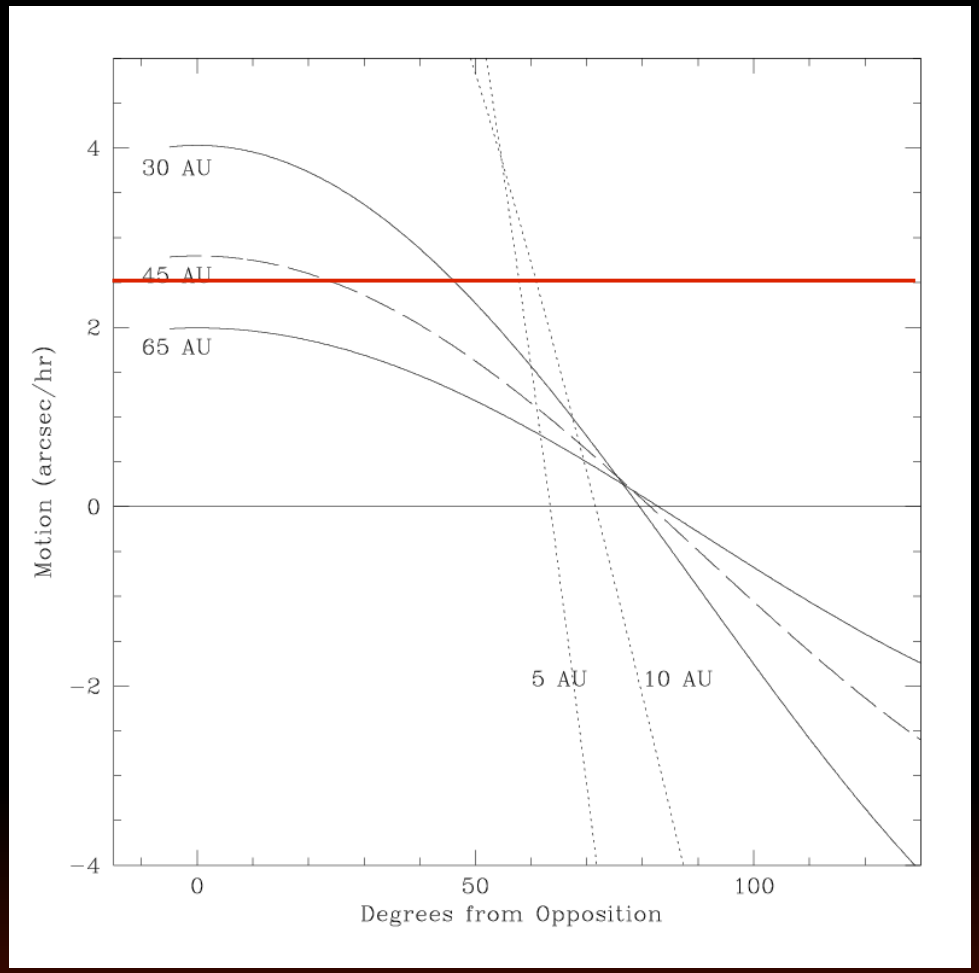
Solar System Science from the SDSS-II Supernova Survey

a > 5 AU : A.Becker, A.Puckett, J.Kubica

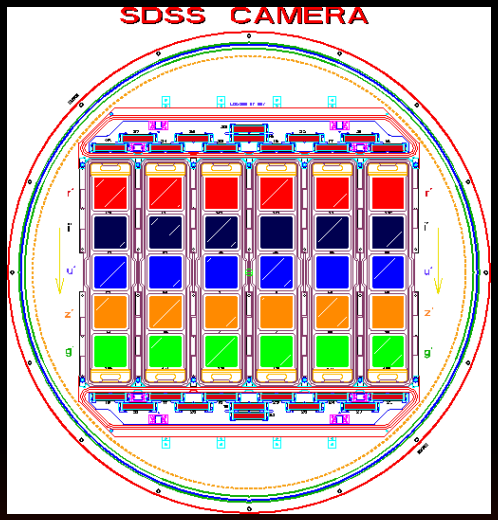
a < 5 AU : A.Becker, A.Rose, B.Dilday

209th Meeting of the American Astronomical Society. Jan 9, 2007. Seattle, WA.

SDSS Moving Object Catalog (MOC)



