.7
12	1599	yes	G0 V	1.2	8.59	322.	-58.	F115W	4.7	6.2	0.50	1.0	0.15	-5.8
13	64 394	yes	G0	1.3	9.15	184.	33.	F115W	4.8	6.3	0.47	1.0	0.14	-5.9
14	57 757	yes	F8	3.4	10.9	177.	0.69	F115W	4.3	6.2	0.27	0.88	0.080	-5.9
15	12 777	yes	F8	2.2	11.2	54.7	32.	F115W	4.6	6.3	0.36	0.99	0.11	-5.9
16	14 632	no	F9.5 V	2.2	10.5	59.3	31.	F115W	4.7	6.3	0.38	0.99	0.11	-5.9
17	96 100	yes	G9 V	0.41	5.77	30.3	81.	F115W	5.0	6.2	0.56	0.97	0.17	-5.9
18	105 858	yes	F7 V	1.4	9.22	299.	-47.	F115W	4.9	6.3	0.47	1.0	0.14	-5.9
19	64 924	no	G5 V	0.81	8.52	205.	-9.3	F115W	4.9	6.3	0.45	0.94	0.14	-5.9
20	78 072	no	F5	2.7	11.1	233.	35.	F115W	4.7	6.4	0.32	0.95	0.097	-6.0
21	15 457	no	G5 V	0.83	9.16	48.3	-14.	F115W	5.0	6.3	0.40	0.90	0.12	-6.0
22	16 852	no	F8 V	2.9	13.7	52.0	-18.	F115W	4.8	6.4	0.24	0.94	0.072	-6.1
23	7513	no	G0	3.3	13.5	38.6	29.	F115W	4.8	6.4	0.23	0.90	0.068	-6.1
24	24 813	no	G1 V	1.7	12.7	81.8	17.	F115W	4.9	6.4	0.30	0.94	0.089	-6.1
25	73 184	yes	K4 V	0.26	5.91	228.	-4.4	F150W	5.0	6.2	0.34	0.76	0.10	-6.2
26	116 771	no	F8	3.3	13.8	358.	7.2	F115W	4.9	6.4	0.22	0.90	0.066	-6.2
27	70 497	yes	F8	3.9	14.6	183.	60.	F115W	4.8	6.4	0.17	0.81	0.051	-6.3
28	23 693	yes	F6/7 V	1.4	11.7	48.7	-79.	F115W	5.2	6.5	0.33	0.91	0.098	-6.3
29	102 485	no	F5 V	3.7	14.7	307.	-7.0	F115W	4.9	6.5	0.18	0.85	0.054	-6.3
30	57 443	no	G3/5 V	0.78	9.24	196.	-38.	F115W	5.4	6.5	0.37	0.87	0.11	-6.4
31	28 103	no	F2 V	5.5	15.0	88.9	-38.	F115W	4.6	6.4	0.11	0.61	0.032	-6.4
32	77 952	yes	F0 III/IV	9.6	12.3	252.	-42.	F070W	4.3	6.2	0.073	0.40	0.022	-6.4
33	71 284	no	F0	2.9	15.5	204.	42.	F115W	5.0	6.6	0.19	0.91	0.056	-6.4
34	59 199	no	F1 V	4.0	14.8	192.	-22.	F115W	5.0	6.6	0.17	0.81	0.050	-6.4
35	29 271	yes	G6 V	0.83	10.2	265.	-82.	F115W	5.4	6.5	0.32	0.81	0.095	-6.5
36	112 447	no	F5	4.3	16.3	348.	18.	F115W	4.9	6.5	0.12	0.76	0.037	-6.5
37	114 622	yes	K3 V	0.28	6.53	23.7	55.	F150W	5.3	6.3	0.27	0.68	0.081	-6.5
38	56 997	no	G8 V	0.59	9.54	161.	29.	F115W	5.4	6.5	0.26	0.68	0.078	-6.6
39	50 954	yes	F2/3 IV/V	5.0	16.2	228.	-68.	F115W	5.0	6.6	0.11	0.68	0.032	-6.6
40	53 721	no	G0	1.6	14.1	149.	31.	F115W	5.4	6.7	0.21	0.79	0.064	-6.6
41	47 592	no	G0 V	1.9	14.9	157.	-35.	F115W	5.5	6.8	0.20	0.82	0.059	-6.8
42	5862	no	G0 V	1.9	15.1	353.	-48.	F115W	5.5	6.9	0.19	0.82	0.058	-6.8
43	17 651	no	F3/5 V	5.0	17.9	47.4	-42.	F115W	5.1	6.7	0.079	0.67	0.024	-6.8
44	61 174	no	F2 V	4.7	18.2	194.	-12.	F115W	5.1	6.7	0.078	0.70	0.023	-6.8
45	99 825	no	K3 V	0.39	8.82	300.	-7.0	F150W	5.4	6.4	0.15	0.52	0.044	-6.8
46	86 796	no	G3 IV/V	1.8	15.3	267.	-28.	F115W	5.6	6.9	0.17	0.76	0.051	-6.9
47	71 957	no	F2 V	7.4	18.7	220.	9.7	F070W	5.2	6.6	0.072	0.55	0.022	-6.9
48	84 862	no	G0	1.2	14.4	255.	55.	F115W	5.5	6.9	0.15	0.61	0.044	-6.9
59	59 072	no	F0 IV	7.2	19.7	221.	-55.	F070W	5.3	6.7	0.067	0.56	0.020	-7.1
60	40 843	no	F6 V	2.2	18.1	121.	7.5	F115W	5.5	7.0	0.091	0.68	0.027	-7.1
61	3909	no	F7 V	1.6	15.5	7.26	-15.	F115W	5.8	7.1	0.15	0.68	0.044	-7.1
62	58 576	no	G8 IV	1.1	12.9	184.	-9.5	F115W	5.9	7.1	0.20	0.67	0.058	-7.1
63	19 893	no	F0 V	6.2	20.3	36.5	-70.	F070W	5.4	6.8	0.070	0.67	0.021	-7.2
64	81 300	no	K1 V	0.45	9.78	248.	20.	F115W	5.8	6.7	0.15	0.48	0.044	-7.2
65	22 263	no	G3 V	0.93	13.3	67.5	-39.	F115W	5.8	7.0	0.14	0.54	0.042	-7.2
66	15 330	no	G3/5 V	0.75	12.1	354.	-72.	F115W	5.8	6.9	0.14	0.52	0.043	-7.2
67	32 480	no	F9 V	1.7	16.5	99.0	21.	F115W	5.7	7.1	0.12	0.67	0.037	-7.2
68	8362	no	G9 V	0.52	9.98	54.0	48.	F115W	5.9	6.8	0.18	0.55	0.054	-7.2
69	910	no	F5 V	3.1	18.9	356.	-15.	F115W	5.5	7.0	0.079	0.75	0.024	-7.2
70	42 438	no	G0	0.93	14.3	112.	45.	F115W	5.7	7.0	0.099	0.45	0.030	-7.2
71	75 181	no	G3/5 V	0.98	14.6	241.	-29.	F115W	5.7	7.0	0.097	0.46	0.029	-7.3
72	34 834	no	F0 IV	6.1	21.2	125.	-68.	F070W	5.5	6.7	0.058	0.65	0.017	-7.3
73	64 792	no	G0	2.1	17.9	194.	16.	F115W	5.7	7.2	0.092	0.67	0.028	-7.3
74	79 672	no	G5 V	1.1	14.0	244.	13.	F115W	6.0	7.2	0.14	0.56	0.042	-7.4
75	97 675	no	G0	2.7	19.4	302.	31.	F115W	5.6	7.1	0.063	0.67	0.019	-7.4
76	3093	no	K0 V	0.54	11.1	17.5	16.	F115W	5.9	6.9	0.11	0.42	0.034	-7.4
77	73 996	no	F5 V	3.2	19.7	215.	40.	F115W	5.6	7.1	0.055	0.70	0.017	-7.4
78	113 357	no	G3 V	1.3	15.4	354.	25.	F115W	5.9	7.2	0.12	0.56	0.035	-7.4
79	36 439	no	F5	2.2	19.9	106.	27.	F115W	5.5	7.0	0.044	0.54	0.013	-7.4
80	50 564	no	F6 IV-V	4.1	21.2	150.	8.4	F070W	5.8	7.1	0.071	0.75	0.021	-7.5
81	97 295	no	F5.5 IV-V	3.4	20.9	309.	54.	F070W	5.8	7.1	0.081	0.73	0.024	-7.5
82	98 767	no	G7 IV-V	1.2	15.9	313.	49.	F115W	5.9	7.2	0.084	0.46	0.025	-7.5
83	32 439	no	F8 V	1.7	17.9	93.7	56.	F115W	5.8	7.2	0.075	0.54	0.022	-7.5
84	86 614	yes	F5	5.5	22.0	104.	84.	F070W	5.6	6.9	0.048	0.67	0.014	-7.5
85	16 245	no	F3 IV/V	4.5	21.4	355.	-74.	F070W	5.8	7.2	0.067	0.73	0.020	-7.6
86	29 800	no	F5 V	2.8	19.6	94.1	-11.	F115W	5.8	7.3	0.057	0.68	0.017	-7.6
87	107 649	no	G0 V	1.2	15.6	312.	-32.	F115W	6.0	7.3	0.092	0.48	0.028	-7.6
88	35 136	no	F9 V	1.3	16.9	104.	25.	F115W	5.9	7.3	0.078	0.47	0.023	-7.6
89	12 653	no	G0 V	1.6	17.2	8.24	-61.	F115W	6.0	7.4	0.092	0.57	0.028	-7.6
90	29 650	no	F5.5 IV-V	2.8	21.1	93.5	-4.2	F115W	5.4	7.0	0.024	0.54	0.0073	-7.6
91	51 523	no	F5 V	4.1	21.9	192.	-56.	F070W	5.8	7.0	0.058	0.71	0.017	-7.6
92	86 486	no	F2 V	4.5	21.9	266.	-26.	F070W	5.8	7.1	0.055	0.70	0.017	-7.6
93	56 452	no	K0 V	0.34	9.54	189.	-32.	F150W	5.9	6.8	0.065	0.31	0.019	-7.6
94	43 587	no	K0 IV-V	0.65	12.5	128.	10.	F115W	6.1	7.1	0.090	0.38	0.027	-7.6
95	110 649	no	G3 IV	3.0	20.5	312.	-44.	F115W	5.7	7.2	0.040	0.62	0.012	-7.6
96	38 908	no	G0 V	1.2	16.2	168.	-76.	F115W	6.1	7.4	0.083	0.46	0.025	-7.7
97	25 110	no	F7 V	3.2	21.0	86.9	56.	F070W	6.0	7.3	0.075	0.70	0.023	-7.7
98	7978	no	F8 V	1.5	17.4	351.	-57.	F115W	6.0	7.4	0.074	0.50	0.022	-7.7
99	3583	no	G1 V	0.89	14.9	346.	-47.	F115W	6.0	7.2	0.065	0.35	0.020	-7.7
100	18 859	no	F7/8 V	2.0	19.2	58.4	-21.	F115W	6.0	7.4	0.056	0.55	0.017	-7.8
101	91 438	no	G5 V	0.65	13.0	279.	2.1	F115W	6.1	7.2	0.067	0.32	0.020	-7.8
102	98 819	no	G0 V	1.2	17.7	308.	37.	F115W	6.0	7.4	0.041	0.34	0.012	-7.9
103	950	no	F3/5 V	2.9	21.8	347.	-33.	F070W	6.1	7.4	0.056	0.60	0.017	-7.9
104	26 394	no	G1 V	1.5	18.2	274.	-76.	F115W	6.1	7.5	0.052	0.43	0.016	-7.9
105	33 277	no	G0 V	1.2	17.3	102.	2.5	F115W	6.1	7.5	0.052	0.37	0.015	-8.0
106	98 470	no	F7 V	1.8	20.9	295.	-13.	F115W	5.7	7.4	0.019	0.35	0.0058	-8.0
107	40 693	no	K0 V	0.57	12.6	130.	-31.	F115W	6.2	7.3	0.055	0.27	0.016	-8.0
108	114 924	no	F8	1.9	20.3	20.1	51.	F115W	6.1	7.6	0.031	0.42	0.0093	-8.1
109	111 449	no	F7 V	3.3	22.7	333.	-11.	F070W	6.2	7.5	0.038	0.58	0.011	-8.1

