TABLE 1
Model Comparison

AICc Qualitative Comparison	Free Parameters	$N_{\rm free}$	$N_{\rm data}$	RMS	$\ln \mathcal{L}$	BIC	AICc	ΔAICc
AICc Favored Model	e_b, K_b, K_d, σ, γ	24	415	4.33	-1058.22	2213.24	2119.64	0.00
Ruled Out	e_b, K_b, K_c, K_d, σ, γ	27	415	4.41	-1067.09	2249.08	2144.22	24.58
	e_b, K_b, e_c, K_c, K_d, σ, γ	29	415	4.40	-1065.79	2258.52	2146.22	26.58
	e_b, K_b, K_c, e_d, K_d, σ, γ	29	415	4.35	-1068.81	2264.57	2152.27	32.63
	e_b, K_b, e_d, K_d, σ, γ	26	415	4.40	-1073.73	2256.33	2155.21	35.57
	e_b, K_b, e_c, K_c, e_d, K_d, σ, γ	31	415	4.37	-1068.87	2276.75	2157.05	37.41
	e_b, K_b, K_c, σ, γ	24	415	4.47	-1087.64	2272.09	2178.49	58.85
	e_b, K_b, e_c, K_c, σ, γ	26	415	4.46	-1086.62	2282.11	2180.99	61.35
	e_b, K_b, σ, γ	21	415	4.50	-1092.69	2264.11	2181.86	62.22
	K_b, e_c, K_c, K_d, σ, γ	27	415	60.97	-3538.38	7191.65	7086.80	4967.16
	K_b, K_c, e_d, K_d, σ, γ	27	415	61.28	-3559.28	7233.45	7128.60	5008.96
	K_b, e_d, K_d, σ, γ	24	415	61.63	-3582.80	7262.42	7168.81	5049.17
	K_b, e_c, K_c, σ, γ	24	415	61.82	-3594.48	7285.77	7192.17	5072.53
	K_b, K_c, K_d, σ, γ	25	415	61.79	-3593.59	7290.01	7192.65	5073.01
	K_b, e_c, K_c, e_d, K_d, σ, γ	29	415	61.81	-3595.62	7318.19	7205.89	5086.25
	K_b, K_d, σ, γ	22	415	62.08	-3611.33	7307.41	7221.37	5101.73
	K_b, K_c, σ, γ	22	415	62.69	-3650.22	7385.19	7299.15	5179.51
	K_b, σ, γ	19	415	63.02	-3670.34	7407.34	7332.73	5213.09
	e_b, K_b, K_c, e_d, K_d, γ	21	415	4.57	-4458.55	8995.83	8913.59	6793.95
	e_b, K_b, e_c, K_c, e_d, K_d, γ	23	415	4.47	-4815.62	9722.02	9632.19	7512.55
	e_b, K_b, e_c, K_c, K_d, γ	21	415	4.71	-4845.68	9770.07	9687.83	7568.19
	e_b, K_b, K_c, K_d, γ	19	415	4.42	-4878.14	9822.95	9748.33	7628.69
	e_b, K_b, e_d, K_d, γ	18	415	4.42	-5041.37	10143.38	10072.60	7952.96
	e_b, K_b, K_d, γ	16	415	4.67	-5296.04	10640.66	10577.58	8457.94
	e_b, K_b, e_c, K_c, γ	18	415	4.55	-5792.34	11645.32	11574.54	9454.90
	e_b, K_b, K_c, γ	16	415	4.60	-5961.53	11971.65	11908.56	9788.92
	e_b, K_b, γ	13	415	4.57	-6311.84	12654.18	12602.72	10483.08
	K_c, K_d, σ, γ	22	415	103.67	-7171.70	14428.15	14342.10	12222.46
	K_c, e_d, K_d, σ, γ	24	415	103.98	-7205.82	14508.46	14414.86	12295.22
	e_c, K_c, K_d, σ, γ	24	415	104.63	-7275.63	14648.06	14554.46	12434.82
	K_c, σ, γ	19	415	104.75	-7284.30	14635.27	14560.66	12441.02
	e_c, K_c, e_d, K_d, σ, γ	26	415	105.25	-7341.27	14791.41	14690.29	12570.65
	K_d, σ, γ	19	415	105.43	-7363.35	14793.37	14718.76	12599.12
	e_d, K_d, σ, γ	21	415	105.92	-7414.84	14908.40	14826.16	12706.52
	e_c, K_c, σ, γ	21	415	105.94	-7416.70	14912.12	14829.87	12710.23
	σ, γ	16	415	106.70	-7500.56	15049.71	14986.62	12866.98
	K_b, e_c, K_c, K_d, γ	19	415	101.53	-2417722.37	4835511.40	4835436.78	4833317.14
	K_b, K_c, K_d, γ	17	415	100.15	-2582181.46	5164417.52	5164350.58	5162230.94
	K_b, K_d, γ	14	415	100.69	-2625181.59	5250399.71	5250344.36	5248224.72
	K_b, K_c, γ	14	415	99.43	-3071531.69	6143099.91	6143044.57	6140924.93
	K_b, γ	11	415	92.16	-3198091.17	6396200.78	6396157.12	6394037.48
	K_b, e_c, K_c, γ	16	415	102.62	-3294879.34	6589807.27	6589744.18	6587624.54
	K_b, e_d, K_d, γ	16	415	104.05	-3421939.63	6843927.83	6843864.75	6841745.11
	K_b, K_c, e_d, K_d, γ	19	415	133.98	-4563041.87	9126150.41	9126075.80	9123956.16
	K_b, e_c, K_c, e_d, K_d, γ	21	415	133.70	-4594302.53	9188683.79	9188601.55	9186481.91
	e_c, K_c, K_d, γ	16	415	109.34	-6103257.77	12206564.12	12206501.03	12204381.39
	K_c, K_d, γ	14	415	109.58	-6295059.59	12590155.71	12590100.36	12587980.72
	K_d, γ	11	415	108.82	-6478529.92	12957078.28	12957034.62	12954914.98
	e_c, K_c, e_d, K_d, γ	18	415	109.28	-6711424.52	13422909.68	13422838.90	13420719.26
	K_c, e_d, K_d, γ	16	415	108.63	-6823037.56	13646123.69	13646060.61	13643940.97