- Single epoch
- Photo astrometry
  - 0.04” band-to-band

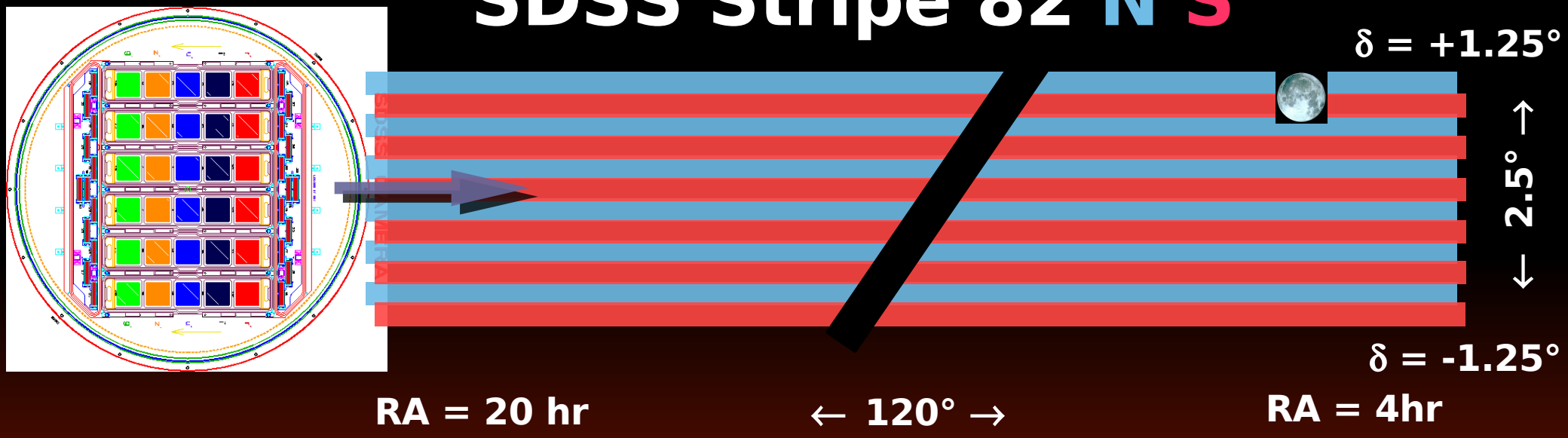


- 5σ (r→g) of 2.5”/hr
- a ~ 45 AU

SDSS Supernova Survey

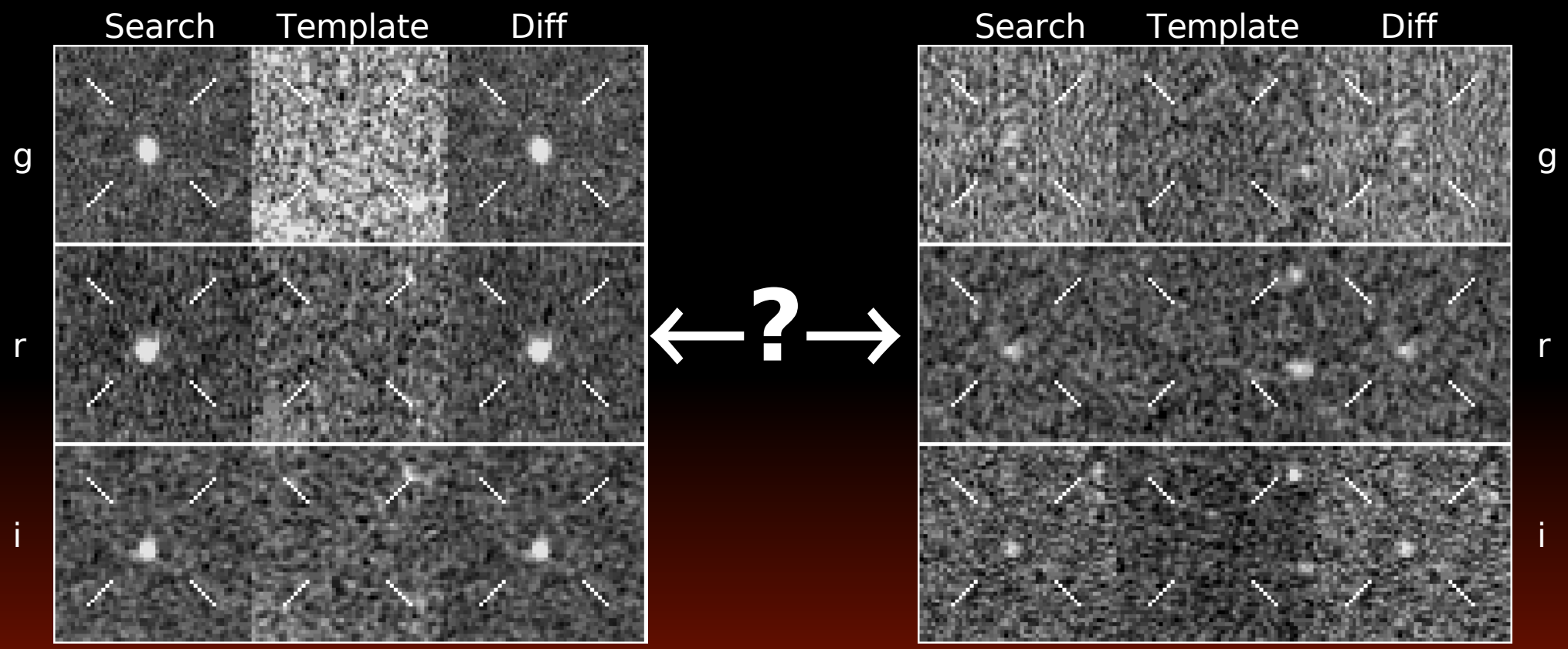
- Sept-Nov 2005-2007
- 300 square degrees, every 2 nights
- 5-band photometry
- Spectroscopic followup

SDSS Stripe 82 N S



SN Search Single Epoch Detections

- Largest SN foreground is solar system objects!
  - 100 : 1
- SN Survey now alerts after 2nd epoch confirmation



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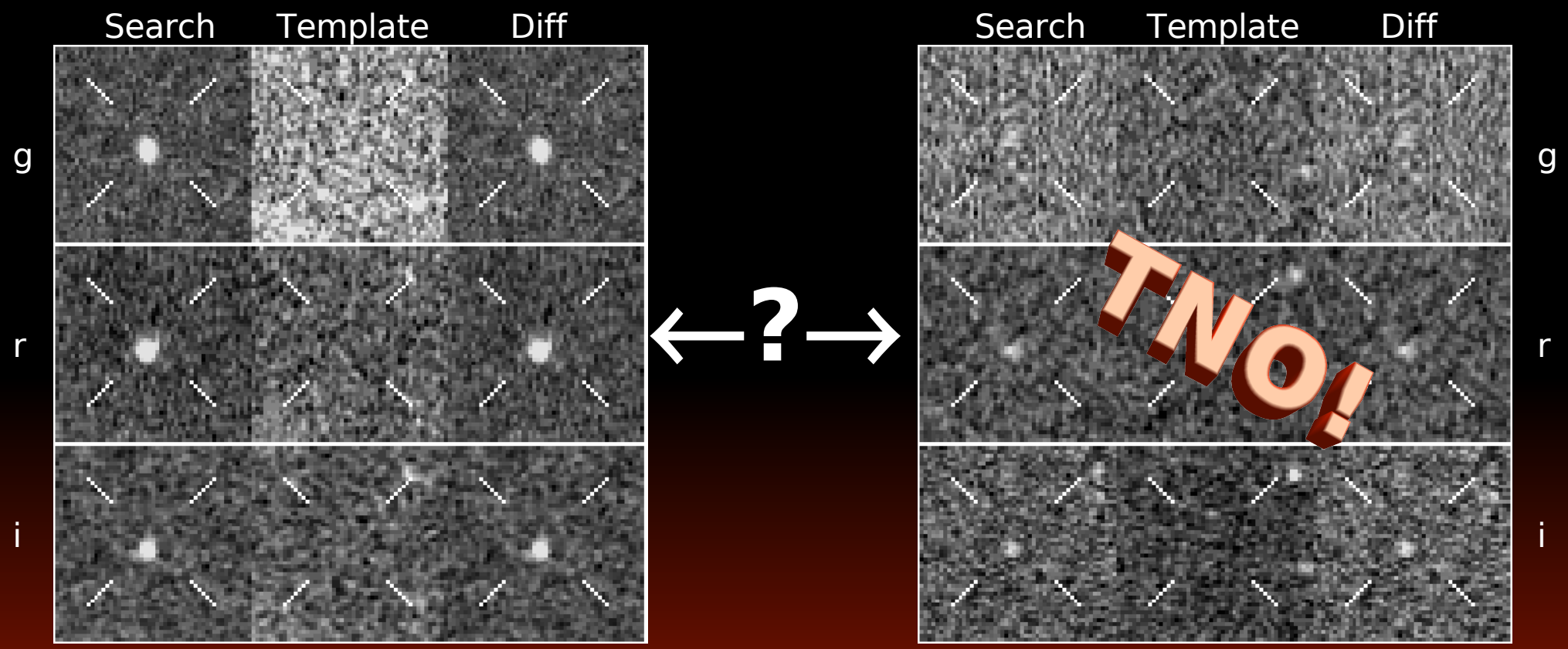
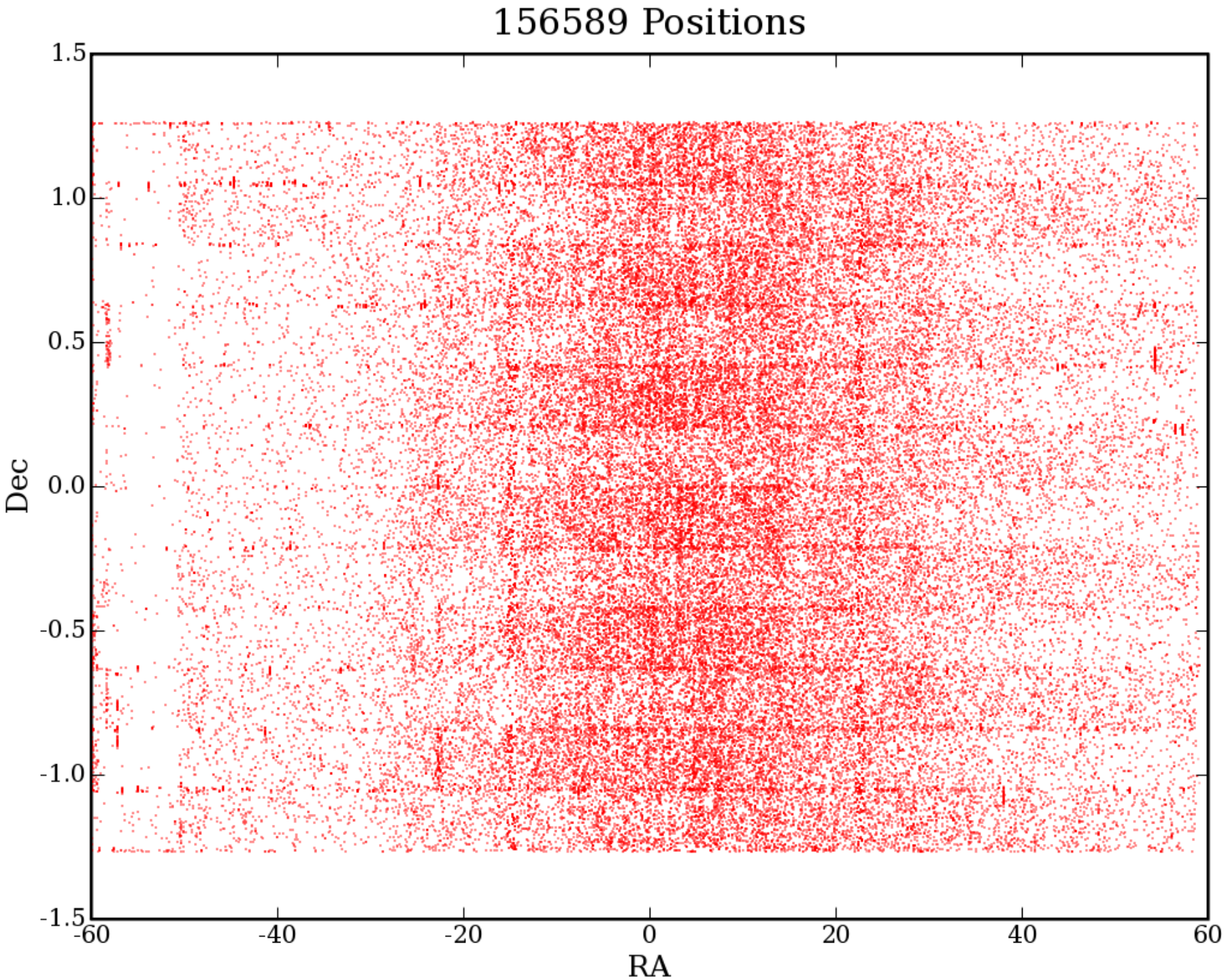