Star catalog

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3	71 683	yes	G2 V	2.2	1.35	239.	-43.	F070W	2.4	6.1	0.55	1.0	0.17	-5.3
4	3821	yes	G0 V	1.2	5.95	40.2	47.	F115W	3.9	6.1	0.59	1.0	0.18	-5.4
5	99 240	yes	G6/8 IV	1.5	6.11	288.	-45.	F115W	4.1	6.2	0.56	1.0	0.17	-5.5
6	108 870	yes	K4/5 V	0.20	3.63	310.	-41.	F150W	4.5	6.1	0.65	1.0	0.19	-5.5
7	22 449	yes	F6 V	2.6	8.03	71.9	-15.	F115W	3.9	6.2	0.39	0.96	0.12	-5.6
8	19 849	yes	K0/1 V	0.41	5.04	60.2	-28.	F115W	4.7	6.2	0.64	1.0	0.19	-5.6
9	15 510	yes	G8 III	0.71	6.06	27.2	-58.	F115W	4.7	6.2	0.63	1.0	0.19	-5.6
10	2021	yes	G1 IV	3.9	7.47	301.	-65.	F070W	4.2	6.2	0.34	0.92	0.10	-5.7
11	27 072	yes	F6.5 V	2.3	8.97	84.8	-46.	F115W	4.5	6.2	0.41	0.98	0.12	-5.7
12	1599	yes	G0 V	1.2	8.59	322.	-58.	F115W	4.7	6.2	0.50	1.0	0.15	-5.8
13	64 394	yes	G0	1.3	9.15	184.	33.	F115W	4.8	6.3	0.47	1.0	0.14	-5.9
14	57 757	yes	F8	3.4	10.9	177.	0.69	F115W	4.3	6.2	0.27	0.88	0.080	-5.9
15	12 777	yes	F8	2.2	11.2	54.7	32.	F115W	4.6	6.3	0.36	0.99	0.11	-5.9
16	14 632	no	F9.5 V	2.2	10.5	59.3	31.	F115W	4.7	6.3	0.38	0.99	0.11	-5.9
17	96 100	yes	G9 V	0.41	5.77	30.3	81.	F115W	5.0	6.2	0.56	0.97	0.17	-5.9
18	105 858	yes	F7 V	1.4	9.22	299.	-47.	F115W	4.9	6.3	0.47	1.0	0.14	-5.9
19	64 924	no	G5 V	0.81	8.52	205.	-9.3	F115W	4.9	6.3	0.45	0.94	0.14	-5.9
20	78 072	no	F5	2.7	11.1	233.	35.	F115W	4.7	6.4	0.32	0.95	0.097	-6.0
21	15 457	no	G5 V	0.83	9.16	48.3	-14.	F115W	5.0	6.3	0.40	0.90	0.12	-6.0
22	16 852	no	F8 V	2.9	13.7	52.0	-18.	F115W	4.8	6.4	0.24	0.94	0.072	-6.1
23	7513	no	G0	3.3	13.5	38.6	29.	F115W	4.8	6.4	0.23	0.90	0.068	-6.1
24	24 813	no	G1 V	1.7	12.7	81.8	17.	F115W	4.9	6.4	0.30	0.94	0.089	-6.1
25	73 184	yes	K4 V	0.26	5.91	228.	-4.4	F150W	5.0	6.2	0.34	0.76	0.10	-6.2
26	116 771	no	F8	3.3	13.8	358.	7.2	F115W	4.9	6.4	0.22	0.90	0.066	-6.2
27	70 497	yes	F8	3.9	14.6	183.	60.	F115W	4.8	6.4	0.17	0.81	0.051	-6.3
28	23 693	yes	F6/7 V	1.4	11.7	48.7	-79.	F115W	5.2	6.5	0.33	0.91	0.098	-6.3
29	102 485	no	F5 V	3.7	14.7	307.	-7.0	F115W	4.9	6.5	0.18	0.85	0.054	-6.3
30	57 443	no	G3/5 V	0.78	9.24	196.	-38.	F115W	5.4	6.5	0.37	0.87	0.11	-6.4
31	28 103	no	F2 V	5.5	15.0	88.9	-38.	F115W	4.6	6.4	0.11	0.61	0.032	-6.4
32	77 952	yes	F0 III/IV	9.6	12.3	252.	-42.	F070W	4.3	6.2	0.073	0.40	0.022	-6.4
33	71 284	no	F0	2.9	15.5	204.	42.	F115W	5.0	6.6	0.19	0.91	0.056	-6.4
34	59 199	no	F1 V	4.0	14.8	192.	-22.	F115W	5.0	6.6	0.17	0.81	0.050	-6.4
35	29 271	yes	G6 V	0.83	10.2	265.	-82.	F115W	5.4	6.5	0.32	0.81	0.095	-6.5
36	112 447	no	F5	4.3	16.3	348.	18.	F115W	4.9	6.5	0.12	0.76	0.037	-6.5
37	114 622	yes	K3 V	0.28	6.53	23.7	55.	F150W	5.3	6.3	0.27	0.68	0.081	-6.5
38	56 997	no	G8 V	0.59	9.54	161.	29.	F115W	5.4	6.5	0.26	0.68	0.078	-6.6
39	50 954	yes	F2/3 IV/V	5.0	16.2	228.	-68.	F115W	5.0	6.6	0.11	0.68	0.032	-6.6
40	53 721	no	G0	1.6	14.1	149.	31.	F115W	5.4	6.7	0.21	0.79	0.064	-6.6
41	47 592	no	G0 V	1.9	14.9	157.	-35.	F115W	5.5	6.8	0.20	0.82	0.059	-6.8
42	5862	no	G0 V	1.9	15.1	353.	-48.	F115W	5.5	6.9	0.19	0.82	0.058	-6.8
43	17 651	no	F3/5 V	5.0	17.9	47.4	-42.	F115W	5.1	6.7	0.079	0.67	0.024	-6.8
44	61 174	no	F2 V	4.7	18.2	194.	-12.	F115W	5.1	6.7	0.078	0.70	0.023	-6.8
45	99 825	no	K3 V	0.39	8.82	300.	-7.0	F150W	5.4	6.4	0.15	0.52	0.044	-6.8
46	86 796	no	G3 IV/V	1.8	15.3	267.	-28.	F115W	5.6	6.9	0.17	0.76	0.051	-6.9
47	71 957	no	F2 V	7.4	18.7	220.	9.7	F070W	5.2	6.6	0.072	0.55	0.022	-6.9
48	84 862	no	G0	1.2	14.4	255.	55.	F115W	5.5	6.9	0.15	0.61	0.044	-6.9
59	59 072	no	F0 IV	7.2	19.7	221.	-55.	F070W	5.3	6.7	0.067	0.56	0.020	-7.1
60	40 843	no	F6 V	2.2	18.1	121.	7.5	F115W	5.5	7.0	0.091	0.68	0.027	-7.1
61	3909	no	F7 V	1.6	15.5	7.26	-15.	F115W	5.8	7.1	0.15	0.68	0.044	-7.1
62	58 576	no	G8 IV	1.1	12.9	184.	-9.5	F115W	5.9	7.1	0.20	0.67	0.058	-7.1
63	19 893	no	F0 V	6.2	20.3	36.5	-70.	F070W	5.4	6.8	0.070	0.67	0.021	-7.2
64	81 300	no	K1 V	0.45	9.78	248.	20.	F115W	5.8	6.7	0.15	0.48	0.044	-7.2
65	22 263	no	G3 V	0.93	13.3	67.5	-39.	F115W	5.8	7.0	0.14	0.54	0.042	-7.2
66	15 330	no	G3/5 V	0.75	12.1	354.	-72.	F115W	5.8	6.9	0.14	0.52	0.043	-7.2
67	32 480	no	F9 V	1.7	16.5	99.0	21.	F115W	5.7	7.1	0.12	0.67	0.037	-7.2
68	8362	no	G9 V	0.52	9.98	54.0	48.	F115W	5.9	6.8	0.18	0.55	0.054	-7.2
69	910	no	F5 V	3.1	18.9	356.	-15.	F115W	5.5	7.0	0.079	0.75	0.024	-7.2
70	42 438	no	G0	0.93	14.3	112.	45.	F115W	5.7	7.0	0.099	0.45	0.030	-7.2
71	75 181	no	G3/5 V	0.98	14.6	241.	-29.	F115W	5.7	7.0	0.097	0.46	0.029	-7.3
72	34 834	no	F0 IV	6.1	21.2	125.	-68.	F070W	5.5	6.7	0.058	0.65	0.017	-7.3
73	64 792	no	G0	2.1	17.9	194.	16.	F115W	5.7	7.2	0.092	0.67	0.028	-7.3
74	79 672	no	G5 V	1.1	14.0	244.	13.	F115W	6.0	7.2	0.14	0.56	0.042	-7.4
75	97 675	no	G0	2.7	19.4	302.	31.	F115W	5.6	7.1	0.063	0.67	0.019	-7.4
76	3093	no	K0 V	0.54	11.1	17.5	16.	F115W	5.9	6.9	0.11	0.42	0.034	-7.4
77	73 996	no	F5 V	3.2	19.7	215.	40.	F115W	5.6	7.1	0.055	0.70	0.017	-7.4
78	113 357	no	G3 V	1.3	15.4	354.	25.	F115W	5.9	7.2	0.12	0.56	0.035	-7.4
79	36 439	no	F5	2.2	19.9	106.	27.	F115W	5.5	7.0	0.044	0.54	0.013	-7.4
80	50 564	no	F6 IV-V	4.1	21.2	150.	8.4	F070W	5.8	7.1	0.071	0.75	0.021	-7.5
81	97 295	no	F5.5 IV-V	3.4	20.9	309.	54.	F070W	5.8	7.1	0.081	0.73	0.024	-7.5
82	98 767	no	G7 IV-V	1.2	15.9	313.	49.	F115W	5.9	7.2	0.084	0.46	0.025	-7.5
83	32 439	no	F8 V	1.7	17.9	93.7	56.	F115W	5.8	7.2	0.075	0.54	0.022	-7.5
84	86 614	yes	F5	5.5	22.0	104.	84.	F070W	5.6	6.9	0.048	0.67	0.014	-7.5
85	16 245	no	F3 IV/V	4.5	21.4	355.	-74.	F070W	5.8	7.2	0.067	0.73	0.020	-7.6
86	29 800	no	F5 V	2.8	19.6	94.1	-11.	F115W	5.8	7.3	0.057	0.68	0.017	-7.6
87	107 649	no	G0 V	1.2	15.6	312.	-32.	F115W	6.0	7.3	0.092	0.48	0.028	-7.6
88	35 136	no	F9 V	1.3	16.9	104.	25.	F115W	5.9	7.3	0.078	0.47	0.023	-7.6
89	12 653	no	G0 V	1.6	17.2	8.24	-61.	F115W	6.0	7.4	0.092	0.57	0.028	-7.6
90	29 650	no	F5.5 IV-V	2.8	21.1	93.5	-4.2	F115W	5.4	7.0	0.024	0.54	0.0073	-7.6
91	51 523	no	F5 V	4.1	21.9	192.	-56.	F070W	5.8	7.0	0.058	0.71	0.017	-7.6
92	86 486	no	F2 V	4.5	21.9	266.	-26.	F070W	5.8	7.1	0.055	0.70	0.017	-7.6
93	56 452	no	K0 V	0.34	9.54	189.	-32.	F150W	5.9	6.8	0.065	0.31	0.019	-7.6
94	43 587	no	K0 IV-V	0.65	12.5	128.	10.	F115W	6.1	7.1	0.090	0.38	0.027	-7.6
95	110 649	no	G3 IV	3.0	20.5	312.	-44.	F115W	5.7	7.2	0.040	0.62	0.012	-7.6
96	38 908	no	G0 V	1.2	16.2	168.	-76.	F115W	6.1	7.4	0.083	0.46	0.025	-7.7
97	25 110	no	F7 V	3.2	21.0	86.9	56.	F070W	6.0	7.3	0.075	0.70	0.023	-7.7
98	7978	no	F8 V	1.5	17.4	351.	-57.	F115W	6.0	7.4	0.074	0.50	0.022	-7.7
99	3583	no	G1 V	0.89	14.9	346.	-47.	F115W	6.0	7.2	0.065	0.35	0.020	-7.7
100	18 859	no	F7/8 V	2.0	19.2	58.4	-21.	F115W	6.0	7.4	0.056	0.55	0.017	-7.8
101	91 438	no	G5 V	0.65	13.0	279.	2.1	F115W	6.1	7.2	0.067	0.32	0.020	-7.8
102	98 819	no	G0 V	1.2	17.7	308.	37.	F115W	6.0	7.4	0.041	0.34	0.012	-7.9
103	950	no	F3/5 V	2.9	21.8	347.	-33.	F070W	6.1	7.4	0.056	0.60	0.017	-7.9
104	26 394	no	G1 V	1.5	18.2	274.	-76.	F115W	6.1	7.5	0.052	0.43	0.016	-7.9
105	33 277	no	G0 V	1.2	17.3	102.	2.5	F115W	6.1	7.5	0.052	0.37	0.015	-8.0
106	98 470	no	F7 V	1.8	20.9	295.	-13.	F115W	5.7	7.4	0.019	0.35	0.0058	-8.0
107	40 693	no	K0 V	0.57	12.6	130.	-31.	F115W	6.2	7.3	0.055	0.27	0.016	-8.0
108	114 924	no	F8	1.9	20.3	20.1	51.	F115W	6.1	7.6	0.031	0.42	0.0093	-8.1
109	111 449	no	F7 V	3.3	22.7	333.	-11.	F070W	6.2	7.5	0.038	0.58	0.011	-8.1

