

The list of Interplanetary Shocks Observed by ACE

Compiled by Dr. Hui Li at NSSC (Latest Update on Jan 1st, 2009)

Based on the 64-second merged IMF and Solar Wind data of ACE satellite, an auto-search computer program was applied to find the potential interplanetary shocks (IP shocks) and shock-like solar wind structures. Each event was further inspected visually. Rankine- Hugoniot relationship was also tested to rule out the sharp interplanetary discontinuities. The shock parameters are all calculated by using the shock fitting procedure proposed by *Lin et al.* [2006].

The shock list is an appendix of the JGR paper by *Wang et al.* [2010, doi:10.1029/2009JA014833]. For more information and extensive use of the survey, please contact Dr. Hui Li (hli@spaceweather.ac.cn). Collaborations are welcome!

Table: Interplanetary Shocks Observed by ACE satellite (1998.02 – 2008.09)

YY	MM	DD	hh	mm	Flag	shock normal	ρ_1/ρ_2	V_{sn}	M_{f1}	M_{f2}
1998	2	17	22	25	0	(-0.805, 0.152, -0.574)	0.79	383.6	0.93	0.66
1998	2	18	7	52	1	(-0.919, 0.044, 0.392)	0.67	450.1	1.55	0.87
1998	3	4	10	57	1	(-0.729, 0.017, -0.684)	0.51	325.9	1.29	0.46
1998	4	23	17	30	1	(-0.978, -0.025, -0.209)	0.35	388.2	1.79	0.45
1998	4	30	8	48	1	(-0.772, -0.421, 0.476)	0.19	330.8	5.19	0.53
1998	5	1	21	20	1	(-0.793, 0.280, -0.541)	0.30	520.2	1.65	0.31
1998	5	3	16	58	1	(-0.790, 0.600, -0.123)	0.36	435.2	2.75	0.58
1998	5	8	9	20	1	(-0.767, 0.640, -0.033)	0.47	582.5	1.25	0.47
1998	5	15	13	56	0	(-0.155, -0.987, 0.044)	0.25	98.6	0.78	0.54
1998	5	29	15	3	1	(-0.455, 0.879, -0.146)	0.40	393.1	1.62	0.47
1998	6	13	18	57	1	(-0.693, 0.712, -0.111)	0.32	324.0	2.32	0.41
1998	6	25	15	42	0	(-0.886, -0.098, 0.453)	0.60	404.4	0.92	0.46
1998	7	5	3	14	1	(-0.949, 0.017, 0.314)	0.74	698.4	3.88	2.00
1998	7	31	9	14	1	(-0.572, -0.319, -0.756)	0.62	344.0	1.39	0.68
1998	8	6	6	42	1	(-0.932, 0.361, 0.033)	0.57	449.8	1.67	0.70
1998	8	10	0	6	1	(-0.439, -0.137, 0.888)	0.48	309.8	2.39	0.83
1998	8	26	6	20	1	(-0.704, -0.491, -0.513)	0.35	644.0	4.58	0.93
1998	9	24	23	13	1	(-0.934, -0.232, -0.272)	0.38	690.9	2.46	0.58
1998	10	2	6	54	1	(-0.854, 0.409, -0.321)	0.35	743.8	2.96	0.65
1998	10	18	19	0	1	(-0.692, -0.242, -0.680)	0.45	317.1	2.74	0.92
1998	10	23	12	33	1	(-0.740, 0.148, -0.656)	0.41	511.0	2.10	0.54
1998	11	7	7	36	1	(-0.921, 0.083, -0.381)	0.43	463.3	1.64	0.43
1998	11	8	4	20	1	(-0.839, 0.302, -0.452)	0.48	658.0	1.84	0.61
1998	11	30	4	17	1	(-0.891, -0.453, 0.026)	0.40	431.0	2.27	0.66
1998	12	1	2	54	1	(-0.404, -0.017, -0.914)	0.74	261.2	1.22	0.74
1998	12	21	22	51	1	(-0.964, -0.037, -0.263)	0.56	412.8	1.41	0.59
1998	12	28	17	32	1	(-0.337, -0.597, -0.728)	0.60	229.2	1.82	0.95
1999	1	13	9	58	1	(-0.913, -0.362, 0.191)	0.52	408.4	1.66	0.71
1999	1	22	19	45	1	(-0.913, 0.380, -0.149)	0.63	691.0	1.39	0.73
1999	2	11	7	47	1	(-0.954, -0.109, 0.278)	0.55	417.6	1.85	0.67
1999	2	17	6	21	1	(-0.948, -0.240, -0.207)	0.60	530.2	1.42	0.67