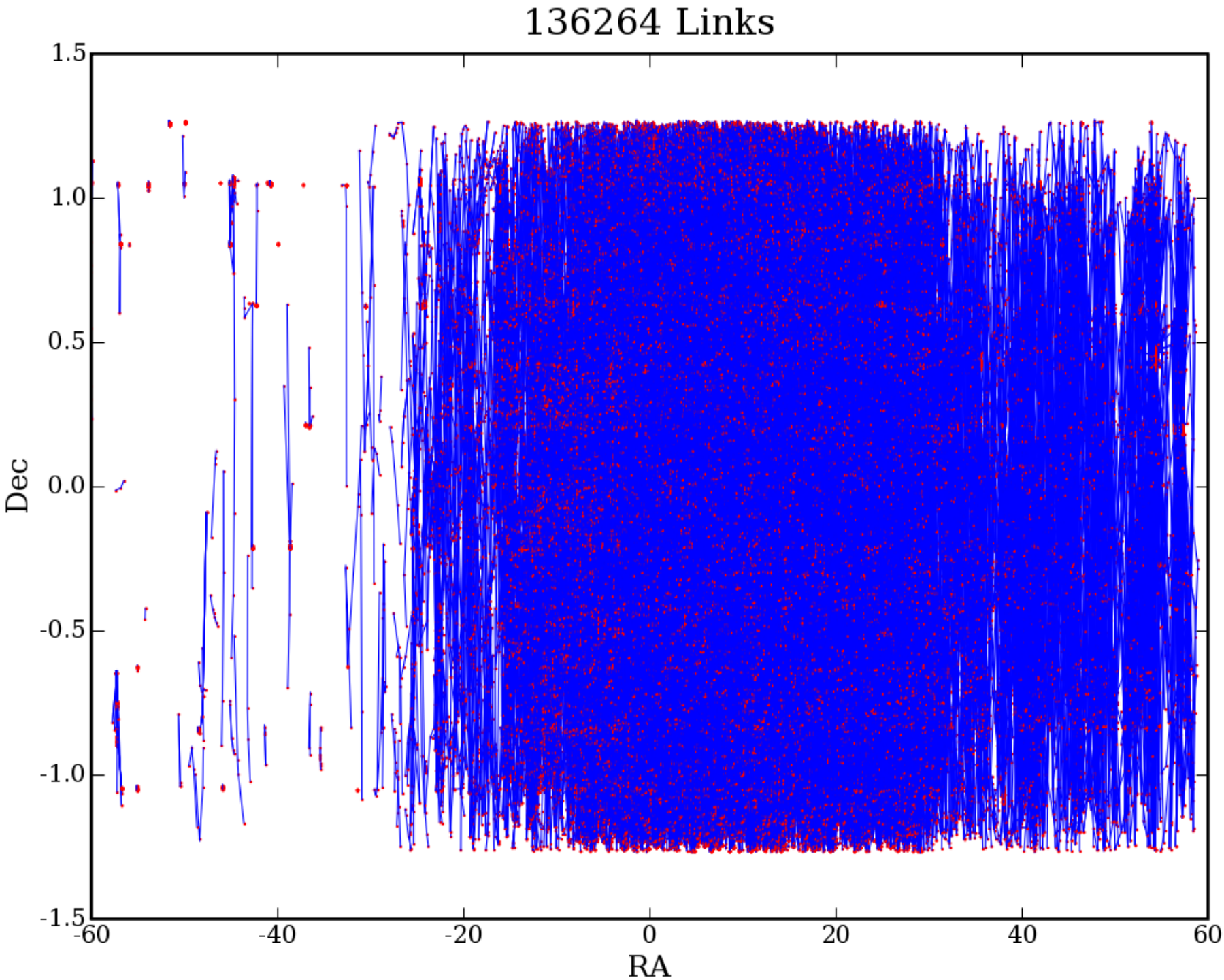
SDSS Linked Object Catalog (LOC)

- Harvest *all* single-epoch detections
  - Once a month from diffim database
- “Link” detections into tracks
  - Quadratic motion
- Verify/reject links by fitting to orbital model
  - Currently only $a > 10$ AU
- Search for precovery/recovery obs