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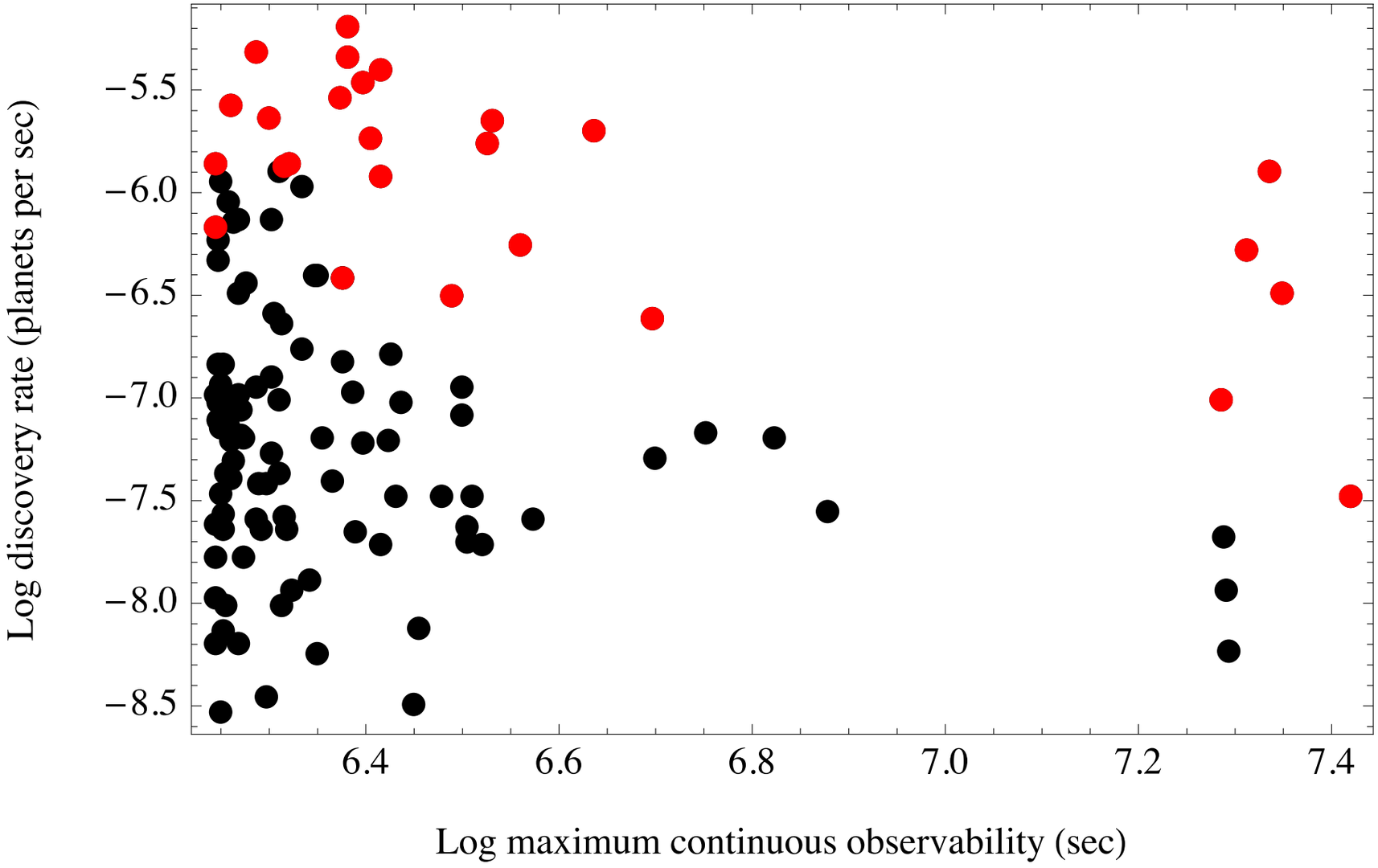
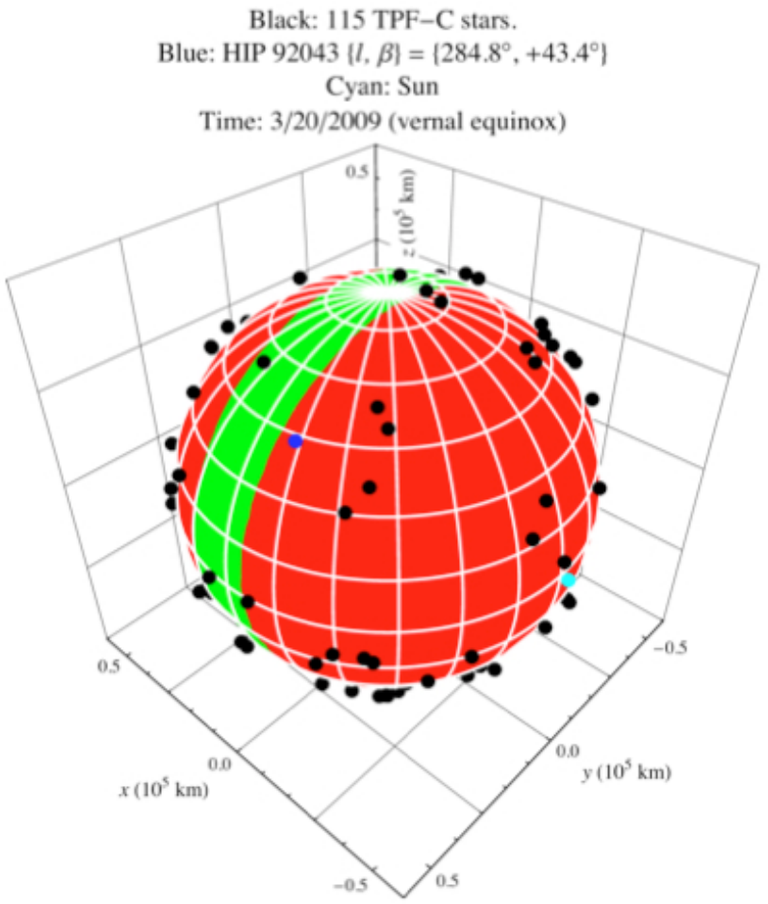
	HIP	∈26?	Type	Lum	Dist	Ecl Long	Ecl Lat	Filter	Log exp time	Log max time	c_1	C_∞	p	Log rate
1	71681	yes	K1 V	0.61	1.35	239.	-43.	F070W	3.2	6.1	0.80	1.0	0.24	-5.2
2	8102	yes	G8 V	0.47	3.65	17.8	-25.	F115W	4.0	6.1	0.76	1.0	0.23	-5.3
3	71683	yes	G2 V	2.2	1.35	239.	-43.	F070W	2.4	6.1	0.55	1.0	0.17	-5.3
4	3821	yes	G0 V	1.2	5.95	40.2	47.	F115W	3.9	6.1	0.59	1.0	0.18	-5.4
15	12777	yes	F8	2.2	11.2	54.7	-32.	F115W	4.6	6.3	0.36	0.99	0.12	-5.9
16	14632	no	F9.5 V	2.2	10.5	59.3	31.	F115W	4.7	6.3	0.38	0.99	0.11	-5.9
17	96100	yes	G9 V	0.41	5.77	30.3	81.	F115W	5.0	6.2	0.56	0.97	0.17	-5.9
18	105858	yes	F7 V	1.4	9.22	299.	-47.	F115W	4.9	6.3	0.47	1.0	0.14	-5.9
19	64924	no	G5 V	0.81	8.52	205.	-9.3	F115W	4.9	6.3	0.45	0.94	0.14	-5.9
20	78072	no	F5	2.7	11.1	233.	35.	F115W	4.7	6.4	0.32	0.95	0.097	-6.0
21	15457	no	G5 V	0.83	9.16	48.3	-14.	F115W	5.0	6.3	0.40	0.90	0.12	-6.0
22	16852	no	F8 V	2.9	13.7	52.0	-18.	F115W	4.8	6.4	0.24	0.94	0.072	-6.1
23	7513	no	G0	3.3	13.5	38.6	29.	F115W	4.8	6.4	0.23	0.90	0.068	-6.1
24	24813	no	G1 V	1.7	12.7	81.8	17.	F115W	4.9	6.4	0.30	0.94	0.089	-6.1
25	73184	yes	K4 V	0.26	5.91	228.	-4.4	F150W	5.0	6.2	0.34	0.76	0.10	-6.2
26	116771	no	F8	3.3	13.8	358.	7.2	F115W	4.9	6.4	0.22	0.90	0.066	-6.2
27	70497	yes	F8	3.9	14.6	183.	60.	F115W	4.8	6.4	0.17	0.81	0.051	-6.3
28	23693	yes	F6/7 V	1.4	11.7	48.7	-79.	F115W	5.2	6.5	0.33	0.91	0.098	-6.3
29	102485	no	F5 V	3.7	14.7	307.	-7.0	F115W	4.9	6.5	0.18	0.85	0.054	-6.3
30	57443	no	G3/5 V	0.78	9.24	196.	-38.	F115W	5.4	6.5	0.37	0.87	0.11	-6.4
31	28103	no	F2 V	5.5	15.0	88.9	-38.	F115W	4.6	6.4	0.11	0.61	0.032	-6.4
32	77952	yes	F0 III/IV	9.6	12.3	252.	-42.	F070W	4.3	6.2	0.073	0.40	0.022	-6.4
33	71284	no	F0	2.9	15.5	204.	42.	F115W	5.0	6.6	0.19	0.91	0.056	-6.4
34	59199	no	F1 V	4.0	14.8	192.	-22.	F115W	5.0	6.6	0.17	0.81	0.050	-6.4
35	29271	yes	G6 V	0.83	10.2	265.	-82.	F115W	5.4	6.5	0.32	0.81	0.095	-6.5
36	112447	no	F5	4.3	16.3	348.	18.	F115W	4.9	6.5	0.12	0.76	0.037	-6.5
37	114622	yes	K3 V	0.28	6.53	23.7	55.	F150W	5.3	6.3	0.27	0.68	0.081	-6.5
38	56997	no	G8 V	0.59	9.54	161.	29.	F115W	5.4	6.5	0.26	0.68	0.078	-6.6
39	50954	yes	F2/3 IV/V	5.0	16.2	228.	-68.	F115W	5.0	6.6	0.11	0.68	0.032	-6.6
40	53721	no	G0	1.6	14.1	149.	31.	F115W	5.4	6.7	0.21	0.79	0.064	-6.6
41	47592	no	G0 V	1.9	14.9	157.	-35.	F115W	5.5	6.8	0.20	0.82	0.059	-6.8
42	5862	no	G0 V	1.9	15.1	353.	-48.	F115W	5.5	6.9	0.19	0.82	0.058	-6.8
43	17651	no	F3/5 V	5.0	17.9	47.4	-42.	F115W	5.1	6.7	0.079	0.67	0.024	-6.8
44	61174	no	F2 V	4.7	18.2	194.	-12.	F115W	5.1	6.7	0.078	0.70	0.023	-6.8
45	99825	no	K3 V	0.39	8.82	300.	-7.0	F150W	5.4	6.4	0.15	0.52	0.044	-6.8