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YY	MM	DD	hh	mm	Flag	shock normal	ρ_1/ρ_2	V_{sn}	M_{f1}	M_{f2}
1999	2	18	2	7	1	(-1.000, -0.015, -0.025)	0.33	688.3	3.09	0.58
1999	2	28	20	33	1	(-0.959, 0.263, -0.102)	0.76	443.3	1.36	0.91
1999	3	10	0	40	0	(-0.885, -0.128, 0.448)	0.59	476.9	2.45	1.25
1999	4	16	10	34	1	(-0.755, 0.487, 0.440)	0.55	411.4	2.03	0.89
1999	5	5	14	58	1	(-0.660, -0.693, 0.290)	0.35	374.0	2.04	0.52
1999	5	18	0	2	1	(-0.994, 0.106, -0.038)	0.34	444.3	2.30	0.55
1999	6	26	2	17	-1					
1999	6	26	19	23	1	(-0.992, 0.045, 0.115)	0.38	452.4	2.03	0.46
1999	6	27	22	29	1	(-0.401, -0.648, -0.648)	0.57	379.4	1.67	0.75
1999	7	2	0	22	1	(-0.980, -0.014, -0.196)	0.39	643.8	1.97	0.49
1999	7	6	14	15	1	(-0.999, -0.015, 0.040)	0.47	467.5	1.83	0.68
1999	7	8	3	57	0	(-0.236, 0.754, -0.613)	0.76	242.5	1.96	1.17
1999	7	26	23	33	1	(-0.761, 0.537, 0.364)	0.65	382.5	1.32	0.69
1999	8	4	1	14	1	(-0.973, 0.013, -0.230)	0.45	410.7	1.69	0.53
1999	8	8	17	44	1	(-0.847, -0.362, -0.389)	0.71	427.2	1.31	0.79
1999	8	15	9	37	1	(-0.982, -0.127, -0.139)	0.42	406.7	1.76	0.50
1999	8	22	22	48	1	(-0.752, -0.470, 0.462)	0.81	430.5	1.24	0.90
1999	8	23	11	29	1	(-0.951, 0.297, 0.089)	0.69	467.2	1.46	0.84
1999	9	12	3	20	0	(-0.799, -0.355, 0.486)	0.44	519.0	3.06	1.04
1999	9	15	7	17	1	(-0.786, 0.617, 0.048)	0.44	525.3	1.48	0.47
1999	9	15	19	40	1	(-0.850, -0.029, 0.526)	0.44	537.8	1.79	0.58
1999	9	22	11	44	1	(-0.616, 0.264, 0.742)	0.33	389.3	2.25	0.38
1999	9	26	14	26	1	(-0.673, -0.686, 0.277)	0.75	371.7	1.20	0.78
1999	10	21	1	37	1	(-0.810, 0.415, 0.414)	0.34	403.7	2.07	0.47
1999	10	28	11	25	0	(-0.811, 0.020, 0.585)	0.66	420.3	1.95	1.18
1999	11	13	12	13	1	(-0.891, 0.449, 0.065)	0.57	473.2	1.70	0.72
1999	11	19	23	57	1	(-0.668, 0.089, 0.739)	0.65	372.8	1.13	0.59
1999	12	11	12	0	1	(-0.030, -0.532, -0.846)	0.54	114.0	1.68	0.60
1999	12	12	15	13	1	(-0.636, -0.230, -0.736)	0.43	419.6	1.97	0.54
1999	12	26	21	25	1	(-0.984, -0.177, -0.002)	0.72	494.5	1.38	0.83
2000	1	11	13	38	1	(-0.564, -0.652, -0.507)	0.64	397.9	1.47	0.74
2000	1	22	0	21	1	(-0.559, 0.393, -0.730)	0.51	282.5	1.77	0.63
2000	1	27	13	55	1	(-0.984, -0.178, 0.016)	0.56	417.2	1.73	0.73
2000	1	30	18	44	0	(-0.929, 0.351, -0.119)	0.71	755.2	2.68	1.70
2000	2	5	14	48	1	(-0.954, -0.300, -0.008)	0.70	460.3	1.91	0.99
2000	2	11	2	11	1	(-0.989, -0.115, -0.094)	0.36	558.7	2.15	0.62
2000	2	11	23	18	1	(-0.849, -0.515, 0.118)	0.29	602.4	3.27	0.53
2000	2	14	6	54	1	(-0.974, 0.188, 0.129)	0.54	679.7	1.83	0.77
2000	2	20	20	44	0	(-0.736, 0.581, 0.347)	0.16	286.9	0.72	0.37
2000	4	6	16	3	1	(-0.980, 0.075, -0.184)	0.32	663.7	3.67	0.63
2000	4	24	8	50	1	(-0.425, 0.895, -0.137)	0.64	329.6	1.36	0.66
2000	5	17	21	40	1	(-0.887, 0.122, 0.445)	0.74	546.0	1.01	0.63
2000	6	3	8	4	1	(-0.896, -0.382, 0.225)	0.72	434.4	1.49	0.90