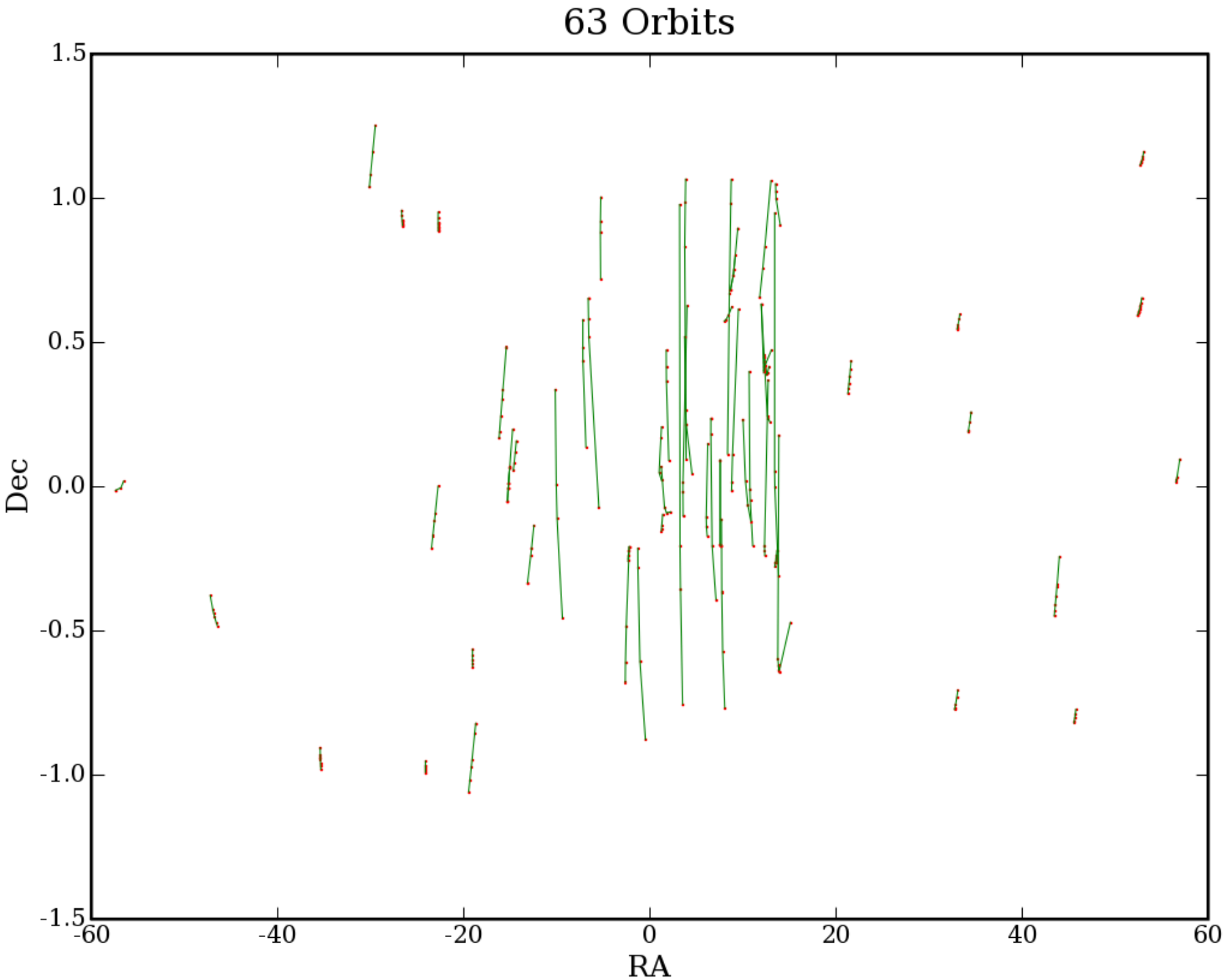
Nov 2006; Single Epoch



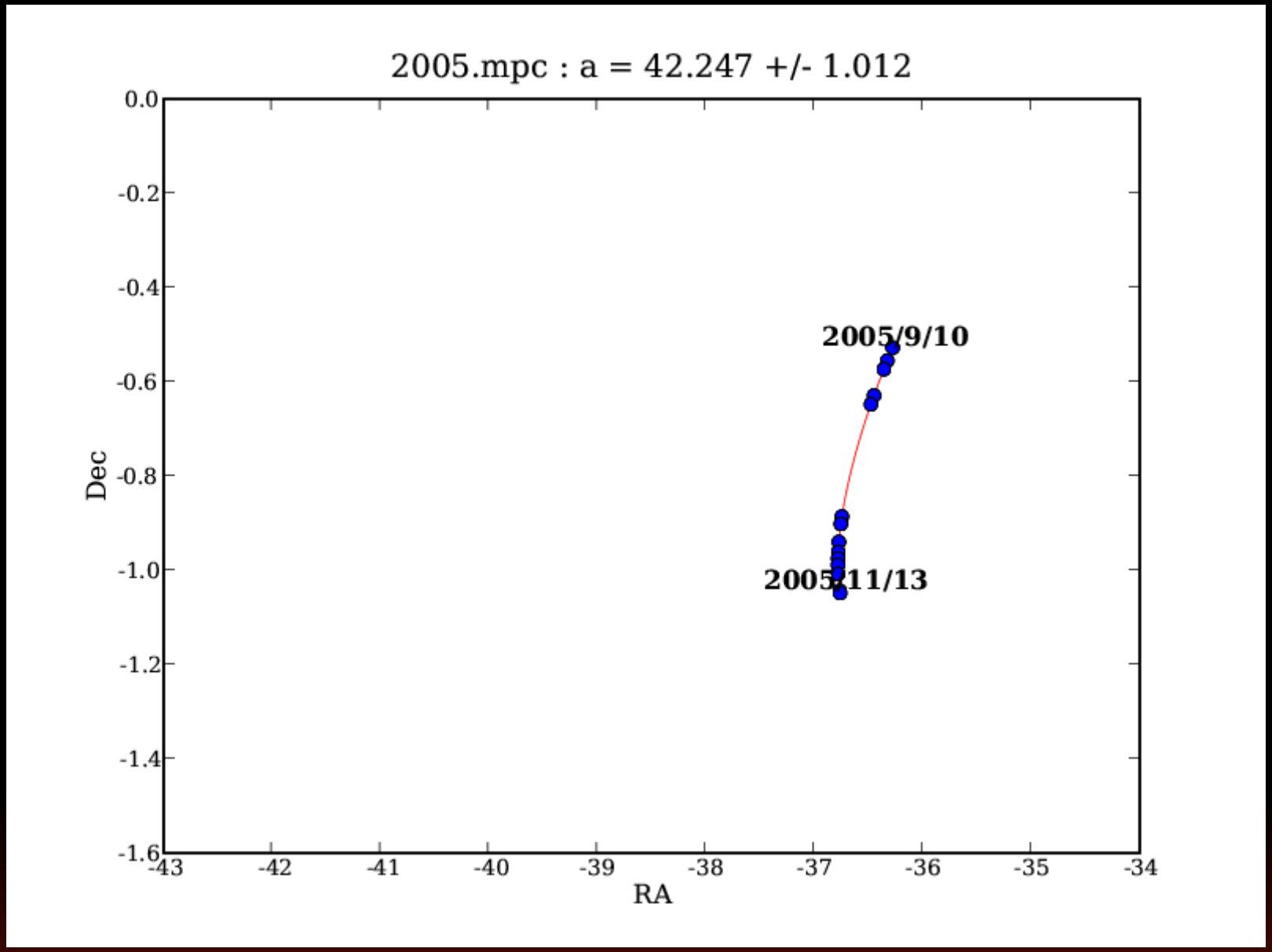
Nov 2006; Quadratic Links



Nov 2006; Verified by Orbit Fitting



Precovery from SDSS



