Improvement of positional accuracy of Solar system bodies ground-based observations with ccd-imaging of close approaches of them with Gaia stars

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Pulkovo Observatory

Observing techniques,
instrumentation and science
for metre-class telescopes 2018

XP 01

Objects of interest

Planetary satellites

Jupiter: Io, Europe, Ganymede, Callisto, Himalia.
Saturn: Mimas, Enceladus, Tethys, Dione, Rhea, Titan, Hyperion, Iapetus, Phoebe, Janus, Epimetheus, Helene, Telesto, Calypso, Atlas, Prometheus, Pandora, Pan.
Uranus: Ariel, Umbriel, Titania, Oberon.

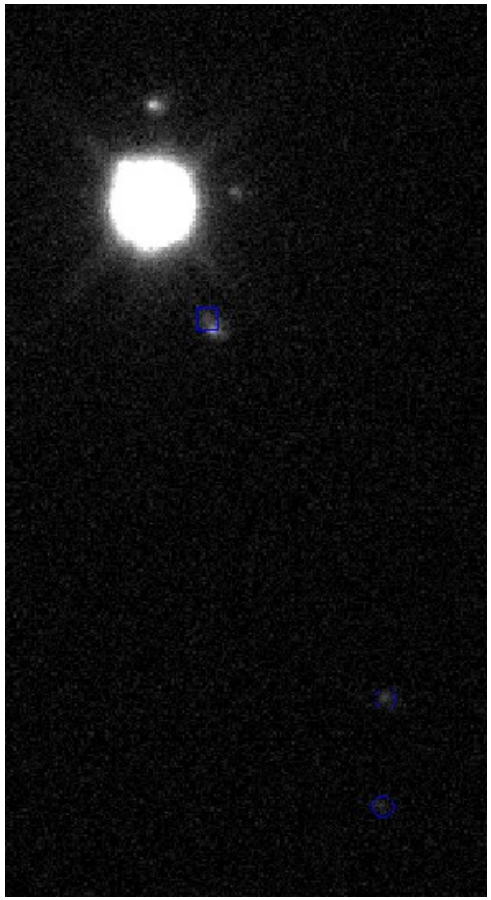
Asteroids and TNO in unstable

Resonance

Earth	Mars	Neptune
164207 2004 GU9	5261 Eureka	309239 2007 RW10
419624 2010 SO16	121514 1999 UJ7	385571 Otrera
459872 2014 EK24	311999 2007 NS2	385695 2005 TO74
	385250 2001 DH47	
	391595 2007 UR2	

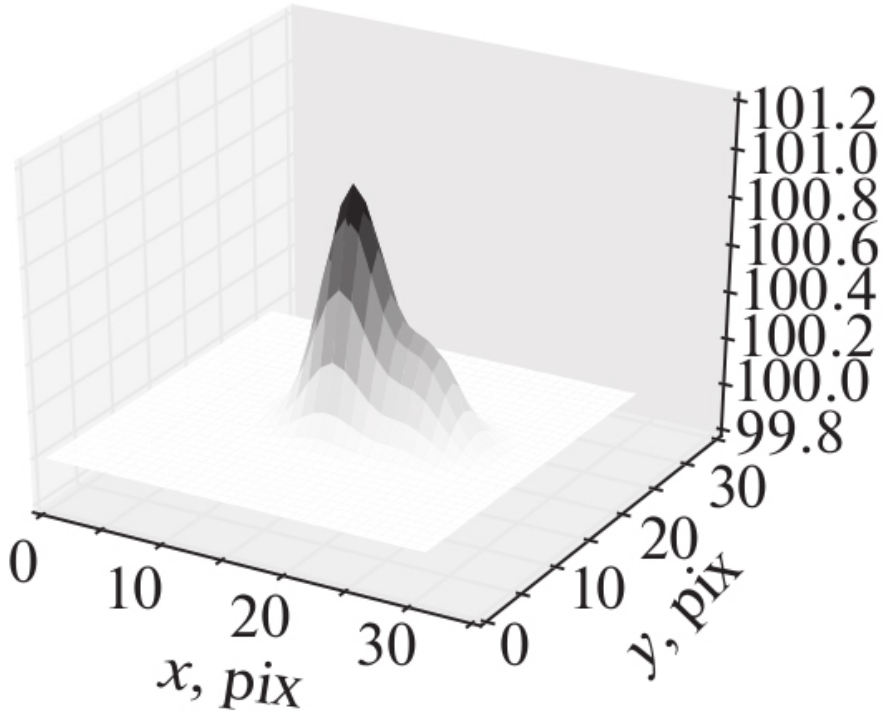
Transient resonance

Venus(T)	Earth(T)	Mars(T)	Neptune(T)
33342 1998 WT24	439898 2000 TG2	16834 1997 WU22	310071 2010 KR59
322756 2001 CK32	439908 2000 XH47	83982 Crantor	316179 2010 EN65
417217 2005 YS	449097 2012 UT68	101429 1998 VF31	
		154020 2002 CA10	
		261938 2006 OB5	
		359170 2009 CN5	
		387505 1998 KN3	
		439898 2000 TG2	
		439908 2000 XH47	
		449097 2012 UT68	