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YY	MM	DD	hh	mm	Flag	shock normal			ρ_1/ρ_2	V_{sn}	M_{f1}	M_{f2}
2000	6	4	14	22	1	(-0.998,	0.060,	0.018)	0.47	628.9	2.68	0.97
2000	6	8	8	40	1	(-0.990,	-0.025,	-0.138)	0.30	872.4	4.00	0.55
2000	6	11	7	16	1	(-0.978,	-0.083,	0.191)	0.58	562.8	1.52	0.72
2000	6	23	12	26	1	(-0.671,	-0.019,	-0.741)	0.38	522.5	2.43	0.59
2000	7	10	5	56	1	(-0.861,	0.496,	-0.112)	0.48	491.3	1.84	0.60
2000	7	11	11	21	1	(-0.959,	0.255,	0.121)	0.48	496.1	1.78	0.59
2000	7	13	9	16	1	(-0.211,	-0.966,	0.148)	0.52	226.6	1.32	0.47
2000	7	17	7	40	1	(-0.573,	0.713,	-0.405)	0.57	469.9	1.26	0.53
2000	7	19	14	47	1	(-0.671,	0.315,	0.671)	0.27	478.4	2.94	0.42
2000	7	26	17	54	1	(-0.944,	0.328,	-0.027)	0.47	402.4	1.56	0.59
2000	7	28	5	43	1	(-0.995,	-0.030,	0.096)	0.35	491.1	2.16	0.45
2000	7	28	9	9	1	(-0.782,	-0.298,	0.547)	0.61	452.4	1.66	0.82
2000	8	10	4	7	1	(-0.981,	0.155,	0.115)	0.50	432.4	1.32	0.49
2000	8	11	18	9	1	(-0.723,	-0.059,	-0.688)	0.49	589.3	1.78	0.59
2000	8	14	21	36	1	(-0.834,	0.410,	-0.370)	0.37	513.0	2.15	0.50
2000	9	4	12	41	1	(-0.956,	0.254,	-0.146)	0.46	494.2	1.31	0.38
2000	9	6	16	12	1	(-0.994,	-0.037,	0.099)	0.40	560.3	2.68	0.65
2000	9	15	3	58	1	(-0.613,	0.675,	0.411)	0.66	430.3	7.07	3.89
2000	9	17	16	57	1	(-0.721,	0.691,	-0.050)	0.51	768.4	2.28	0.87
2000	9	30	10	37	1	(-0.912,	0.359,	0.201)	0.78	446.3	1.03	0.70
2000	10	3	0	7	1	(-0.986,	-0.113,	-0.119)	0.45	468.0	1.49	0.47
2000	10	4	13	36	1	(-0.953,	-0.180,	0.245)	0.80	520.2	1.47	0.95
2000	10	5	2	39	1	(-0.920,	-0.048,	0.388)	0.41	520.3	2.95	0.75
2000	10	28	9	7	1	(-0.826,	0.562,	0.039)	0.46	422.7	2.30	0.71
2000	10	31	16	30	1	(-0.893,	-0.237,	0.384)	0.32	465.6	2.75	0.63
2000	11	4	1	33	1	(-0.990,	0.133,	-0.046)	0.27	414.3	1.04	0.80
2000	11	6	9	15	1	(-0.926,	0.172,	-0.336)	0.39	631.1	2.58	0.68
2000	11	11	4	0	1	(-0.956,	0.276,	0.094)	0.41	906.8	1.88	0.75
2000	11	26	5	0	1	(-0.875,	-0.129,	0.467)	0.59	456.3	2.22	0.97
2000	11	26	11	23	0	(-0.527,	-0.850,	-0.005)	0.39	407.9	2.65	1.28
2000	11	28	4	55	1	(-0.812,	-0.085,	-0.577)	0.43	529.6	1.47	0.49
2000	11	29	3	5	1	(-0.724,	0.399,	-0.563)	0.67	526.5	1.79	0.99
2000	12	3	3	18	1	(-0.991,	0.116,	0.067)	0.66	500.4	1.33	0.73
2001	1	10	15	19	1	(-0.767,	-0.174,	0.618)	0.34	288.8	0.88	0.52
2001	1	13	1	40	1	(-0.227,	0.111,	0.968)	0.33	182.7	1.32	0.36
2001	1	17	15	30	1	(-0.883,	-0.165,	-0.438)	0.48	409.9	2.40	0.83
2001	1	23	10	4	1	(-0.985,	-0.038,	-0.166)	0.23	583.6	3.45	0.45
2001	1	31	7	22	1	(-0.720,	0.621,	0.310)	0.40	416.5	2.22	0.56
2001	2	12	20	45	1	(-0.837,	-0.210,	-0.505)	0.63	445.9	1.59	0.79
2001	3	3	10	38	1	(-0.869,	0.126,	-0.479)	0.47	470.9	1.60	0.42
2001	3	19	10	26	-1							
2001	3	27	1	8	1	(-0.499,	0.362,	-0.787)	0.20	290.2	3.60	0.35
2001	3	27	17	14	1	(-0.669,	0.608,	-0.427)	0.51	377.4	1.07	0.37