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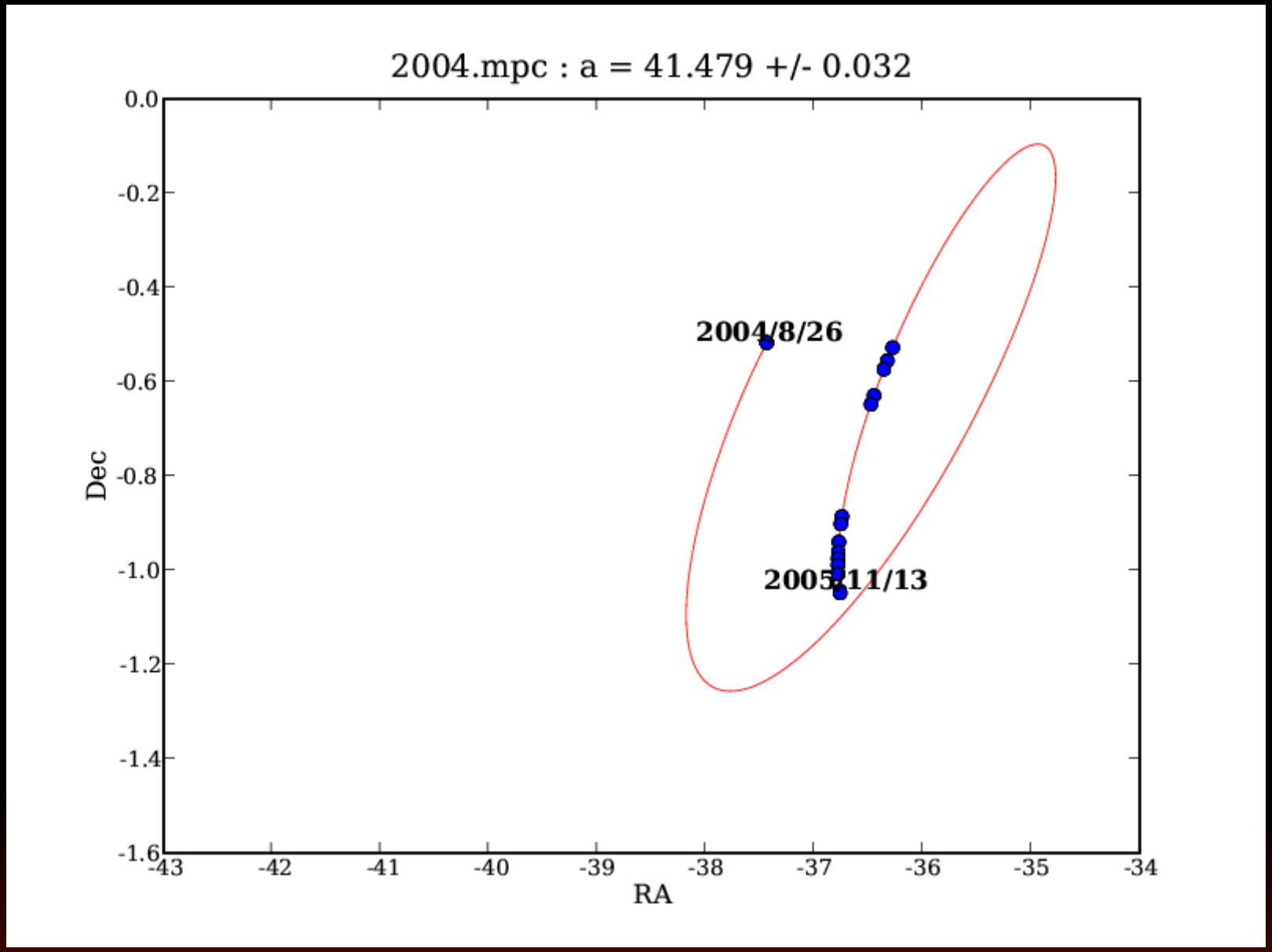

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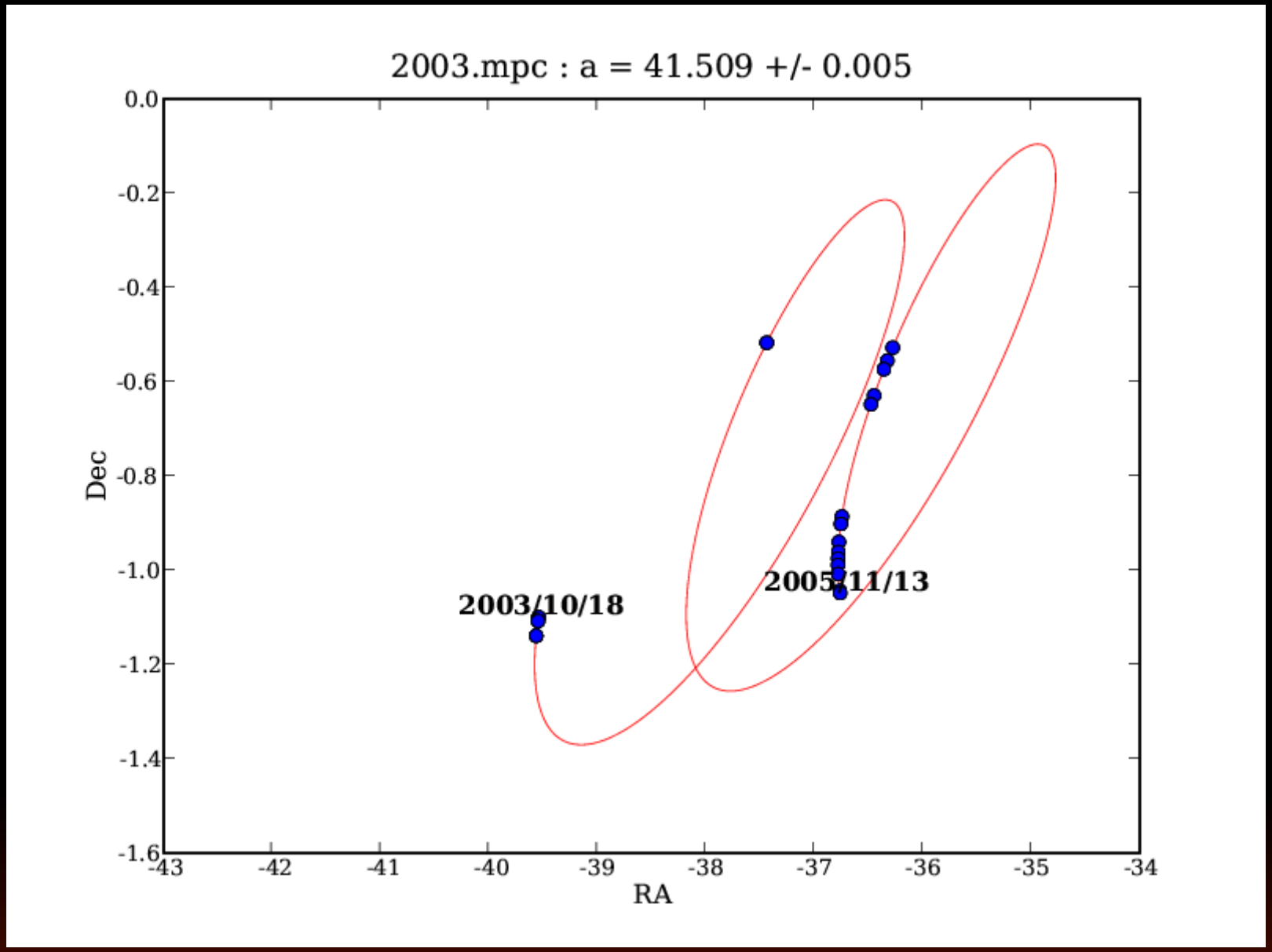
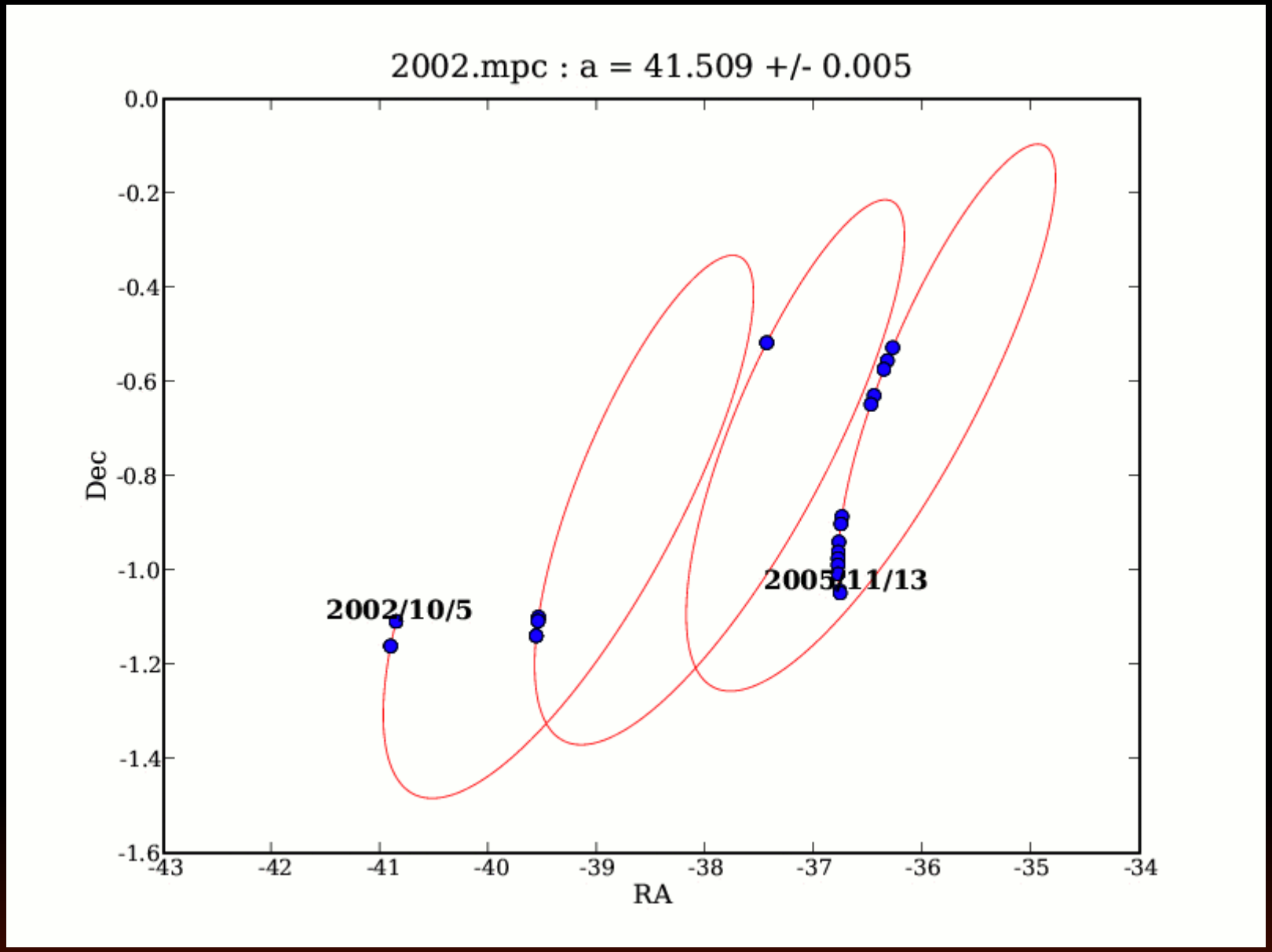