46	86796	no	G3 IV/V	1.8	15.3	267.	-28.	F115W	5.6	6.9	0.17	0.76	0.051	-6.9
47	71957	no	F2 V	7.4	18.7	220.	9.7	F070W	5.2	6.6	0.072	0.55	0.022	-6.9
48	84862	no	G0	1.2	14.4	255.	55.	F115W	5.5	6.9	0.15	0.61	0.044	-6.9
75	97675	no	G0	2.7	19.4	302.	31.	F115W	5.6	7.1	0.063	0.67	0.019	-7.4
76	3093	no	K0 V	0.54	11.1	17.5	16.	F115W	5.9	6.9	0.11	0.42	0.034	-7.4
77	73996	no	F5 V	3.2	19.7	215.	40.	F115W	5.6	7.1	0.055	0.70	0.017	-7.4
78	113357	no	G3 V	1.3	15.4	354.	25.	F115W	5.9	7.2	0.12	0.56	0.035	-7.4
79	36439	no	F5	2.2	19.9	106.	27.	F115W	5.5	7.0	0.044	0.54	0.013	-7.4
80	50564	no	F6 IV-V	4.1	21.2	150.	8.4	F070W	5.8	7.1	0.071	0.75	0.021	-7.5
81	97295	no	F5.5 IV-V	3.4	20.9	309.	54.	F070W	5.8	7.1	0.081	0.73	0.024	-7.5
82	98767	no	G7 IV-V	1.2	15.9	313.	49.	F115W	5.9	7.2	0.084	0.46	0.025	-7.5
83	32439	no	F8 V	1.7	17.9	93.7	56.	F115W	5.8	7.2	0.075	0.54	0.022	-7.5
84	86614	yes	F5	5.5	22.0	104.	84.	F070W	5.6	6.9	0.048	0.67	0.014	-7.5
85	16245	no	F3 IV/V	4.5	21.4	355.	-74.	F070W	5.8	7.2	0.067	0.73	0.020	-7.6
86	29800	no	F5 V	2.8	19.6	94.1	-11.	F115W	5.8	7.3	0.057	0.68	0.017	-7.6
87	107649	no	G0 V	1.2	15.6	312.	-32.	F115W	6.0	7.3	0.092	0.48	0.028	-7.6
88	35136	no	F9 V	1.3	16.9	104.	25.	F115W	5.9	7.3	0.078	0.47	0.023	-7.6
89	12653	no	G0 V	1.6	17.2	8.24	-61.	F115W	6.0	7.4	0.092	0.57	0.028	-7.6
90	29650	no	F5.5 IV-V	2.8	21.1	93.5	-4.2	F115W	5.4	7.0	0.024	0.54	0.0073	-7.6
91	51523	no	F5 V	4.1	21.9	192.	-56.	F070W	5.8	7.0	0.058	0.71	0.017	-7.6
92	86486	no	F2 V	4.5	21.9	266.	-26.	F070W	5.8	7.1	0.055	0.70	0.017	-7.6
93	56452	no	K0 V	0.34	9.54	189.	-32.	F150W	5.9	6.8	0.065	0.31	0.019	-7.6
94	43587	no	K0 IV-V	0.65	12.5	128.	10.	F115W	6.1	7.1	0.090	0.38	0.027	-7.6
95	110649	no	G3 IV	3.0	20.5	312.	-44.	F115W	5.7	7.2	0.040	0.62	0.012	-7.6
96	38908	no	G0 V	1.2	16.2	168.	-76.	F115W	6.1	7.4	0.083	0.46	0.025	-7.7
97	25110	no	F7 V	3.2	21.0	86.9	56.	F070W	6.0	7.3	0.075	0.70	0.023	-7.7
98	7978	no	F8 V	1.5	17.4	351.	-57.	F115W	6.0	7.4	0.074	0.50	0.022	-7.7
99	3583	no	G1 V	0.89	14.9	346.	-47.	F115W	6.0	7.2	0.065	0.35	0.020	-7.7
100	18859	no	F7/8 V	2.0	19.2	58.4	-21.	F115W	6.0	7.4	0.056	0.55	0.017	-7.8
101	91438	no	G5 V	0.65	13.0	279.	2.1	F115W	6.1	7.2	0.067	0.32	0.020	-7.8
102	98819	no	G0 V	1.2	17.7	308.	37.	F115W	6.0	7.4	0.041	0.34	0.012	-7.9
103	950	no	F3/5 V	2.9	21.8	347.	-33.	F070W	6.1	7.4	0.056	0.60	0.017	-7.9
104	26394	no	G1 V	1.5	18.2	274.	-76.	F115W	6.1	7.5	0.052	0.43	0.016	-7.9
105	33277	no	G0 V	1.2	17.3	102.	2.5	F115W	6.1	7.5	0.052	0.37	0.015	-8.0
106	98470	no	F7 V	1.8	20.9	295.	-13.	F115W	5.7	7.4	0.019	0.35	0.0058	-8.0
107	40693	no	K0 V	0.57	12.6	130.	-31.	F115W	6.2	7.3	0.055	0.27	0.016	-8.0
108	114924	no	F8	1.9	20.3	20.1	51.	F115W	6.1	7.6	0.031	0.42	0.0093	-8.1
109	111449	no	F7 V	3.3	22.7	333.	-11.	F070W	6.2	7.5	0.038	0.58	0.011	-8.1