TABLE 2
MCMC Posteriors

Parameter	Credible Interval	Maximum Likelihood	Units
Modified MCMC Step Parameters			
P_b	$2088.81^{+0.37}_{-0.36}$	2088.81	days
$T\mathrm{conj_b}$	$2458628.1^{+1.2}_{-1.4}$	2458628.1	JD
$T\mathrm{peri_b}$	$2458389.45^{+0.5}_{-0.52}$	2458389.41	JD
e_b	0.6416 ± 0.0012	0.6415	
ω_b	$-0.5074^{+0.0049}_{-0.005}$	−0.508	radians
K_b	193.44 ± 0.45	193.44	m s^{-1}
P_c	$8.2991^{+0.0049}_{-0.0074}$	6.6831	days
$T\mathrm{conj_c}$	$2450828.5^{+6.8}_{-4.5}$	2450827.2	JD
$T\mathrm{peri_c}$	$2450828.6^{+6.9}_{-4.5}$	2450828.3	JD
e_c	$0.85^{+0.13}_{-0.41}$	0.45	
ω_c	$2.37^{+0.87}_{-0.64}$	−2.8	radians
K_c	$0.38^{+1.1}_{-0.28}$	0.62	m s^{-1}
P_d	$123.935^{+0.063}_{-0.43}$	123.85	days
$T\mathrm{conj_d}$	$2457652.3^{+2.7}_{-15.0}$	2457652	JD
$T\mathrm{peri_d}$	$2457659.1^{+4.3}_{-1.5}$	2457659.5	JD
e_d	$0.752^{+0.093}_{-0.28}$	0.75	
ω_d	$-2.79^{+0.32}_{-0.18}$	−2.77	radians
K_d	$2.29^{+1.4}_{-0.73}$	2.5	m s^{-1}
Orbital Parameters			
P_b	$2088.81^{+0.37}_{-0.36}$	2088.81	days
$T\mathrm{conj_b}$	$2458628.1^{+1.2}_{-1.4}$	2458628.1	JD
$T\mathrm{peri_b}$	$2458389.45^{+0.5}_{-0.52}$	2458389.41	JD
e_b	0.6416 ± 0.0012	0.6415	
ω_b	$-0.5074^{+0.0049}_{-0.005}$	−0.508	radians
K_b	193.44 ± 0.45	193.44	m s^{-1}
P_c	$8.2991^{+0.0049}_{-0.0074}$	6.6831	days
$T\mathrm{conj_c}$	$2450828.5^{+6.8}_{-4.5}$	2450827.2	JD
$T\mathrm{peri_c}$	$2450828.6^{+6.9}_{-4.5}$	2450828.3	JD
e_c	$0.85^{+0.13}_{-0.41}$	0.45	
ω_c	$2.37^{+0.87}_{-0.64}$	−2.8	radians
K_c	$0.38^{+1.1}_{-0.28}$	0.62	m s^{-1}
P_d	$123.935^{+0.063}_{-0.43}$	123.85	days
$T\mathrm{conj_d}$	$2457652.3^{+2.7}_{-15.0}$	2457652	JD
$T\mathrm{peri_d}$	$2457659.1^{+4.3}_{-1.5}$	2457659.5	JD