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YY	MM	DD	hh	mm	Flag	shock normal			ρ_1/ρ_2	V_{sn}	M_{f1}	M_{f2}
2001	3	31	0	22	1	(-0.615,	0.315,	-0.723)	0.33	580.3	3.82	0.75
2001	3	31	21	37	0	(-0.652,	0.622,	-0.434)	0.39	598.9	0.63	0.56
2001	4	4	14	22	1	(-0.806,	0.452,	0.382)	0.25	603.3	2.53	0.42
2001	4	7	16	58	1	(-0.949,	-0.314,	0.008)	0.23	584.5	1.86	0.36
2001	4	8	10	30	1	(-0.917,	-0.379,	-0.122)	0.30	720.3	3.40	0.58
2001	4	11	13	12	1	(-0.625,	-0.657,	0.422)	0.41	509.8	2.22	0.60
2001	4	11	15	27	1	(-0.501,	-0.499,	0.707)	0.50	606.4	2.13	0.95
2001	4	13	7	3	1	(-0.973,	0.145,	0.178)	0.33	840.6	1.98	0.45
2001	4	18	0	5	1	(-0.931,	-0.358,	0.070)	0.22	517.3	3.44	0.30
2001	4	21	15	4	1	(-0.886,	0.459,	0.068)	0.39	374.0	2.41	0.71
2001	4	28	4	32	1	(-0.946,	-0.305,	-0.112)	0.32	882.5	4.46	0.83
2001	5	8	9	30	1	(-0.993,	-0.049,	-0.110)	0.52	433.5	1.02	0.29
2001	5	12	9	22	1	(-0.553,	-0.481,	-0.681)	0.78	436.9	1.07	0.74
2001	5	27	14	16	1	(-0.974,	-0.116,	0.195)	0.44	625.2	2.42	0.72
2001	6	7	8	51	1	(-0.996,	0.003,	-0.090)	0.63	472.9	1.40	0.71
2001	8	3	6	24	1	(-0.940,	0.186,	0.285)	0.26	434.1	2.42	0.46
2001	8	5	11	55	1	(-0.908,	0.088,	0.411)	0.73	537.6	1.34	0.87
2001	8	12	10	48	1	(-0.561,	0.026,	0.827)	0.24	271.8	2.07	0.33
2001	8	17	10	14	1	(-0.972,	-0.035,	-0.234)	0.27	504.7	3.19	0.44
2001	8	27	19	18	1	(-0.717,	0.042,	0.696)	0.35	510.7	2.35	0.52
2001	8	30	13	29	1	(-0.786,	-0.145,	0.601)	0.54	492.1	2.07	0.84
2001	9	14	1	16	1	(-0.865,	-0.450,	0.223)	0.39	440.3	2.28	0.55
2001	9	29	9	5	0	(-0.906,	0.317,	0.280)	0.49	739.8	3.63	1.83
2001	9	30	18	45	0	(-0.880,	0.425,	-0.212)	0.63	556.3	3.04	1.15
2001	10	11	16	19	1	(-0.997,	-0.081,	-0.018)	0.36	578.6	2.97	0.62
2001	10	14	17	7	1	(-0.998,	0.059,	0.000)	0.69	454.8	1.15	0.67
2001	10	21	16	12	1	(-0.994,	-0.061,	0.096)	0.33	638.4	2.70	0.50
2001	10	25	8	2	1	(-0.873,	0.037,	0.487)	0.26	463.2	5.50	0.69
2001	10	28	2	40	1	(-0.874,	0.486,	-0.019)	0.39	519.6	2.38	0.59
2001	10	31	12	52	1	(-0.959,	-0.069,	-0.276)	0.35	434.0	2.02	0.48
2001	11	19	17	35	1	(-0.967,	-0.136,	-0.217)	0.48	634.6	2.35	0.74
2001	11	30	17	26	1	(-0.910,	0.382,	0.164)	0.67	363.8	1.44	0.84
2001	12	23	22	18	1	(-0.889,	-0.106,	0.445)	0.31	344.1	2.20	0.49
2001	12	29	4	45	1	(-0.991,	0.042,	0.128)	0.28	480.6	3.21	0.49
2001	12	30	19	30	1	(-0.994,	0.096,	0.045)	0.41	651.4	1.90	0.49
2002	1	10	15	44	1	(-0.736,	-0.364,	-0.571)	0.48	546.9	2.05	0.85
2002	1	31	20	37	1	(-0.883,	-0.089,	0.460)	0.50	413.1	1.81	0.85
2002	2	17	2	8	1	(-0.458,	-0.695,	0.553)	0.31	238.5	1.79	0.27
2002	3	18	12	36	1	(-0.986,	-0.168,	0.014)	0.26	503.1	3.95	0.56
2002	3	20	13	4	1	(-0.964,	-0.077,	0.255)	0.62	883.0	1.22	0.57
2002	3	22	3	21	1	(-0.786,	0.319,	0.529)	0.65	447.2	1.70	0.91
2002	3	23	10	52	1	(-0.840,	0.161,	0.517)	0.32	460.1	2.28	0.43
2002	3	25	0	57	1	(-0.796,	0.370,	0.479)	0.79	694.5	1.36	0.98