Precovery from SDSS



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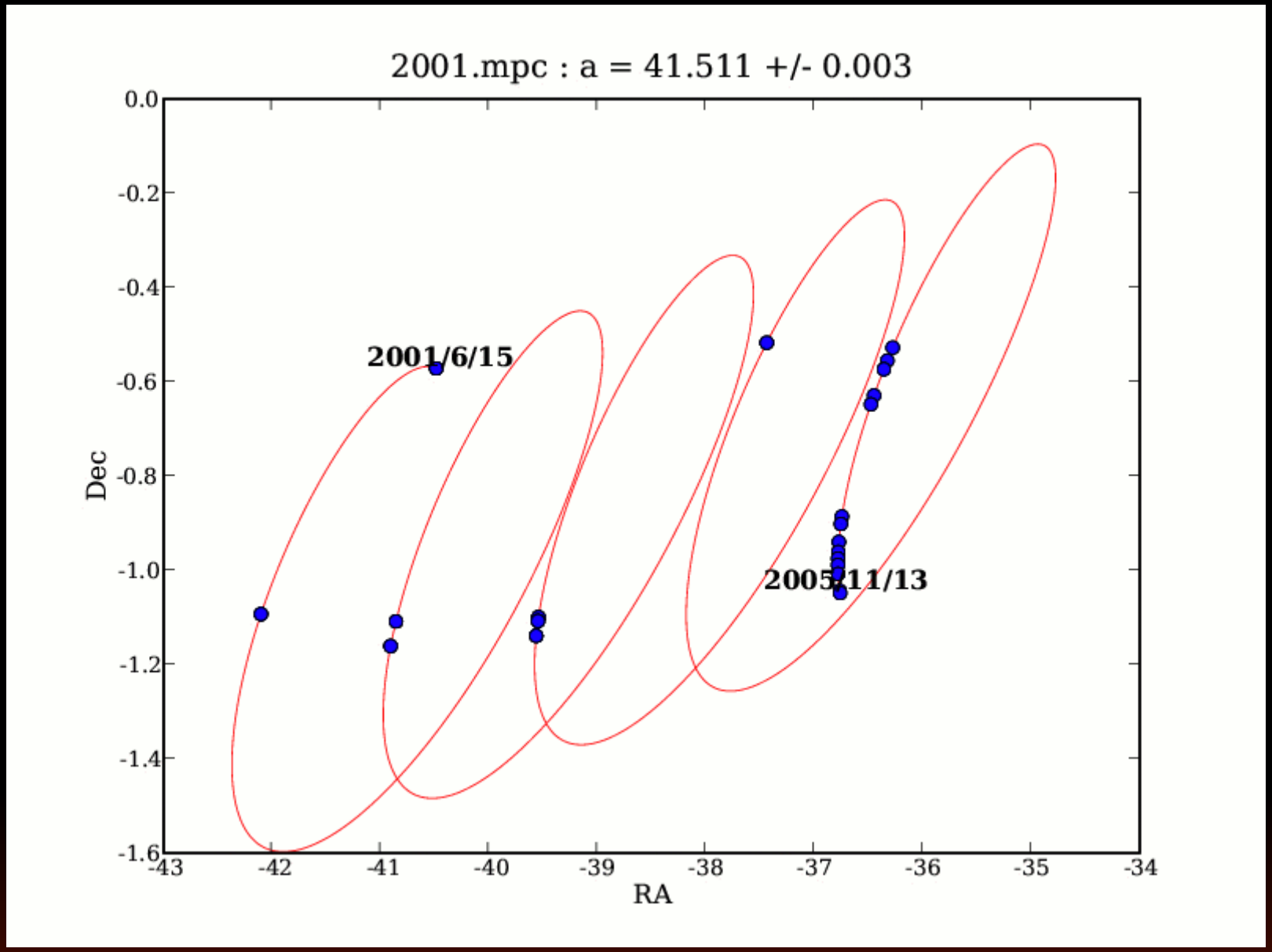
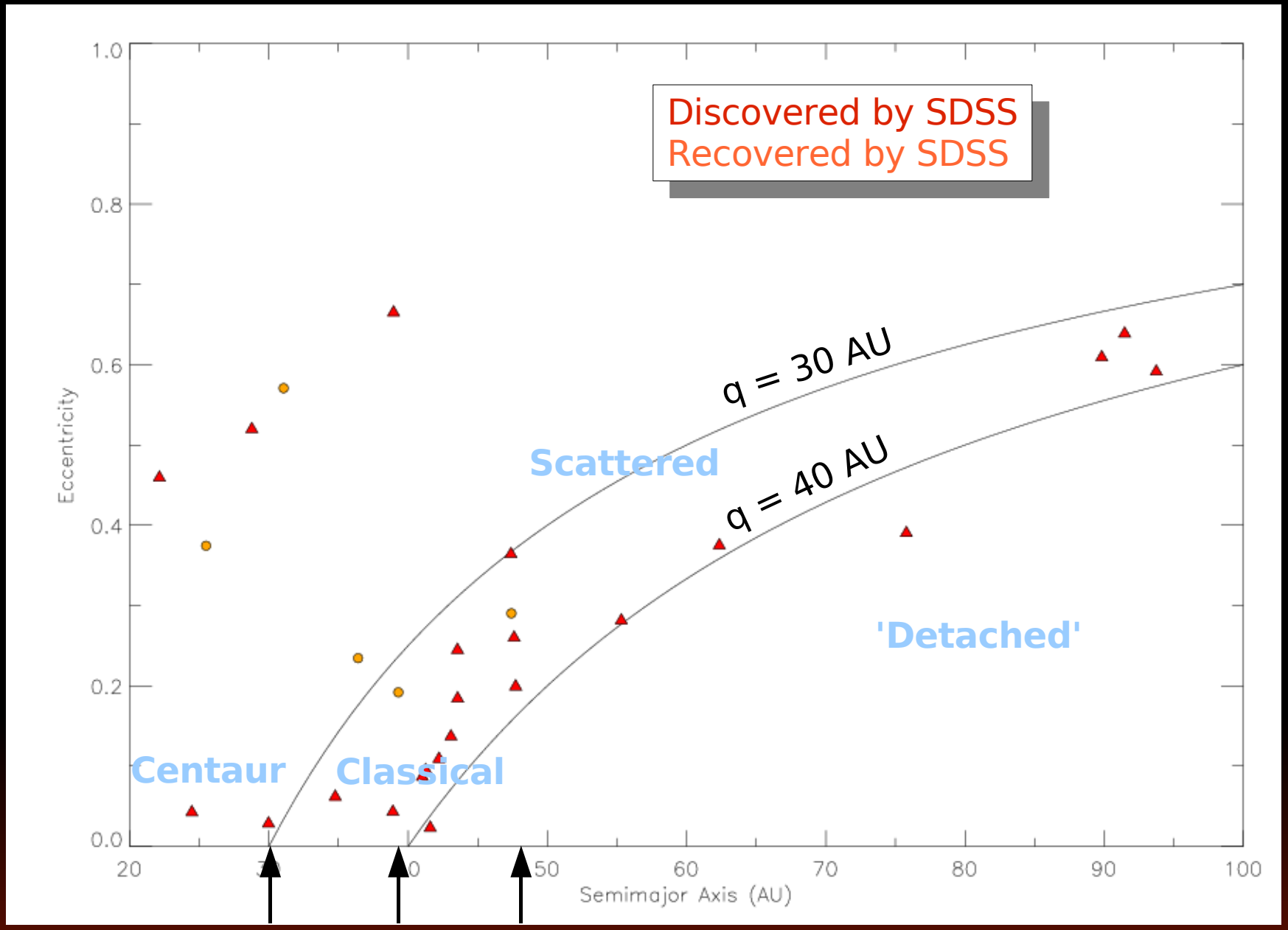