e_d	$0.752^{+0.093}_{-0.28}$	0.75	
ω_d	$-2.79^{+0.32}_{-0.18}$	−2.77	radians
K_d	$2.29^{+1.4}_{-0.73}$	2.5	m s^{-1}
Other Parameters			
γ_{UCLES}	$-14.82^{+0.76}_{-0.72}$	−14.93	m s−1
$\gamma_{\mathrm{PFS-post}}$	-245.71 ± 0.59	−245.87	m s−1
$\gamma_{\mathrm{HARPS-pre}}$	$19.94^{+0.52}_{-0.53}$	19.95	m s−1
$\gamma_{\mathrm{HARPS-post}}$	$-103.75^{+0.49}_{-0.46}$	−103.78	m s−1
$\gamma_{\mathrm{ESPRESSO}}$	$10642.93^{+0.61}_{-0.59}$	10642.9	m s−1
$\gamma_{\mathrm{CORALIE-98}}$	$10673.5^{+4.7}_{-4.6}$	10673.4	m s−1
$\gamma_{\mathrm{CORALIE-14}}$	10698.4 ± 1.1	10698.3	m s−1
$\gamma_{\mathrm{CORALIE-07}}$	$10674.0^{+4.2}_{-4.4}$	10674.2	m s−1
$\dot{\gamma}$	$\equiv 0.0$	$\equiv 0.0$	m s^{-1} d^{-1}
$\ddot{\gamma}$	$\equiv 0.0$	$\equiv 0.0$	m s^{-1} d^{-2}
σ_{UCLES}	$5.58^{+0.65}_{-0.57}$	5.25	m s^{-1}
$\sigma_{\mathrm{PFS-post}}$	$1.88^{+0.32}_{-0.25}$	1.83	m s^{-1}
$\sigma_{\mathrm{HARPS-pre}}$	$2.55^{+0.38}_{-0.31}$	2.37	m s^{-1}
$\sigma_{\mathrm{HARPS-post}}$	$2.27^{+0.17}_{-0.15}$	2.19	m s^{-1}
$\sigma_{\mathrm{ESPRESSO}}$	$1.57^{+0.27}_{-0.22}$	1.41	m s^{-1}
$\sigma_{\mathrm{CORALIE-98}}$	$12.6^{+3.9}_{-3.0}$	11.3	m s^{-1}
$\sigma_{\mathrm{CORALIE-14}}$	$4.63^{+1.0}_{-0.82}$	4.15	m s^{-1}
$\sigma_{\mathrm{CORALIE-07}}$	$12.8^{+3.5}_{-2.8}$	11.5	m s^{-1}

TABLE 3
Derived Posteriors

Parameter	Credible Interval	Maximum Likelihood	Units
a_b	$3.28^{+0.04}_{-0.041}$	3.305	AU
$M_b \sin i$	$9.77^{+0.24}_{-0.25}$	9.96	M_{Jup}
a_c	$0.082^{+0.001}_{-0.0011}$	0.0834	AU
$M_c \sin i$	$0.7^{+0.91}_{-0.51}$	0.44	$M_\oplus$
a_d	$0.4972^{+0.0062}_{-0.0063}$	0.5051	AU
$M_d \sin i$	$13.0^{+3.8}_{-2.9}$	13.3	$M_\oplus$