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YY	MM	DD	hh	mm	Flag	shock normal	ρ_1/ρ_2	V_{sn}	M_{f1}	M_{f2}
2002	4	17	10	20	1	(-0.896, -0.444, 0.002)	0.23	444.8	1.84	0.16
2002	4	19	8	1	1	(-0.955, -0.293, -0.049)	0.45	746.6	1.76	0.52
2002	4	23	4	14	1	(-0.892, 0.449, 0.053)	0.37	666.2	4.17	0.99
2002	5	10	10	29	1	(-0.947, -0.204, 0.249)	0.40	433.1	1.80	0.48
2002	5	11	9	24	1	(-0.880, -0.032, 0.475)	0.36	406.8	1.88	0.44
2002	5	18	19	18	1	(-0.919, -0.363, 0.151)	0.30	520.3	4.00	0.67
2002	5	20	3	0	1	(-0.948, -0.279, 0.155)	0.60	582.8	2.06	0.99
2002	5	21	20	59	0	(-0.258, -0.041, -0.965)	0.60	142.0	0.74	0.19
2002	5	23	10	14	1	(-0.809, -0.123, -0.575)	0.51	727.8	2.83	0.98
2002	5	30	1	31	1	(-0.613, 0.636, -0.469)	0.50	439.5	1.96	0.76
2002	7	17	15	24	1	(-0.892, -0.321, -0.318)	0.32	506.0	2.09	0.43
2002	7	19	9	31	1	(-0.693, -0.677, -0.249)	0.39	507.3	2.61	0.69
2002	7	19	14	41	0	(-0.427, -0.831, -0.356)	0.66	553.1	2.79	1.40
2002	7	22	4	50	1	(-0.712, 0.195, 0.674)	0.51	445.2	1.61	0.59
2002	7	25	12	59	1	(-0.844, -0.175, 0.507)	0.67	565.5	1.65	0.90
2002	7	29	12	39	1	(-0.839, 0.145, 0.525)	0.36	490.8	2.61	0.68
2002	8	1	4	22	1	(-0.685, 0.726, -0.056)	0.43	427.1	1.48	0.46
2002	8	1	22	17	1	(-0.970, -0.232, -0.079)	0.60	484.4	1.21	0.52
2002	8	18	18	9	1	(-0.881, 0.219, 0.420)	0.23	603.5	5.39	0.56
2002	8	26	10	50	-1					
2002	9	7	16	8	1	(-0.932, -0.331, 0.147)	0.33	639.0	3.12	0.55
2002	10	2	22	12	1	(-0.444, 0.670, -0.596)	0.50	256.2	1.42	0.49
2002	11	9	17	54	1	(-0.961, 0.255, -0.111)	0.55	429.6	1.97	0.85
2002	11	11	11	51	1	(-0.992, -0.086, 0.095)	0.63	683.5	1.73	0.99
2002	11	16	23	5	1	(-0.719, 0.689, -0.096)	0.60	388.4	1.62	0.71
2002	11	20	10	18	1	(-0.708, 0.630, 0.321)	0.53	335.9	1.39	0.66
2002	11	26	21	8	1	(-0.927, -0.316, 0.201)	0.35	597.4	2.28	0.48
2002	12	22	9	40	1	(-0.829, -0.464, 0.314)	0.71	527.9	1.75	0.98
2002	12	22	12	13	1	(-0.964, -0.074, -0.257)	0.82	573.0	1.01	0.74
2002	12	24	13	13	1	(-0.931, -0.198, 0.306)	0.64	556.2	1.46	0.81
2003	2	17	23	0	0	(-0.654, -0.222, 0.723)	0.72	628.1	2.29	1.64
2003	3	20	4	19	1	(-0.760, 0.236, 0.605)	0.62	735.1	1.43	0.69
2003	3	26	16	50	1	(-0.725, -0.688, -0.035)	0.49	326.6	0.87	0.30
2003	4	8	0	14	1	(-0.928, -0.093, 0.361)	0.39	382.6	2.12	0.64
2003	4	28	18	33	1	(-0.943, -0.285, -0.173)	0.66	549.6	1.19	0.63
2003	5	9	4	54	1	(-0.778, 0.593, 0.208)	0.44	797.5	2.10	0.56
2003	5	29	11	50	1	(-0.776, -0.097, 0.623)	0.60	611.4	2.42	1.23
2003	5	29	18	29	1	(-0.928, -0.098, 0.359)	0.40	817.0	1.55	0.38
2003	5	30	15	50	1	(-0.957, -0.266, 0.118)	0.63	910.1	2.26	1.17
2003	6	18	4	27	1	(-0.840, -0.539, -0.063)	0.69	558.5	1.55	0.89
2003	6	20	7	54	1	(-0.986, -0.169, -0.012)	0.36	605.3	1.76	0.40
2003	7	6	12	22	1	(-0.873, 0.481, -0.077)	0.52	614.7	1.34	0.48
2003	8	17	13	39	1	(-1.000, -0.011, -0.002)	0.52	598.4	2.47	0.98