Summary of Orbital Params

Object	*a (AU)*	*e*	*i (deg)*	*q (AU)*	*Q (AU)*	*H*
2005 VD*	6.6	0.25	172	4.9	8.3	14.2
2005 WY_3*	6.7	0.73	29.4	1.7	11.6	13.4
Asbolus*	17.9	0.62	17.6	6.8	29.1	9.0
2006 SX_{368}	22.2	0.46	36.2	11.9	32.4	9.5
2005 RL_{43}	24.4	0.04	12.2	23.4	25.4	8.5
2002 QX_{47}*	25.4	0.37	7.2	15.9	34.9	8.9
2005 RO_{43}	28.8	0.52	35.5	13.8	43.8	7.1
2002 PN_{34}*	30.9	0.57	16.6	13.3	48.6	8.2
2005 SC_{278}	34.3	0.005	1.5	34.1	34.5	7.5
2003 SS_{317}*	36.3	0.23	5.9	27.8	44.8	7.6
2004 UX_{10}	38.8	0.04	9.5	37.2	40.5	4.7
2006 QP_{180}	38.9	0.66	4.9	13.0	64.8	10.2
2001 QG_{298}*	39.2	0.19	6.4	31.7	46.7	7.0
2006 RC_{103}	40.7	0.07	17.2	37.5	43.8	6.4
2005 RN_{43}	41.5	0.02	19.3	40.6	42.4	3.8
2005 SE_{278}	42.0	0.12	6.8	37.1	46.8	7.5
2005 RQ_{43}	42.1	0.11	20.0	37.5	46.6	6.6
2005 RR_{43}	43.0	0.14	28.5	37.1	48.9	4.0
2006 QQ_{180}	43.5	0.24	9.3	32.8	54.1	7.2
2005 SF_{278}	43.8	0.20	13.3	35.2	52.5	7.0
2005 RS_{43}	46.8	0.13	9.9	40.8	52.8	5.3
1999 RB_{216}*	47.3	0.28	12.7	33.6	61.0	7.3
2006 SG_{369}	47.7	0.36	13.5	30.1	65.4	7.9
2005 SD_{278}	55.8	0.29	17.8	39.6	72.0	6.6
2006 SF_{369}	62.3	0.37	27.6	38.9	85.6	6.8
2005 TB_{190}	75.0	0.38	26.5	46.2	103.8	4.7
2005 RM_{43}	89.7	0.61	28.7	35.1	144.3	4.4
2005 SA_{278}	91.4	0.64	16.2	33.0	149.8	6.2
2005 RP_{43}	94.9	0.60	23.0	37.9	151.8	6.2
Unnamed	795	0.96	19.4	24.1	1566	...

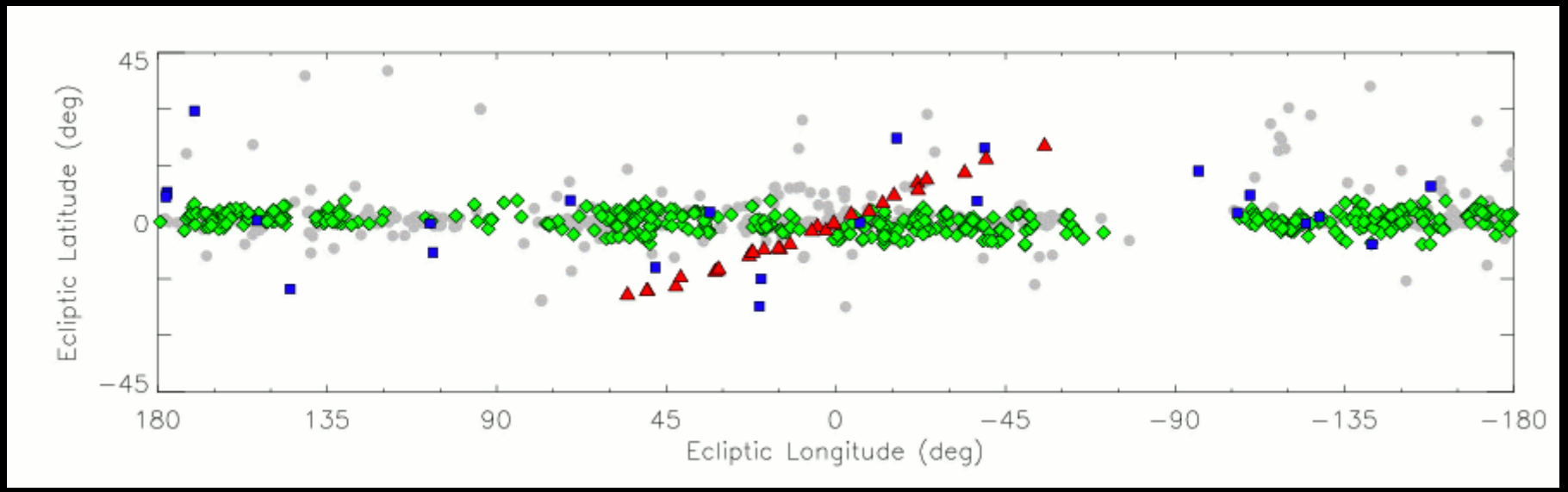
- Discovered by others
- Discovered by SDSS
- Discovered by SDSS and permanent designations