Discovery rates





DRM example

	HIP	Filter	Visit	p	Log LSO cost	Rate	Disc	Log obs time	Log clock time	Log cum obs time	Log cum clock time
1	71681	F070W	1	0.24	4.6	-5.2	no	4.6	5.8	4.6	5.8
2	8102	F115W	1	0.23	4.7	-5.3	no	4.7	5.8	4.9	6.1
3	71683	F070W	1	0.17	4.6	-5.3	no	4.6	5.8	5.1	6.3
4	3821	F115W	1	0.18	4.7	-5.4	no	4.7	5.8	5.2	6.4
5	99240	F115W	1	0.17	4.7	-5.5	no	4.7	5.8	5.3	6.5
6	108870	F150W	1	0.19	4.8	-5.5	no	4.8	5.8	5.4	6.6
7	22449	F115W	1	0.12	4.6	-5.6	no	4.6	5.8	5.5	6.7
8	19849	F115W	1	0.19	4.9	-5.6	yes	5.3	6.2	5.7	6.8
9	15510	F115W	1	0.19	4.9	-5.6	no	4.9	5.8	5.8	6.8
10	71683	F070W	2	0.079	4.6	-5.7	no	4.6	5.8	5.8	6.9
11	2021	F070W	1	0.10	4.7	-5.7	no	4.7	5.8	5.9	6.9
12	27072	F115W	1	0.12	4.8	-5.7	yes	5.7	6.2	6.1	7.0
13	1599	F115W	1	0.15	4.9	-5.8	no	4.9	5.8	6.1	7.0
14	3821	F115W	2	0.077	4.7	-5.8	no	4.7	5.8	6.1	7.0
15	22449	F115W	2	0.070	4.6	-5.8	no	4.6	5.8	6.2	7.1
16	99240	F115W	2	0.079	4.7	-5.8	no	4.7	5.8	6.2	7.1
17	71681	F070W	2	0.054	4.6	-5.8	no	4.6	5.8	6.2	7.1