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Table – continued from previous page

YY	MM	DD	hh	mm	Flag	shock normal	ρ_1/ρ_2	V_{sn}	M_{f1}	M_{f2}
2003	10	24	14	47	1	(-0.999, -0.025, -0.044)	0.36	683.1	3.42	0.63
2003	10	26	8	8	1	(-0.750, 0.504, -0.428)	0.76	476.2	1.04	0.80
2003	10	26	18	30	1	(-0.995, -0.054, -0.083)	0.65	665.9	1.53	0.80
2003	10	28	1	30	1	(-0.883, -0.310, -0.352)	0.52	670.2	1.54	0.57
2003	11	4	6	0	1	(-0.883, 0.459, -0.096)	0.28	792.5	4.39	0.83
2003	11	6	19	19	1	(-0.416, 0.818, -0.397)	0.40	400.3	2.89	0.73
2003	11	15	5	18	1	(-0.858, -0.194, 0.476)	0.51	761.5	2.33	0.73
2003	11	20	7	27	1	(-0.958, 0.123, -0.260)	0.31	675.1	3.55	0.63
2003	11	22	10	0	1	(-0.902, 0.241, 0.358)	0.64	609.5	1.17	0.61
2003	11	30	2	45	1	(-0.761, 0.527, -0.378)	0.72	377.8	1.13	0.56
2003	12	7	13	41	1	(-0.437, -0.348, 0.829)	0.50	366.3	2.09	0.76
2004	1	6	19	25	1	(-0.900, -0.333, 0.283)	0.53	674.2	1.42	0.54
2004	1	22	1	3	1	(-0.994, -0.034, 0.101)	0.27	731.4	3.56	0.44
2004	1	23	14	20	1	(-0.749, -0.383, -0.541)	0.52	521.6	1.50	0.59
2004	4	3	8	54	1	(-0.020, -0.245, 0.969)	0.56	87.6	1.06	0.28
2004	4	9	1	48	0	(-0.993, 0.096, 0.073)	0.63	613.7	2.84	1.50
2004	4	10	19	24	1	(-0.632, -0.583, 0.510)	0.38	439.9	2.74	0.71
2004	4	12	4	24	1	(-0.739, -0.069, 0.671)	0.47	385.9	1.70	0.60
2004	4	12	17	34	1	(-0.527, -0.411, 0.744)	0.35	362.2	2.40	0.60
2004	4	24	8	7	1	(-0.949, 0.102, -0.297)	0.59	528.8	1.66	0.81
2004	4	26	15	16	1	(-0.991, 0.046, 0.126)	0.48	553.9	1.65	0.72
2004	5	10	21	57	1	(-0.936, 0.352, 0.014)	0.67	417.6	1.05	0.52
2004	7	16	21	5	1	(-0.964, -0.236, -0.119)	0.53	470.2	1.49	0.58
2004	7	22	9	53	1	(-0.736, -0.629, 0.252)	0.27	420.4	2.54	0.43
2004	7	24	5	41	-1					
2004	7	26	22	26	0	(-0.938, -0.183, 0.295)	0.33	1002.7	5.84	1.29
2004	7	30	20	30	1	(-0.948, 0.278, 0.153)	0.38	556.6	1.92	0.47
2004	8	1	1	46	0	(-0.850, 0.527, -0.012)	0.56	576.5	2.95	1.50
2004	8	29	9	16	1	(-0.987, 0.148, -0.064)	0.45	468.3	1.79	0.62
2004	9	22	5	52	1	(-0.972, 0.233, -0.013)	0.51	582.5	2.18	0.78
2004	10	2	2	29	-1					
2004	10	27	11	17	1	(-0.970, -0.085, -0.228)	0.59	432.5	1.46	0.67
2004	11	7	2	6	-1					
2004	11	7	9	59	1	(-0.712, -0.659, 0.242)	0.33	408.4	3.28	0.74
2004	11	7	17	52	1	(-0.819, -0.510, 0.264)	0.49	652.3	1.97	0.73
2004	11	9	9	13	1	(-0.616, -0.114, -0.779)	0.27	764.2	4.87	0.56
2004	11	9	18	20	1	(-0.910, 0.118, -0.397)	0.26	754.5	1.66	0.29
2004	11	11	16	43	1	(-0.528, -0.313, -0.790)	0.44	437.0	2.63	0.75
2004	12	11	12	55	1	(-0.487, 0.723, -0.490)	0.33	334.3	2.02	0.48
2004	12	29	12	34	1	(-0.526, -0.712, 0.466)	0.68	284.7	1.02	0.56
2005	1	1	10	6	1	(-0.928, -0.339, 0.156)	0.57	503.8	1.42	0.62
2005	1	7	8	40	1	(-0.873, -0.445, 0.200)	0.65	522.5	1.62	0.95
2005	1	17	7	15	1	(-0.910, 0.245, 0.335)	0.55	697.6	3.28	1.40

