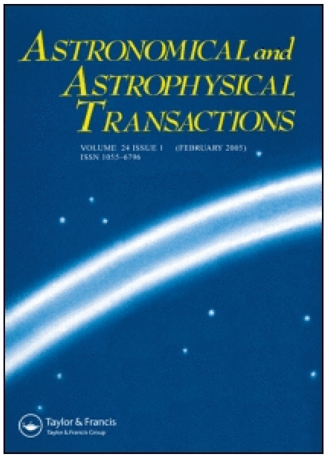

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ON THE DETERMINATION OF A CIRCULAR ASTEROID ORBIT WITH THE USE OF ITS SINGLE CCD-OBSERVATION (ALPHA, DELTA, ALPHA-DOT, DELTA-DOT, UT)

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As is known, modern positional CCD-observation of a celestial body moving against the background of stars gives the coordinates (alpha, delta) and its first derivatives (alpha-dot, delta-dot) for a given moment UT. The accuracy of such CCD-observations is sufficient for the determination of a reliable circular orbit of the observed celestial body or its initial elliptical orbit on the assumption that the observation corresponds to the body's perihelion point. For these orbit determinations we put into practice the Method of Apparent Motion Parameters developed at Pulkovo Observatory by Dr. A. A. Kiselev and Dr. O. P. Bykov in 1973–80. This new method may be considered as an extension of Laplace's idea in the problem of initial orbit determination from positional observations. The Laplace and APM-method algorithms were published in (Bykov, 1989).

Due to the courtesy of Dr. D. Rabinowitz (USA) and Dr. E. Yagudina (Russia) we obtained a good opportunity to apply the results of American CCD-observations of asteroids made in May 1991 on the Spacewatch Telescope of the Steward Observatory on Kitt Peak. These CCD-observations consisted of positions and rates of their change for 926 asteroids referred to a fixed moment UT. We calculated the elements of initial orbits practically for each of these objects by AMP-method using alpha, delta, alpha-dot, delta-dot and UT only. Such information is likely to be the first used for orbit determination in astronomy.

Some results of our calculations for Numbered Minor Planets are presented in Table 1. In the first line, the number of the Minor Planet, its theoretical quantitative of the topocentric angular rates and its real orbital elements are given. In the second line, there are the same data resulting from CCD-observations and our AMP-calculations of a circular orbit.

Table 1

NN	$\dot{\alpha}$ (*deg. per day*)	$\dot{\delta}$	*a*	*e*	*Orbital elements* Ω (*in degrees*)	i	$M+\omega$	*1991, May, UT*
MP 4060	−0.116	0.050	5.25	0.16	167.6	16.16	28	5.25
CCD 67	− .114	.054	5.34	0.00	174	17.9	42	
MP 2290	−0.208	0.077	2.59	0.24	155.6	11.52	44	5.26
CCD 73	− .228	.081	2.40	0.00	146	9.2	73	
MP 3026	−0.186	0.102	3.03	0.03	215.6	9.64	10	12.25
CCD 299	− .179	.106	3.02	0.00	217	10.2	9	
MP 1154	−0.190	0.035	3.39	0.07	82.6	4.55	148	13.28
CCD 345	− .210	.040	2.86	0.00	84	4.2	144	
MP 3689	−0.204	0.087	2.88	0.08	201.9	9.34	44	14.40
CCD 518	− .198	.091	2.82	0.00	202	9.0	36	14.40
CCD 533	− .201	.086	2.79	0.00	198	8.1	40	14.41
MP 518	−0.223	0.113	2.53	0.22	203.8	6.74	46	15.20
CCD 578	− .218	.113	2.37	0.00	205	6.7	22	
MP 1910	−0.168	0.089	3.05	0.05	200.7	10.33	18	18.32
CCD 862	− .167	.095	3.15	0.00	205	12.5	21	

As follows from the table, our results are very close to real orbits, especially in the case of a real circular motion of the Minor Planet.

We believe that the AMP-method orbits may be used for identifications of observed celestial objects (Bykov and Komarov). These orbital computations can be produced in real time during CCD-observation of Near Earth Objects, for example Artificial Earth Satellites or Asteroids crossing the Earth orbit.

We present orbital elements derived for 15 asteroids from single CCD-observations.

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