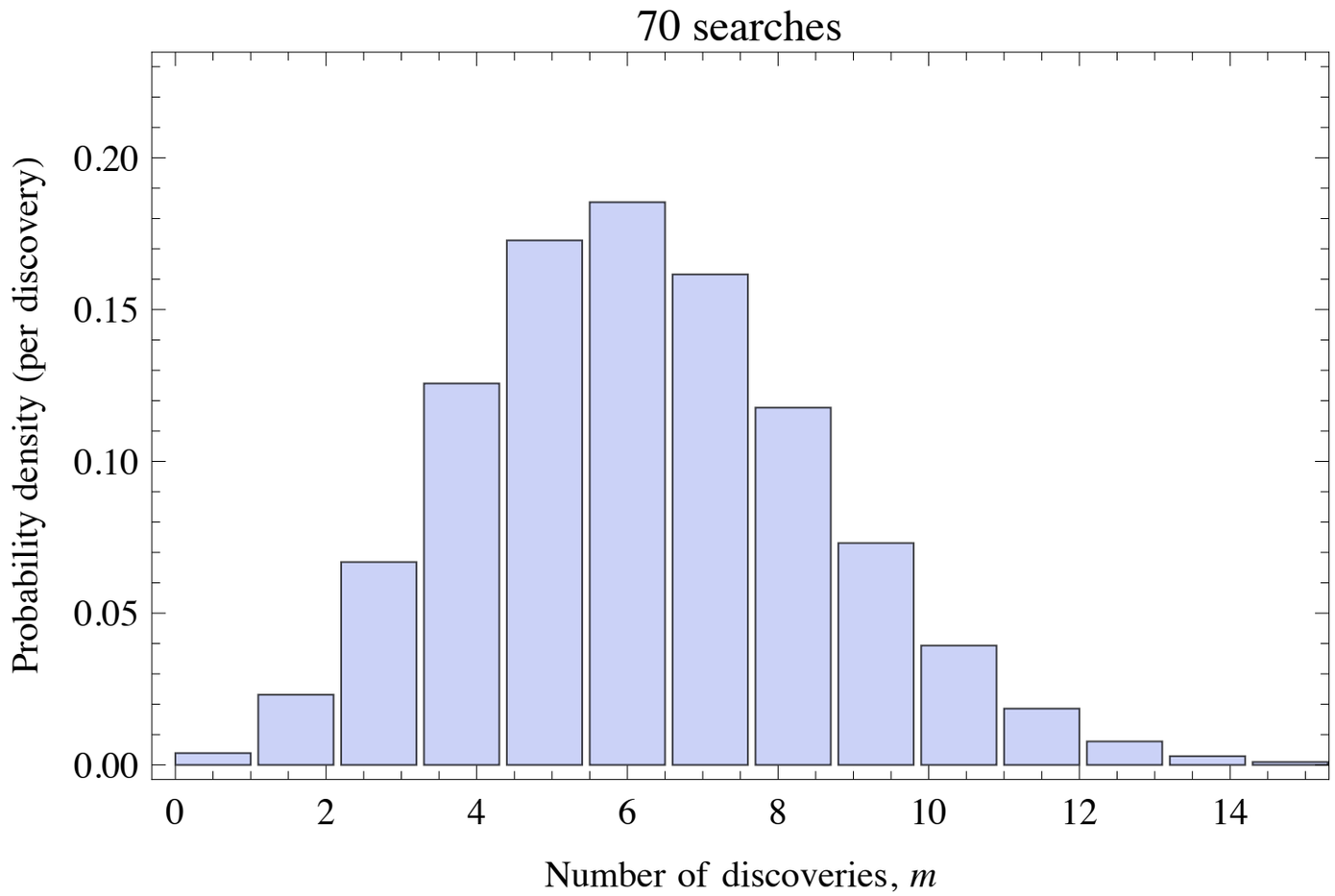
DRM example

7	22 449	F115W	1	0.12	4.6	−5.6	no	4.6	5.8	5.5	6.7
8	19 849	F115W	1	0.19	4.9	−5.6	yes	5.3	6.2	5.7	6.8
9	15 510	F115W	1	0.19	4.9	−5.6	no	4.9	5.8	5.8	6.8
10	71 683	F070W	2	0.079	4.6	−5.7	no	4.6	5.8	5.8	6.9
11	2021	F070W	1	0.10	4.7	−5.7	no	4.7	5.8	5.9	6.9
12	27 072	F115W	1	0.12	4.8	−5.7	yes	5.7	6.2	6.1	7.0
13	1599	F115W	1	0.15	4.9	−5.8	no	4.9	5.8	6.1	7.0
14	3821	F115W	2	0.077	4.7	−5.8	no	4.7	5.8	6.1	7.0
15	22 449	F115W	2	0.070	4.6	−5.8	no	4.6	5.8	6.2	7.1
16	99 240	F115W	2	0.079	4.7	−5.8	no	4.7	5.8	6.2	7.1
17	71 681	F070W	2	0.054	4.6	−5.8	no	4.6	5.8	6.2	7.1
18	64 394	F115W	1	0.14	5.0	−5.9	no	5.0	5.8	6.2	7.1
19	57 757	F115W	1	0.080	4.8	−5.9	no	4.8	5.8	6.2	7.2
20	12 777	F115W	1	0.11	4.9	−5.9	no	4.9	5.8	6.2	7.2
21	8102	F115W	2	0.059	4.7	−5.9	no	4.7	5.8	6.3	7.2
22	96 100	F115W	1	0.17	5.1	−5.9	yes	5.6	6.2	6.3	7.2
23	2021	F070W	2	0.063	4.7	−5.9	no	4.7	5.8	6.3	7.3
24	105 858	F115W	1	0.14	5.1	−5.9	no	5.1	5.9	6.4	7.3
25	71 683	F070W	3	0.040	4.6	−6.0	no	4.6	5.8	6.4	7.3
26	22 449	F115W	3	0.044	4.6	−6.0	no	4.6	5.8	6.4	7.3
27	108 870	F150W	2	0.065	4.8	−6.0	no	4.8	5.8	6.4	7.3
28	57 757	F115W	2	0.055	4.8	−6.0	no	4.8	5.8	6.4	7.3
29	1599	F115W	2	0.075	4.9	−6.1	no	4.9	5.8	6.4	7.3
30	12 777	F115W	2	0.069	4.9	−6.1	no	4.9	5.8	6.4	7.4
31	15 510	F115W	2	0.071	4.9	−6.1	no	4.9	5.8	6.4	7.4
32	3821	F115W	3	0.038	4.7	−6.1	no	4.7	5.8	6.5	7.4
33	99 240	F115W	3	0.041	4.7	−6.1	no	4.7	5.8	6.5	7.4

DRM example

25	71683	F070W	3	0.040	4.6	-6.0	no	4.6	5.8	6.4	7.3
26	22449	F115W	3	0.044	4.6	-6.0	no	4.6	5.8	6.4	7.3
27	108870	F150W	2	0.065	4.8	-6.0	no	4.8	5.8	6.4	7.3
28	57757	F115W	2	0.055	4.8	-6.0	no	4.8	5.8	6.4	7.3
29	1599	F115W	2	0.075	4.9	-6.1	no	4.9	5.8	6.4	7.3
30	12777	F115W	2	0.069	4.9	-6.1	no	4.9	5.8	6.4	7.4
31	15510	F115W	2	0.071	4.9	-6.1	no	4.9	5.8	6.4	7.4
32	3821	F115W	3	0.038	4.7	-6.1	no	4.7	5.8	6.5	7.4
33	99240	F115W	3	0.041	4.7	-6.1	no	4.7	5.8	6.5	7.4
34	2021	F070W	3	0.042	4.7	-6.1	no	4.7	5.8	6.5	7.4
35	64394	F115W	2	0.074	5.0	-6.1	no	5.0	5.8	6.5	7.4
36	22449	F115W	4	0.030	4.6	-6.2	no	4.6	5.8	6.5	7.4
37	73184	F150W	1	0.10	5.2	-6.2	no	5.2	5.9	6.5	7.4
38	57757	F115W	3	0.039	4.8	-6.2	no	4.8	5.8	6.5	7.4
39	105858	F115W	2	0.075	5.1	-6.2	no	5.1	5.9	6.5	7.5
40	71683	F070W	4	0.022	4.6	-6.2	no	4.6	5.8	6.5	7.5
41	12777	F115W	3	0.046	4.9	-6.2	no	4.9	5.8	6.5	7.5
42	2021	F070W	4	0.029	4.7	-6.3	no	4.7	5.8	6.6	7.5
43	70497	F115W	1	0.051	5.0	-6.3	no	5.0	5.8	6.6	7.5
44	23693	F115W	1	0.098	5.3	-6.3	no	5.3	5.9	6.6	7.5
45	57757	F115W	4	0.029	4.8	-6.3	no	4.8	5.8	6.6	7.5
46	1599	F115W	3	0.043	4.9	-6.3	no	4.9	5.8	6.6	7.5
47	108870	F150W	3	0.032	4.8	-6.3	no	4.8	5.8	6.6	7.5
48	8102	F115W	3	0.022	4.7	-6.3	yes	5.1	6.1	6.6	7.6
49	64394	F115W	3	0.045	5.0	-6.3	no	5.0	5.8	6.6	7.6
50	71681	F070W	3	0.017	4.6	-6.4	no	4.6	5.8	6.6	7.6

PDF of discoveries



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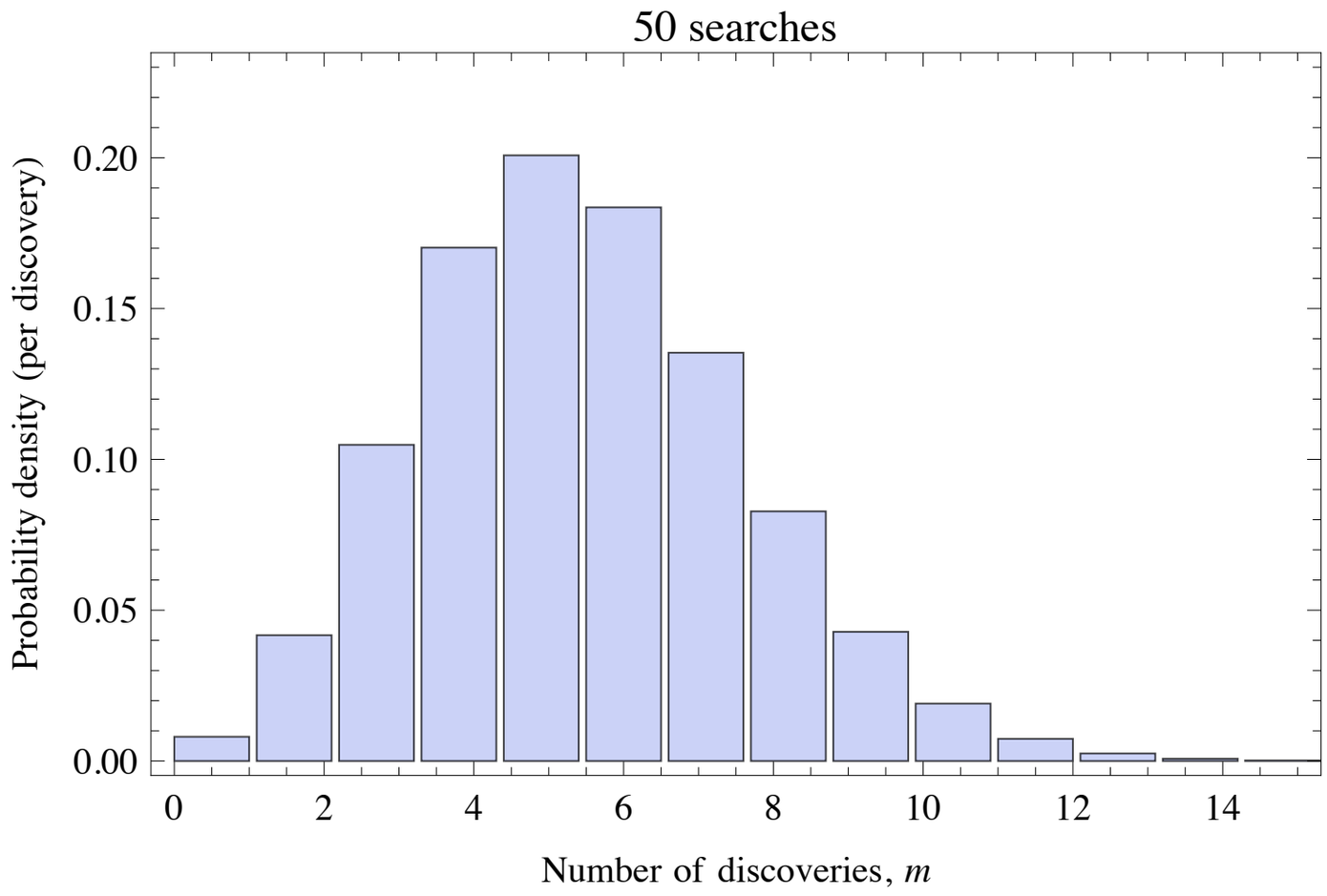