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YY	MM	DD	hh	mm	Flag	shock normal	ρ_1/ρ_2	V_{sn}	M_{f1}	M_{f2}
2005	1	17	10	42	1	(-0.311, -0.495, 0.812)	0.68	440.8	1.02	0.58
2005	1	21	16	49	1	(-0.987, -0.008, -0.160)	0.30	1030.0	5.17	0.79
2005	2	17	22	4	0	(-0.821, 0.562, 0.103)	0.47	341.0	0.02	0.04
2005	4	29	15	3	0	(-0.615, -0.768, 0.180)	0.68	320.3	2.27	1.23
2005	5	6	12	4	1	(-0.929, -0.357, 0.099)	0.56	414.0	1.87	0.85
2005	5	7	18	19	0	(-0.819, 0.351, -0.453)	0.61	351.1	0.88	0.36
2005	5	20	3	15	1	(-0.766, 0.542, 0.346)	0.61	403.3	1.38	0.99
2005	5	29	9	3	1	(-0.955, -0.150, 0.257)	0.51	484.8	1.47	0.52
2005	6	12	6	52	1	(-0.604, -0.233, -0.762)	0.32	265.3	1.49	0.39
2005	6	14	17	54	1	(-0.853, 0.106, 0.512)	0.42	541.4	2.59	0.72
2005	6	16	8	10	1	(-0.913, -0.215, 0.346)	0.59	601.4	1.44	0.64
2005	7	10	2	48	1	(-0.908, 0.287, 0.305)	0.55	483.0	1.87	0.76
2005	7	16	1	51	0	(-0.822, 0.261, 0.506)	0.67	373.9	0.67	0.30
2005	7	16	16	16	1	(-0.938, -0.001, 0.346)	0.58	427.7	1.34	0.55
2005	7	17	0	53	1	(-0.834, 0.533, 0.144)	0.48	450.9	1.35	0.42
2005	7	27	18	50	0	(-0.142, -0.652, 0.745)	0.44	78.9	0.54	0.69
2005	8	1	6	6	1	(-0.524, -0.491, -0.696)	0.59	417.8	1.56	0.69
2005	8	23	19	38	0	(-0.811, 0.584, 0.044)	0.68	506.4	2.11	1.18
2005	8	24	5	38	1	(-0.822, 0.490, 0.292)	0.45	538.9	2.18	0.64
2005	8	24	8	29	0	(-0.558, -0.030, 0.829)	0.67	581.6	2.42	1.54
2005	8	25	13	8	1	(-0.628, 0.775, -0.080)	0.43	540.0	1.92	0.57
2005	9	2	13	40	1	(-0.944, -0.125, 0.304)	0.51	587.6	2.00	0.69
2005	9	9	13	17	1	(-0.799, -0.161, 0.579)	0.27	428.6	3.18	0.56
2005	9	12	6	4	1	(-0.936, 0.333, 0.113)	0.45	990.3	1.54	0.70
2005	9	13	9	1	0	(-0.076, -0.959, 0.275)	0.92	162.4	0.29	0.27
2005	9	15	8	30	1	(-0.732, -0.355, 0.582)	0.31	577.7	2.92	0.43
2005	12	30	23	46	1	(-0.937, 0.333, -0.109)	0.65	603.5	1.47	0.76