TABLE 4
Summary of Priors

e_b constrained to be < 0.99
e_c constrained to be < 0.99
e_d constrained to be < 0.99
K constrained to be > 0
Bounded prior: $0.0 < \sigma_{\mathrm{CORALIE-07}} < 20.0$
Bounded prior: $0.0 < \sigma_{\mathrm{CORALIE-14}} < 20.0$
Bounded prior: $0.0 < \sigma_{\mathrm{CORALIE-98}} < 20.0$
Bounded prior: $0.0 < \sigma_{\mathrm{ESPRESSO}} < 20.0$
Bounded prior: $0.0 < \sigma_{\mathrm{HARPS-post}} < 20.0$
Bounded prior: $0.0 < \sigma_{\mathrm{HARPS-pre}} < 20.0$
Bounded prior: $0.0 < \sigma_{\mathrm{PFS-post}} < 20.0$
Bounded prior: $0.0 < \sigma_{\mathrm{UCLES}} < 20.0$

TABLE 5
Final Convergence Criterion

Criterion	Final Value
minAfactor	24.338
maxArchange	0.007
maxGR	1.084
minTz	375.880

TABLE 6
Radial Velocities

Time (JD)	RV (m s^{-1})	RV Unc. (m s^{-1})	Inst.
2454433.74172	10759.67	3.21	CORALIE-07
2454768.87129	10683.87	4.28	CORALIE-07
2454808.72226	10665.89	7.64	CORALIE-07
2454814.68881	10661.97	2.73	CORALIE-07
2454817.69207	10655.47	2.83	CORALIE-07
2455097.89742	10627.11	3.04	CORALIE-07
2455129.86077	10624.08	2.88	CORALIE-07
2455201.65081	10627.52	4.23	CORALIE-07
2455927.67028	10598.38	2.74	CORALIE-07
2456318.60734	10980.69	3.04	CORALIE-07
2456586.84666	10771.65	2.76	CORALIE-07
2456648.79097	-63.99	2.48	CORALIE-14
2457650.83194	-181.41	2.52	CORALIE-14
2457701.75546	-180.20	2.76	CORALIE-14
2457739.66804	-174.68	3.65	CORALIE-14
2457771.64982	-184.36	2.76	CORALIE-14
2458023.86325	-190.72	2.79	CORALIE-14
2458039.87156	-183.64	2.65	CORALIE-14
2458067.71194	-175.37	2.59	CORALIE-14
2458068.72624	-174.17	2.61	CORALIE-14
2458105.59462	-182.80	11.13	CORALIE-14
2458118.69456	-167.67	2.93	CORALIE-14
2458368.90422	127.16	2.40	CORALIE-14
2458369.82735	134.02	1.82	CORALIE-14
2458370.84283	130.33	1.86	CORALIE-14
2458371.85622	139.10	1.82	CORALIE-14
2458372.82350	138.93	1.94	CORALIE-14
2458375.82531	151.96	1.93	CORALIE-14
2458376.91023	152.92	3.10	CORALIE-14
2458378.83319	152.62	1.84	CORALIE-14
2458414.87105	204.25	2.06	CORALIE-14
2458417.86628	196.81	2.95	CORALIE-14
2458427.74937	194.52	2.55	CORALIE-14
2458451.64571	184.23	2.48	CORALIE-14
2458468.60960	161.35	2.89	CORALIE-14
2458493.61533	132.68	3.04	CORALIE-14
2458542.59565	79.32	2.86	CORALIE-14
2458745.90108	-51.86	4.26	CORALIE-14
2458756.89120	-48.37	3.15	CORALIE-14
2458802.77286	-65.95	3.82	CORALIE-14
2458844.69037	-76.37	3.23	CORALIE-14
2458855.70383	-85.57	4.42	CORALIE-14
2458891.54319	-93.16	2.94	CORALIE-14
2451131.80611	-21.82	8.74	CORALIE-98
2451139.79166	-38.83	6.14	CORALIE-98
2451189.66615	-14.23	5.81	CORALIE-98
2451256.51102	-5.63	5.32	CORALIE-98
2451453.86645	-47.06	5.70	CORALIE-98
2451902.68050	-16.24	2.56	CORALIE-98
2453418.55091	-36.42	3.20	CORALIE-98

Note. — Only the first 50 of 415 RVs are displayed in this table. Use `radvel table -t rv` to save the full LaTeX table as a separate file.