a vs *e*



1:1 3:2 2:1 Resonance with Neptune

Ecliptic Latitude Sampling



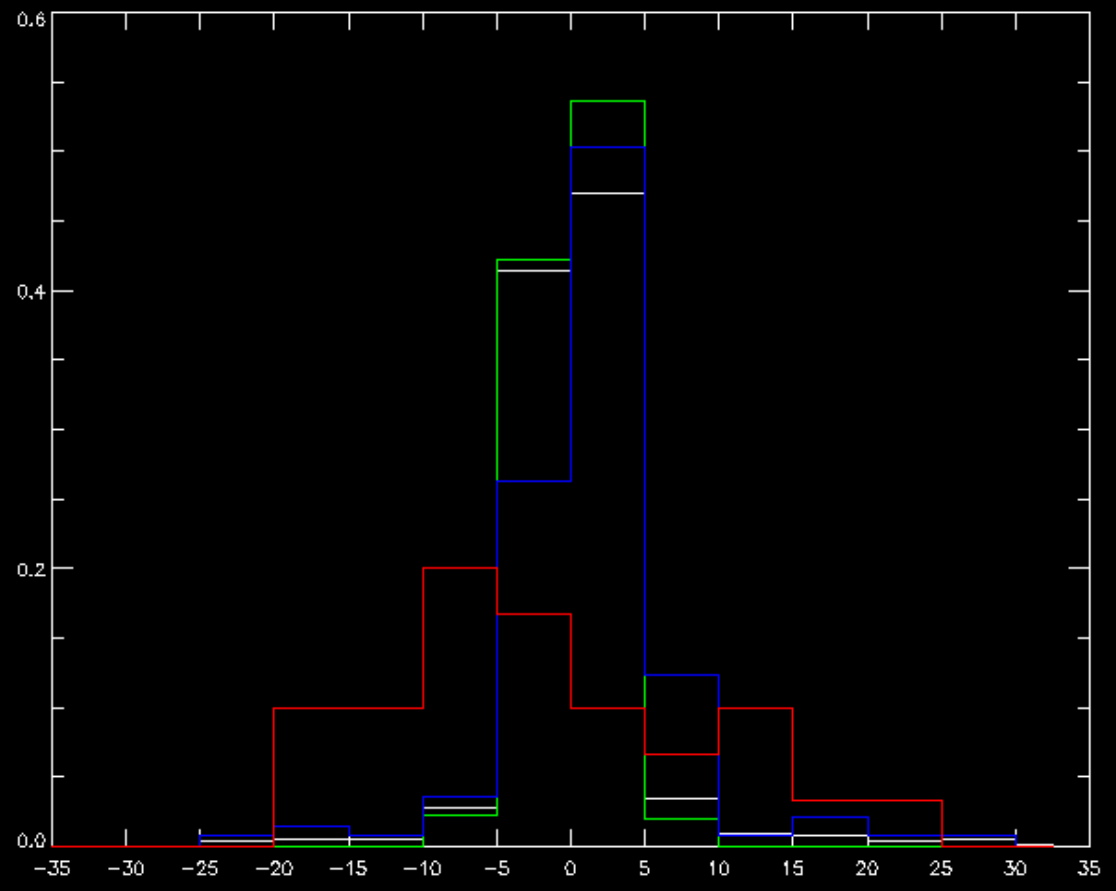
SDSS

Deep Ecliptic Survey (Buie et.al)

Caltech Wide Area Survey (Brown et.al)

Others

Ecliptic Latitude Distribution



SDSS

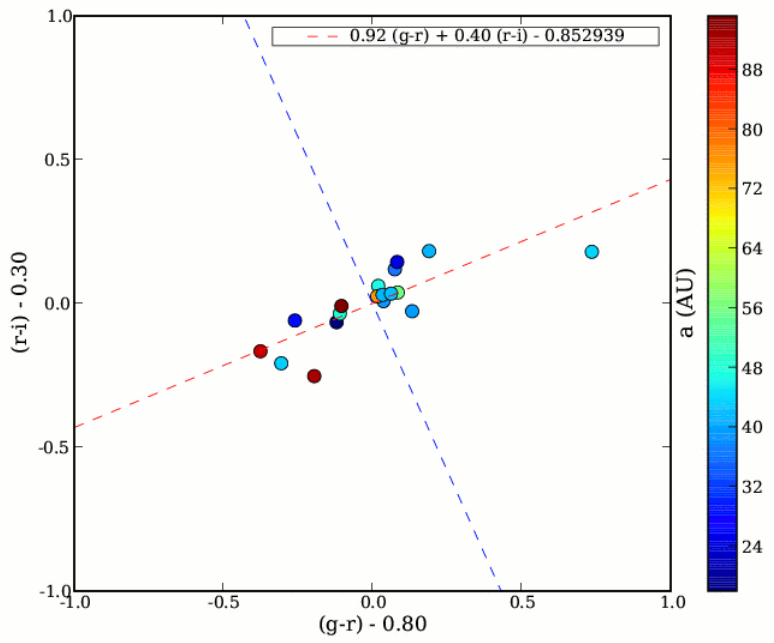
Deep Ecliptic Survey (Buie et.al)

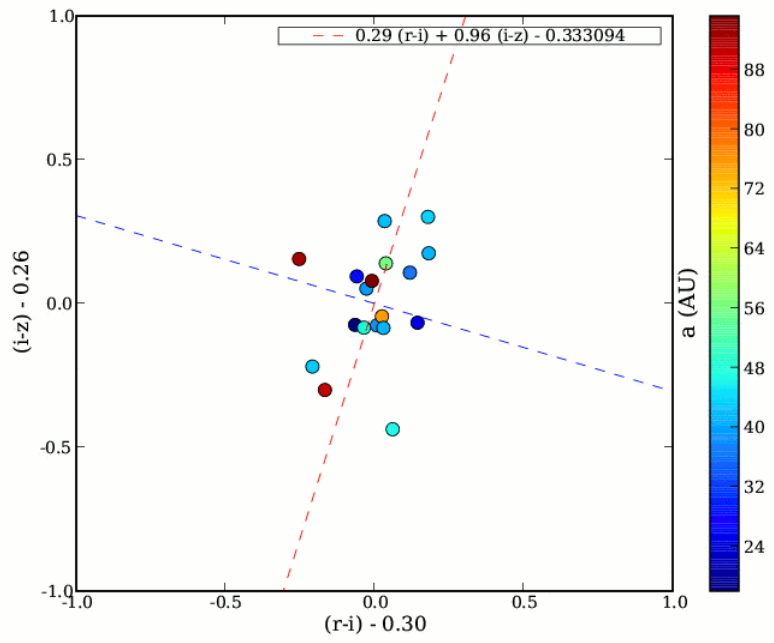
Caltech Wide Area Survey (Brown et.al)

All

Principal Colors

- As a function of population
  - Space weathering; cosmics, resurfacing
  - Inclination
  - Primordial temperature gradients?
- Lightcurves yield periods





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SEATTLE