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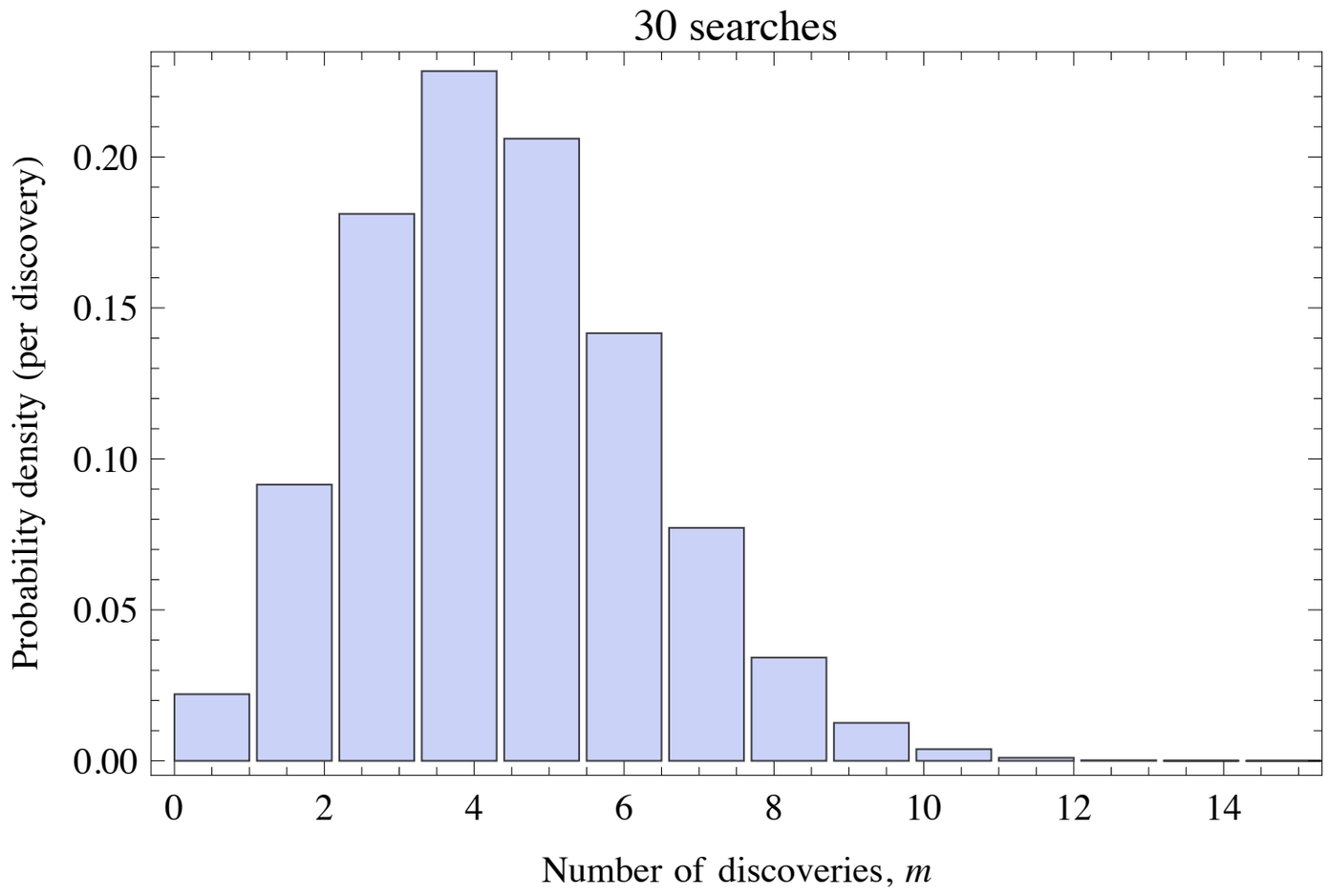
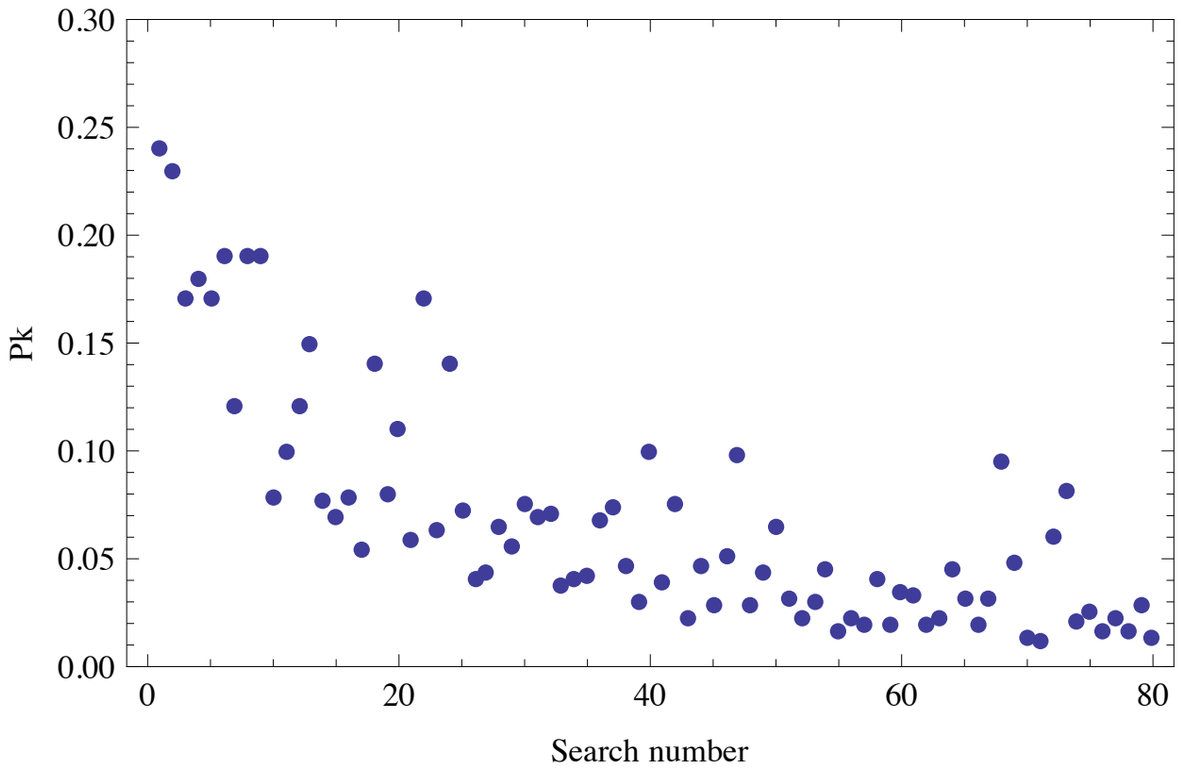
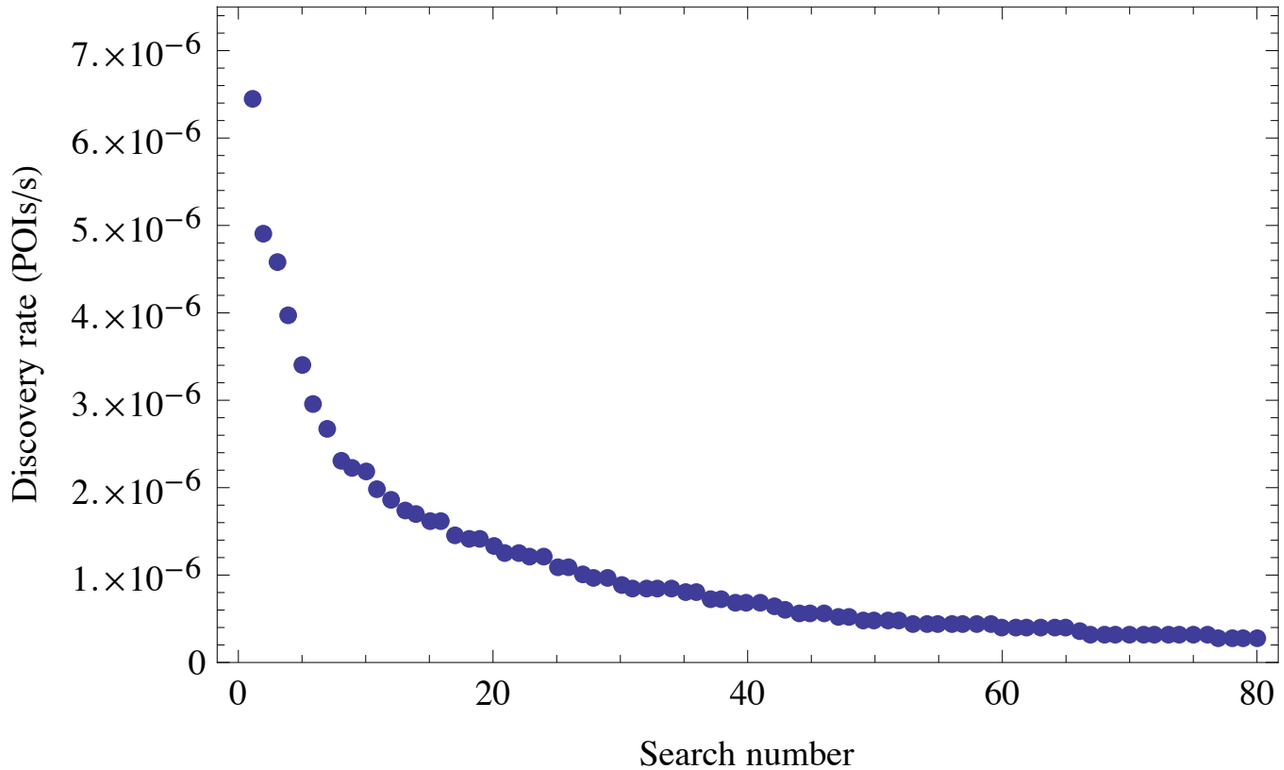
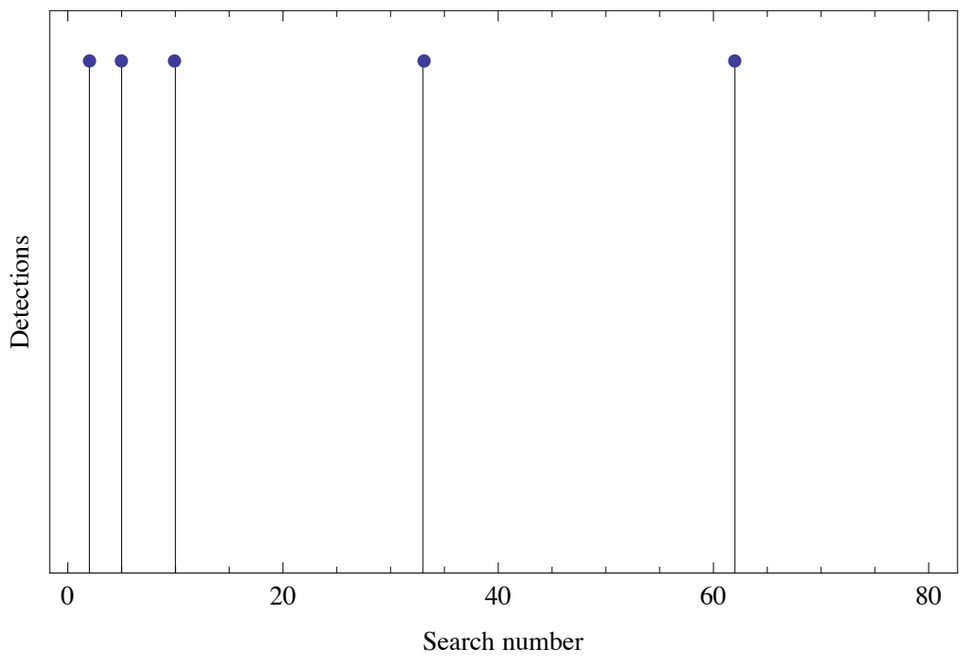