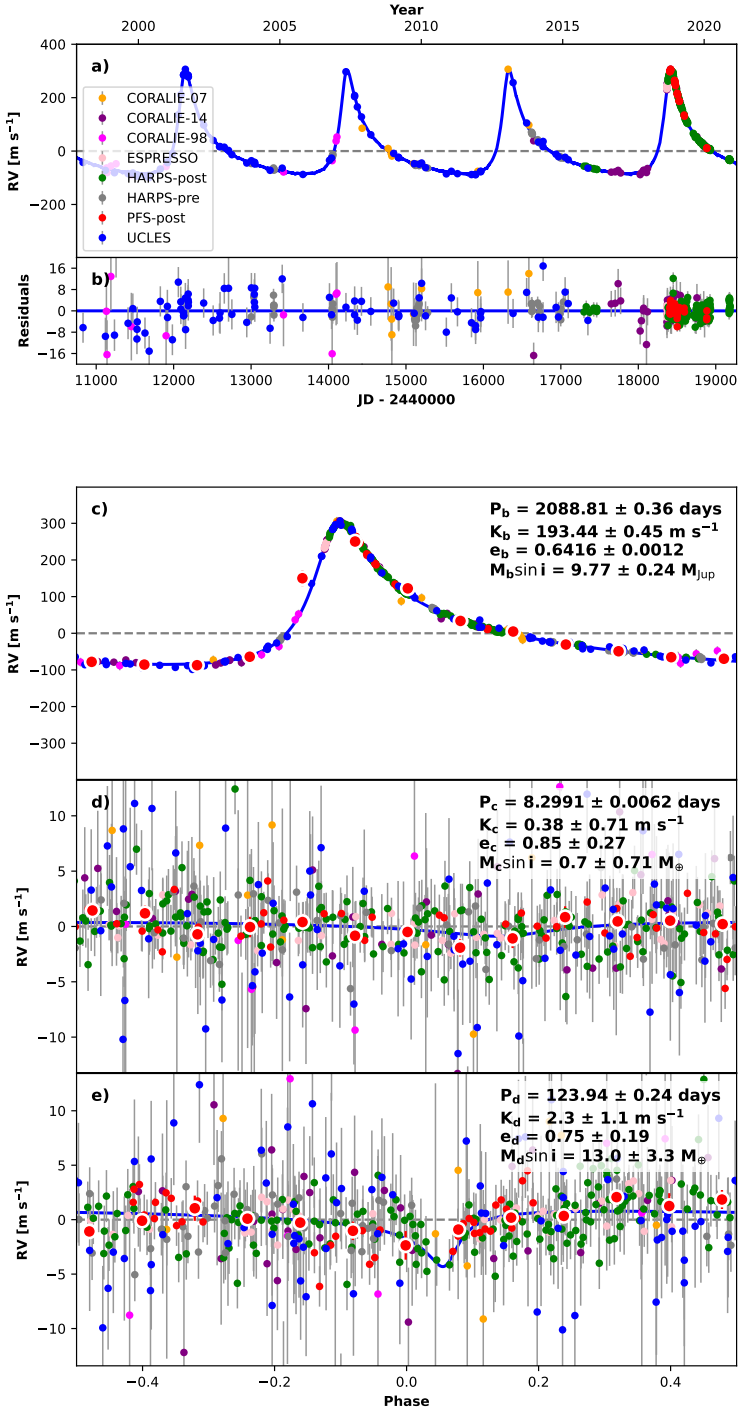

FIG. 1.— Best-fit 3-planet Keplerian orbital model for pi Men (HD 39091). The maximum likelihood model is plotted while the orbital parameters listed in Table 2 are the median values of the posterior distributions. The thin blue line is the best fit 3-planet model. We add in quadrature the RV jitter term(s) listed in Table 2 with the measurement uncertainties for all RVs. **b)** Residuals to the best fit 3-planet model. **c)** RVs phase-folded to the ephemeris of planet b. The Keplerian orbital models for all other planets (if any) have been subtracted. The small point colors and symbols are the same as in panel **a**. Red circles (if present) are the same velocities binned in 0.08 units of orbital phase. The phase-folded model for planet b is shown as the blue line.