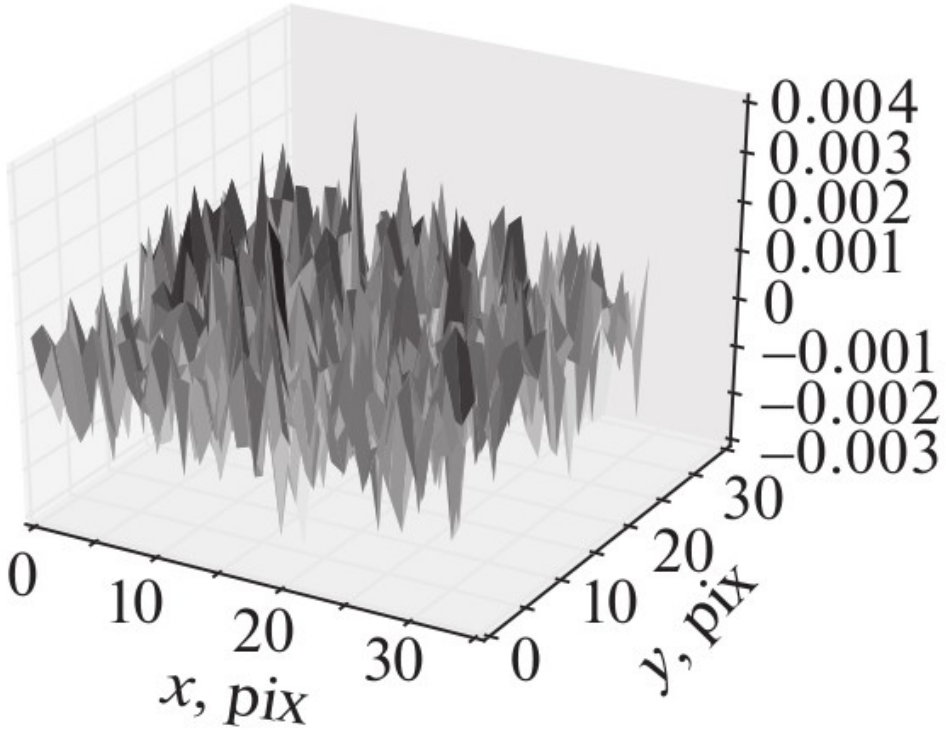


Close approach of U4 Oberon to Gaia2574476038004764800 at 2018-09-23T22:23:32.100 taken with the Saturn1m telescope of Pulkovo Observatory

Shapelet analysis

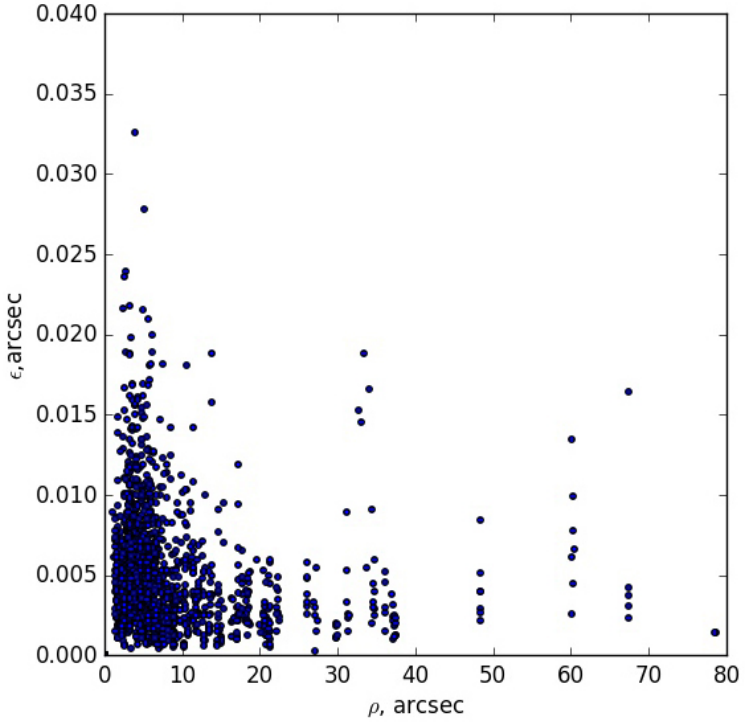


(a) The image of star and asteroid at the moment of maximal approach (Δm = 1 m, ρ = 6 pixels)