2006	1	1	13	31	1	(-0.644, 0.235, 0.728)	0.54	431.9	1.46	0.58
2006	4	8	23	16	1	(-0.687, -0.228, -0.690)	0.76	317.0	1.32	0.89
2006	4	13	11	13	1	(-0.930, -0.307, 0.204)	0.64	520.0	1.54	0.99
2006	7	9	20	51	-1					
2006	8	18	15	51	1	(-0.998, 0.039, 0.045)	0.59	477.9	1.86	0.87
2006	8	19	10	51	1	(-0.772, 0.570, 0.281)	0.57	458.6	1.61	0.74
2006	8	21	15	56	1	(-0.579, 0.610, -0.542)	0.78	349.4	1.33	0.97
2006	9	3	23	29	1	(-0.890, -0.094, 0.445)	0.42	441.6	2.37	0.74
2006	12	14	13	53	0	(-0.803, 0.560, 0.204)	0.27	909.7	5.31	1.44
2006	12	16	17	23	1	(-0.587, 0.809, -0.009)	0.35	474.8	2.60	0.49
2006	12	18	9	21	1	(-0.802, -0.581, 0.140)	0.46	354.5	1.61	0.41
2007	2	12	9	12	1	(-0.949, -0.306, 0.071)	0.48	376.2	1.68	0.67
2007	5	7	7	30	-1					
2007	9	27	10	53	1	(-0.993, 0.076, 0.090)	0.46	437.4	1.79	0.56
2007	10	25	10	40	-1					
2007	11	12	21	27	1	(-0.332, -0.460, 0.824)	0.62	219.5	1.03	0.46

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YY	MM	DD	hh	mm	Flag	shock normal	ρ_1/ρ_2	V_{sn}	M_{f1}	M_{f2}
2007	12	17	2	4	1	(-0.885, -0.347, 0.311)	0.42	415.0	2.35	0.72
2008	1	12	11	34	1	(-0.732, -0.624, -0.274)	0.73	334.9	1.31	0.69
2008	4	23	2	24	1	(-0.900, -0.426, 0.088)	0.72	453.1	1.06	0.69
2008	4	30	14	56	1	(-0.912, 0.312, 0.265)	0.64	388.0	1.33	0.68
2008	5	28	1	25	-1					
2008	7	22	6	10	0	(-0.379, 0.799, -0.468)	0.80	173.3	0.64	0.21
2008	8	8	22	51	1	(-0.451, -0.852, 0.265)	0.75	249.1	1.03	0.67

Note:

YY-MM-DD hh:mm: the UT of IP shocks;

Flag: 1 denotes a shock;

0 denotes a shock-like structure;

-1 denotes the plasma data gap for upstream;

shock normal: shock normal vector;

ρ_1/ρ_2 : density ratio of upstream (ρ_1) and downstream (ρ_2) of a shock;

V_{sn} : shock normal speed;

M_{f1} , M_{f2} : upstream and downstream fast Mach number, respectively.