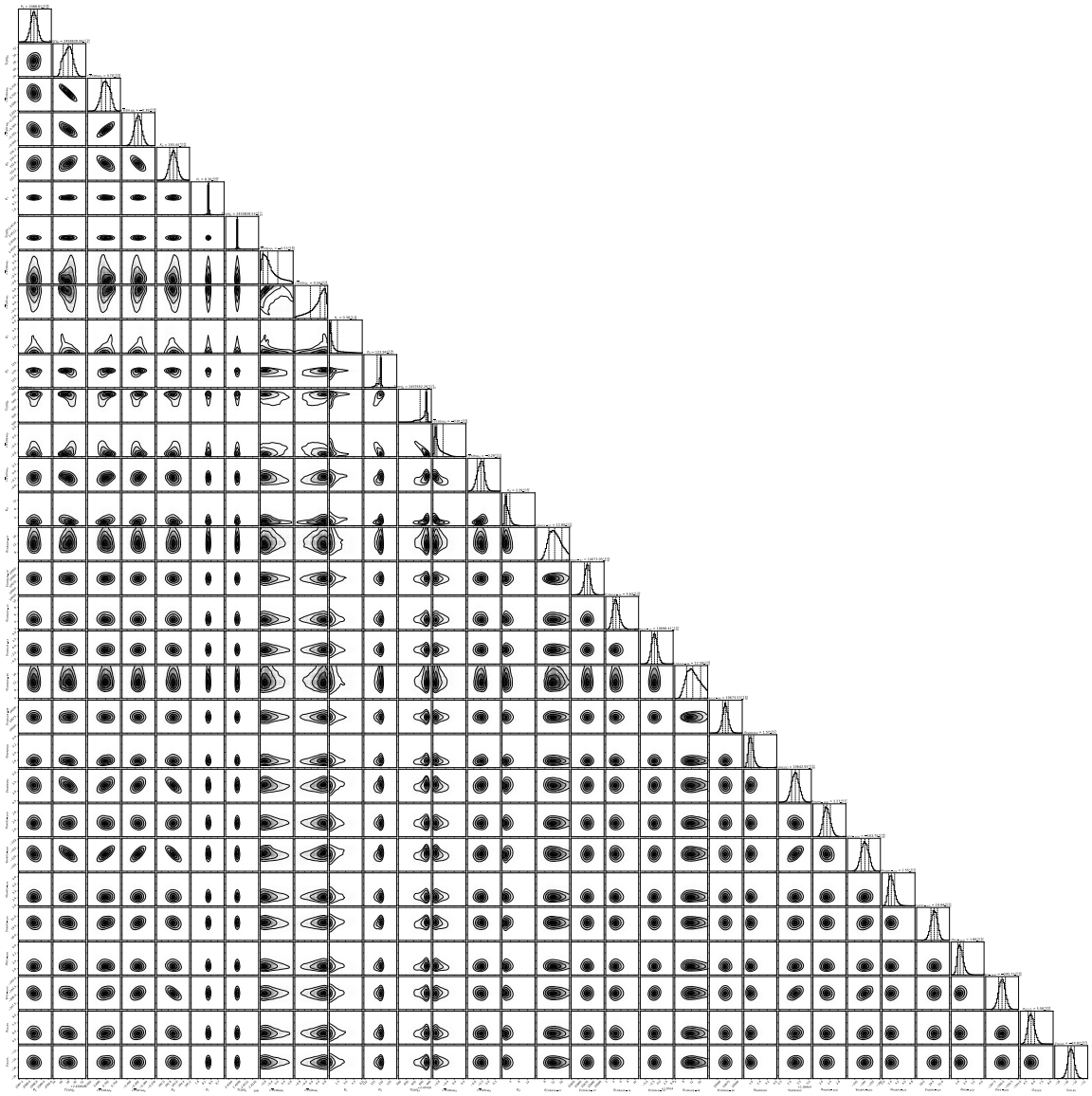

FIG. 2.— Posterior distributions for all free parameters.