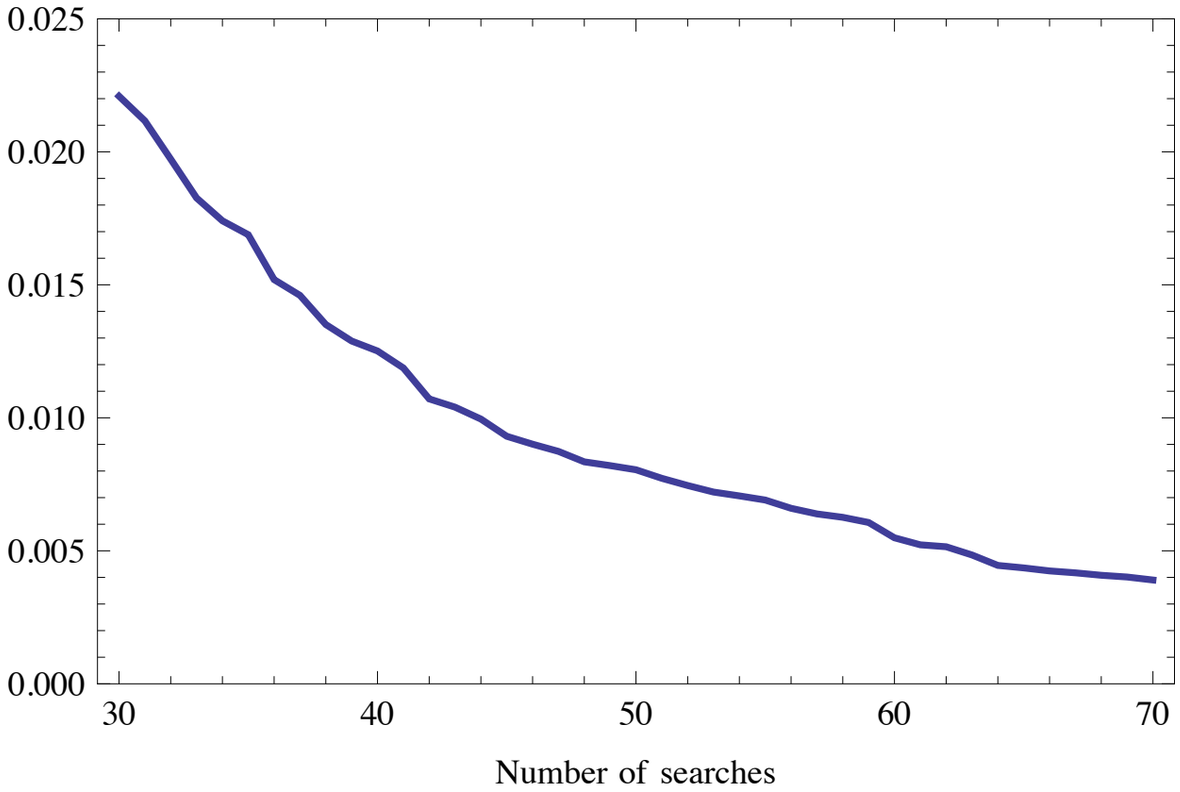
Probability of detection & discovery rate

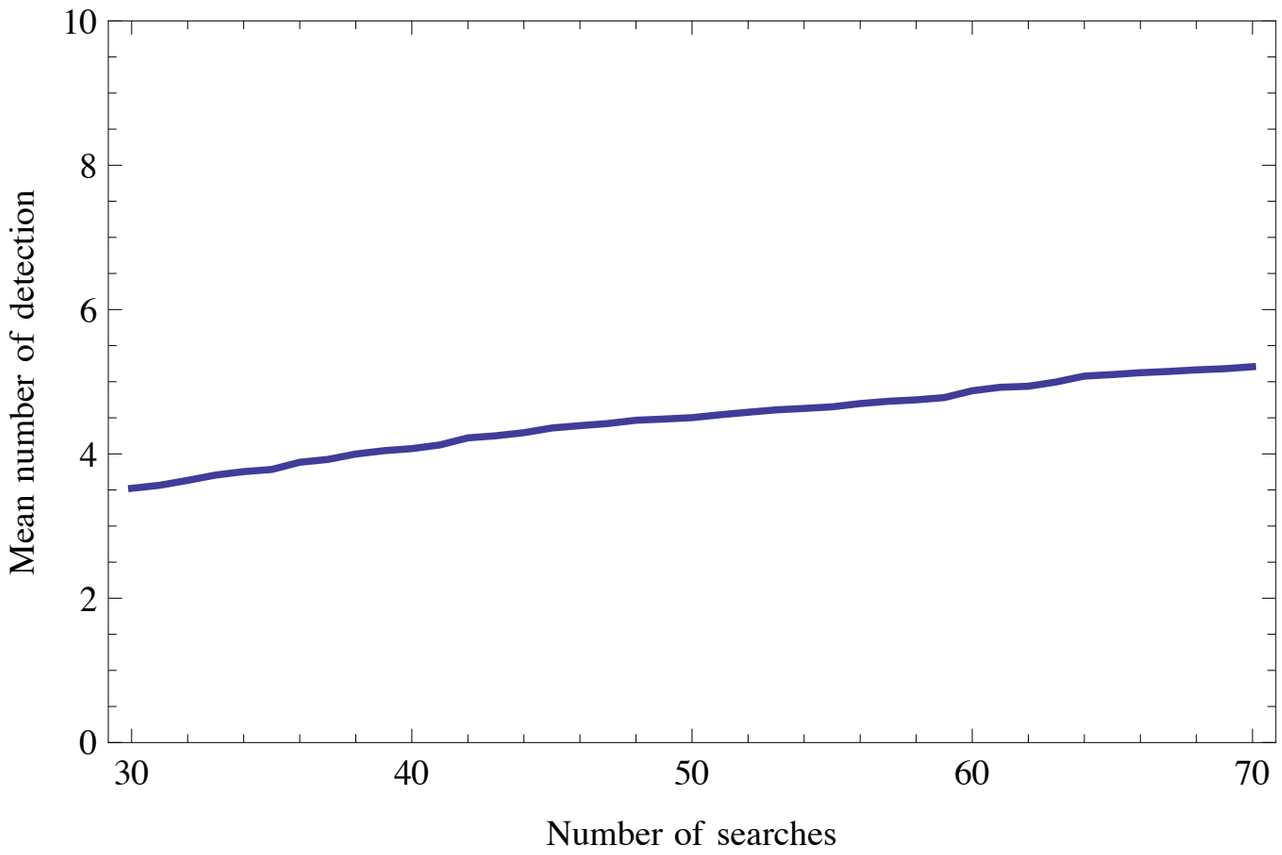






Mean detections & probability of zero detection





extra slides

Exposure time estimation: imaging

Filter Name	wavelength (μm)	Star (Jy)	Contrast	Δm	ExpTime (s)	ExpTime (hours)
F070W	0.7	54.1	1.32×10^{-10}	24.70	155,627	43
F115W	1.15	58.2	1.08×10^{-10}	24.91	69,018	19
F150W	1.5	52.4	5.91×10^{-11}	25.57	258,077	72
F140M	1.4	53.7	1.20×10^{-11}	27.30	18,606,700	5169
F162M	1.62	50.6	1.04×10^{-10}	24.96	284,017	79

Exposure time calculations for each of the NIRCam filters assuming an Earth twin around the Sun at 10 pc. The calculation includes an exozodiacal disk identical to our solar system disk with a 20% margin applied to the total background. The brightness of the planet accounts for the spectral features included in the effective albedo for each filter. All these estimations are background limited. Note that F140M corresponds exactly to a water band and a non-detection in this filter together with a detection in F162M would be most interesting.

Exposure time estimation: spectroscopy

Detection of water

Planet type, Mass	Separation (AU)	distance (pc)	significance	ExpTime(s)	ExpTime (hours)
Earth-like, 1 M_{Earth}	1	10	5 σ	73,400	20
Earth-like, 5 M_{Earth}	1	10	5 σ	8600	2.4
Earth-like 5 M_{Earth}	0.8	8	5 σ	3600	1

Exposure times required for a 5σ significance detection of water with the prism, assuming zodiacal and exozodiacal background, one additional zodi for telescope stray light. This assumes an upgraded target acquisition filter in NIRSpec.

Detection of oxygen

Planet type, Mass	Separation (AU)	distance (pc)	significance	ExpTime(s)	ExpTime (hours)
Earth-like, 5 M_{Earth}	1	10	3 σ	1.06×10^6	295
Earth-like, 5 M_{Earth}	0.8	8	3 σ	436,000	121
Earth-like, 8 M_{Earth}	1	10	3 σ	574,000	160
Earth-like 8 M_{Earth}	0.8	8	3 σ	236,000	66

Exposure time estimation for the detection of 1.26 μm oxygen in the atmosphere of a habitable terrestrial planet. The exposure time is calculated for a 3 σ detection of the spectral feature, based on an estimation of the measurement of the line depth. The simulation includes residual starlight, and background, but does not include contamination from zeroth order, and higher order diffraction. The calculation include a stray light within NIRSpec of 5% of the total red leak counts, and LSF wings 100 x worse than the diffraction limited profile. This calculation assumes an upgraded filter in NIRSpec