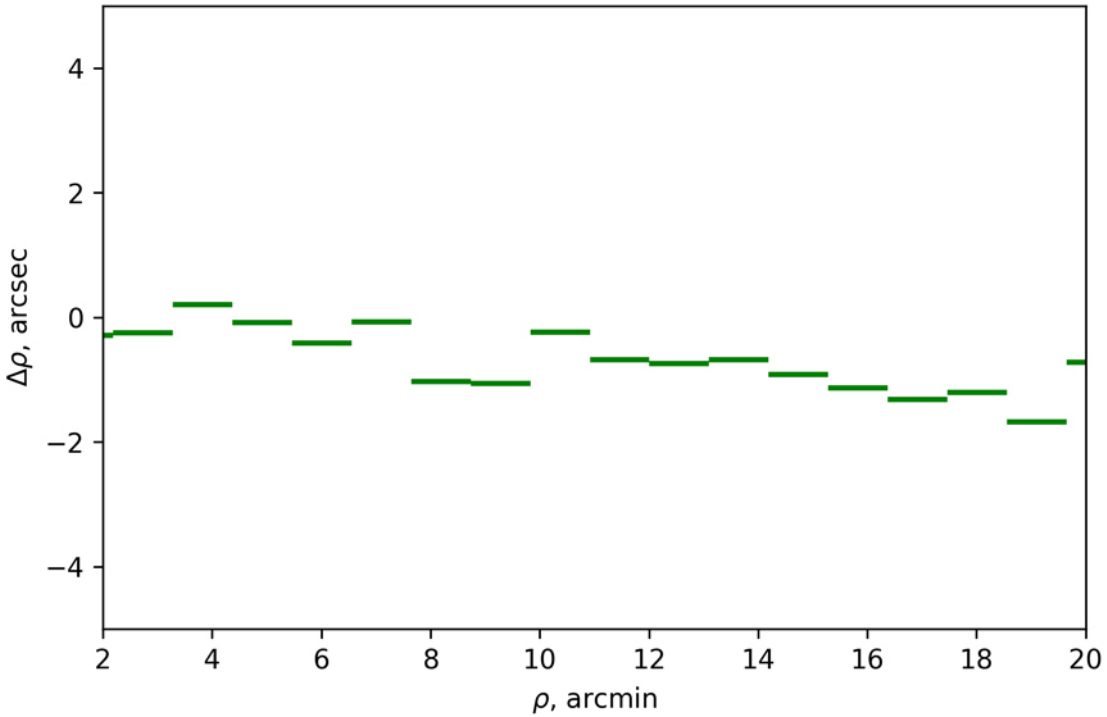


(b) The result of subtracting model fitted with shapelet decomposition from the real image.

The accuracy of the method



Standard errors of determination of angular separation vs angular separation for binary stars taken with the 26-inch refractor of the Pulkovo Observatory.



An analysis of several images taken with the Saturn 1-meter telescope (Pulkovo Observatory). Standard astrometric reduction of these images with Gaia DR2 as astrometric calibrator has been made. As a result, residuals for angular distances between stars of each pair in the image have been calculated.

Also on the poster

Telescopes of the Pulkovo Observatory

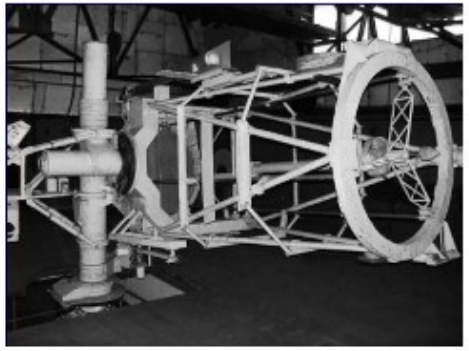
26-inch refractor

D=0.65 m, F=10.5m,
FOV=12 × 12 arcmins,
CCD-scale=0.238 arcsec/pix,
Ph-scale=19.81 arcsec/mm,
$mag_{lim} = 19.5^m$

Normal Astrograph

D=0.33 m, F=3.5m,
FOV=35 × 25 arcmins,
CCD-scale=0.530 arcsec/pix,
Ph-scale=59.56 arcsec/mm,
$mag_{lim} = 17.0^m$

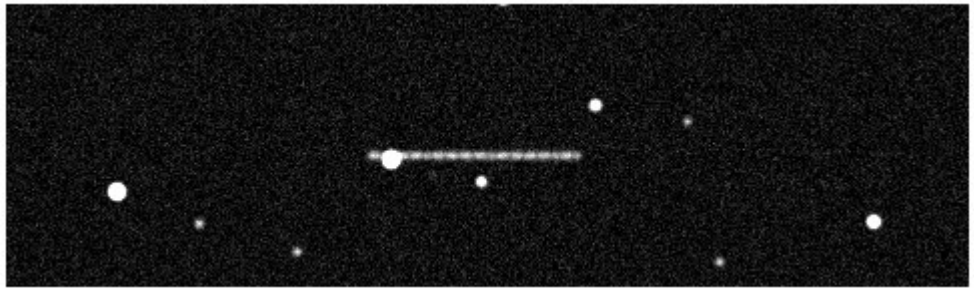
1-m Saturn telescope



D=1 m, F=4m,
FOV=30 × 20 arcmins,
CCD-scale=0.460 arcsec/pix,

$mag_{lim} = 20.0^m$

Simulation of images taken during close approach



We are wellcome in cooperation.

We have developed several python scripts that allow performing calculations of the parameters of the events: moment of maximal approaching between Gaia star and asteroid, angular separation at this moment, celestial coordinates of the asteroid, appropriate magnitudes. We can send theese scripts to all observers who would like to take part in observations of the events. We are wellcome in cooperation. Please, don't hesistate to send appropriate e-mail to us:

ras1304@yandex.ru

Thank you for attention!