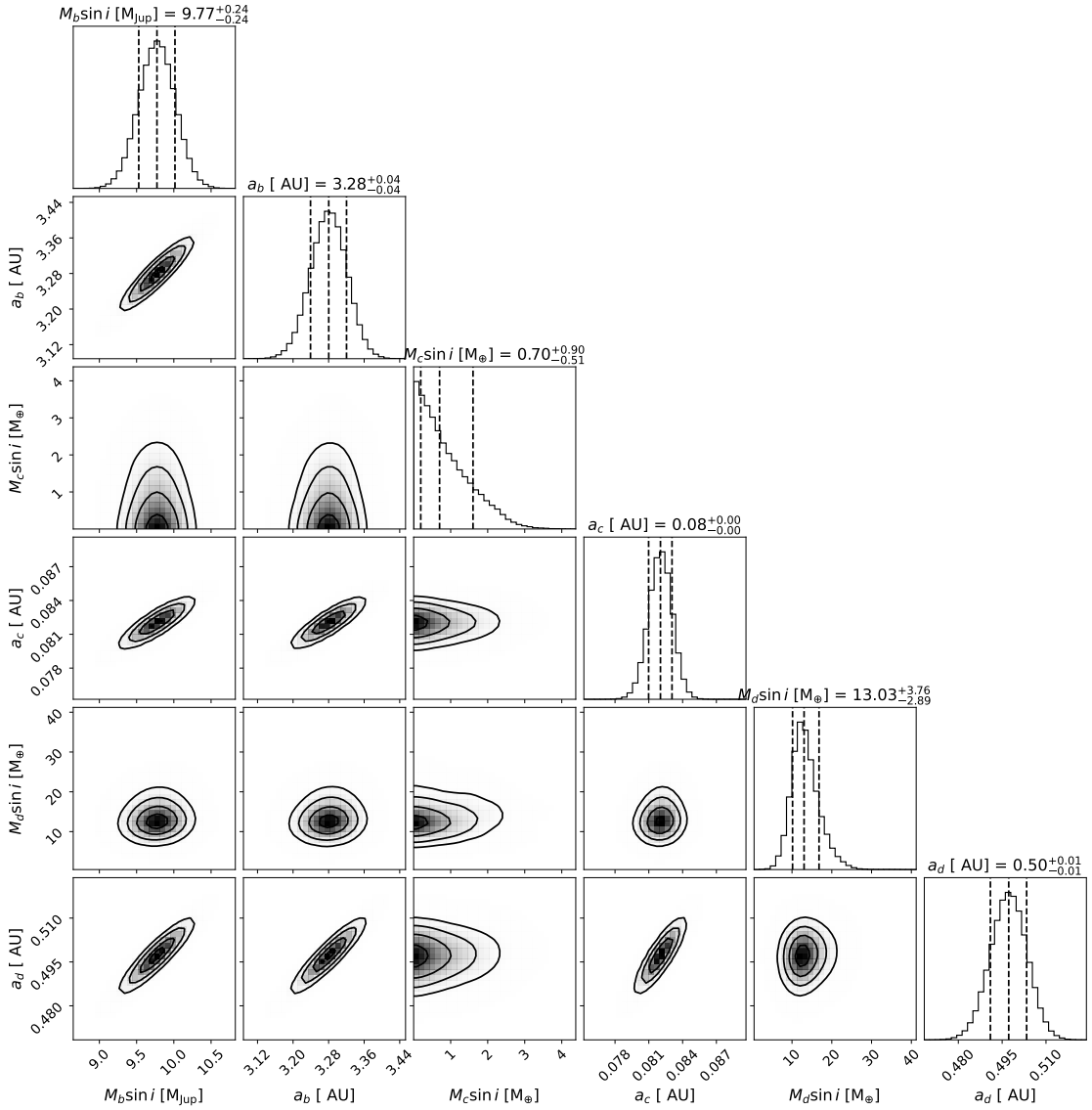

FIG. 3.— Posterior distributions for all derived parameters.