

Physical property of 162173 1999JU3 estimated by ground-based observations

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Introduction: The asteroid 162173 1999 JU3 is an Apollo type near-earth asteroid, which is one of the most accessible asteroids by spacecraft, and it has been selected as a target of the sample return mission, Hayabusa-2 and Marco Polo mission. It is important to get to know what kind of asteroid 1999JU3 is for mission design, and we have observed this asteroid from May, 2007 to April, 2008. As a result, direction of a period of rotation and a rotation axis, shape, HG parameter, the albedo and size of asteroid, reflectance spectrum, etc. had become clear so far. We summarize observations for 1999 JU3, which were executed last year in Table 1.

Observational data

Table 1: Summary of observational data.

Telescope	Date	Observer
<Visible photometry & lightcurve data> Total 57 nights		
UH 2.2 m	July 8, Sep 4, 2007	1
Lulin 1 m	July 19-23, Dec 3, 4, 6-8, 2007 Feb 26-28, Apr 2, 4, 5, 2008	2, 3, 4
Ishigaki 1 m	Aug 5, 15, Sep 6, 11, 13, 15, Oct 16, 18, Nov 13, 15, 2007	5
BSGC 1 m	Aug 9, 10, 17, 20, Sep 6, 10, 2007	6, 7
Kiso 1.05 m	Sep 4, 5, 7, 8, 10, 12, 14, 15, Nov 7- 9, 11, 13, 2007, Feb 5-8, Apr 14, 15, 2008	2, 3, 8, 9, 10
Steward 1.55 m	Sep 11-14, 2007	11, 12, 13
<Near infrared photometry>		
CFHT 3.6 m	Aug 29-31, 2007	4
<Thermal infrared photometry>		
AKARI	May 16, 2007	3, 14, 15, 16
Subaru/COMICS	Aug 28, 2007	1, 2, 3, 17, 18
<Visible spectroscopy>		
MMT 6.5 m	July 11, Sep 10, 11, 2007	19
<Near infrared spectroscopy>		
IRTF 3 m	Sep 18, 20, 2007	20, 21

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Pole orientation and shape of 1999 JU3

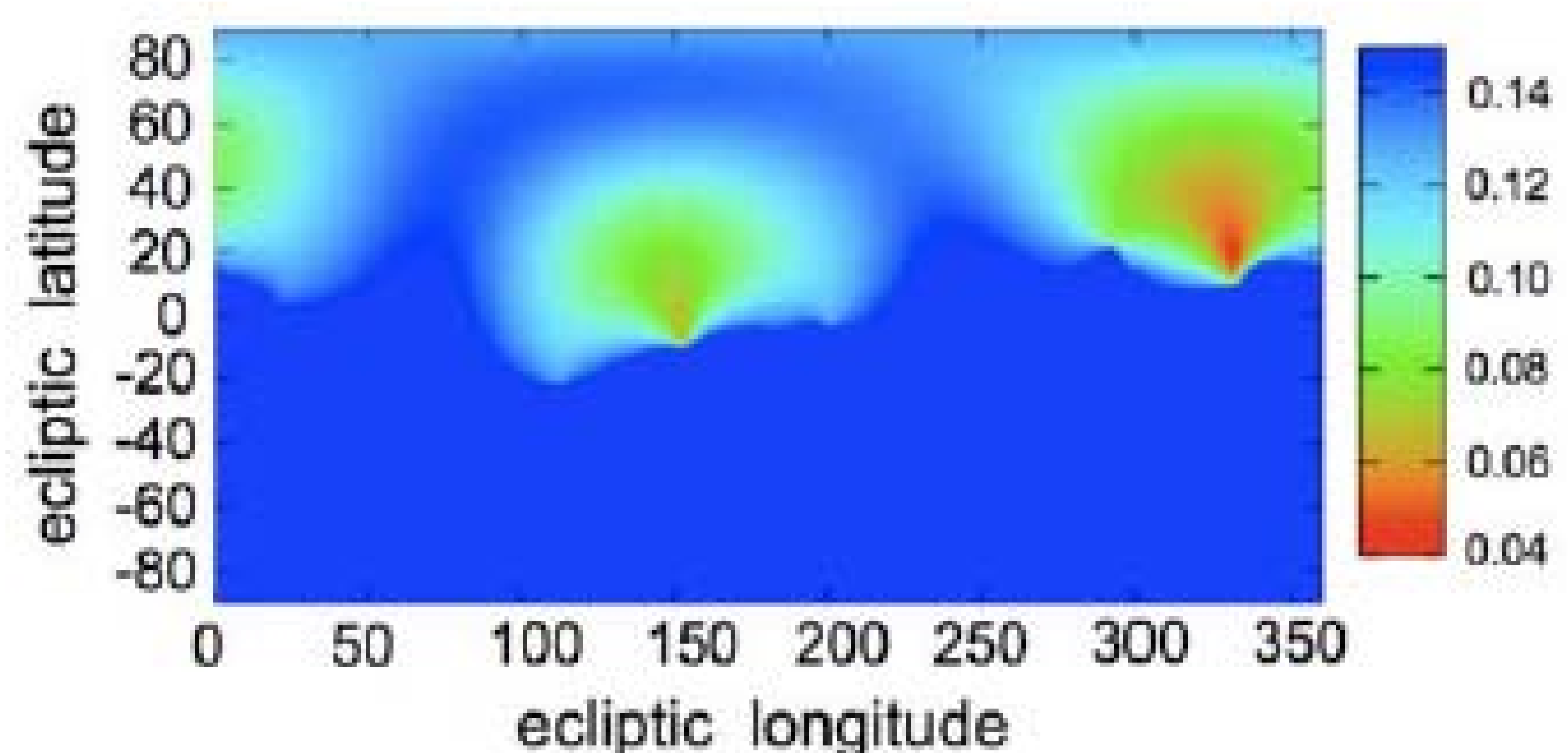


Figure 2: Pole orientation of 1999 JU3 estimated using Amplitude/Epoch method.

Prograde rotation

Pole orientation: Ecliptic longitude = ~ 331 degrees, Ecliptic latitude = ~ 20 degrees
Axis ratio: a:b:c = 1.3 : 1.1 : 1.0



Figure 3: Estimated shape of 1999 JU3 using Kaasalainen program. Face view (left), side view (center), top view (right). The lightcurve of 1999 JU3 phased against 0.3178 days.

Observational direction of the 1999 JU3

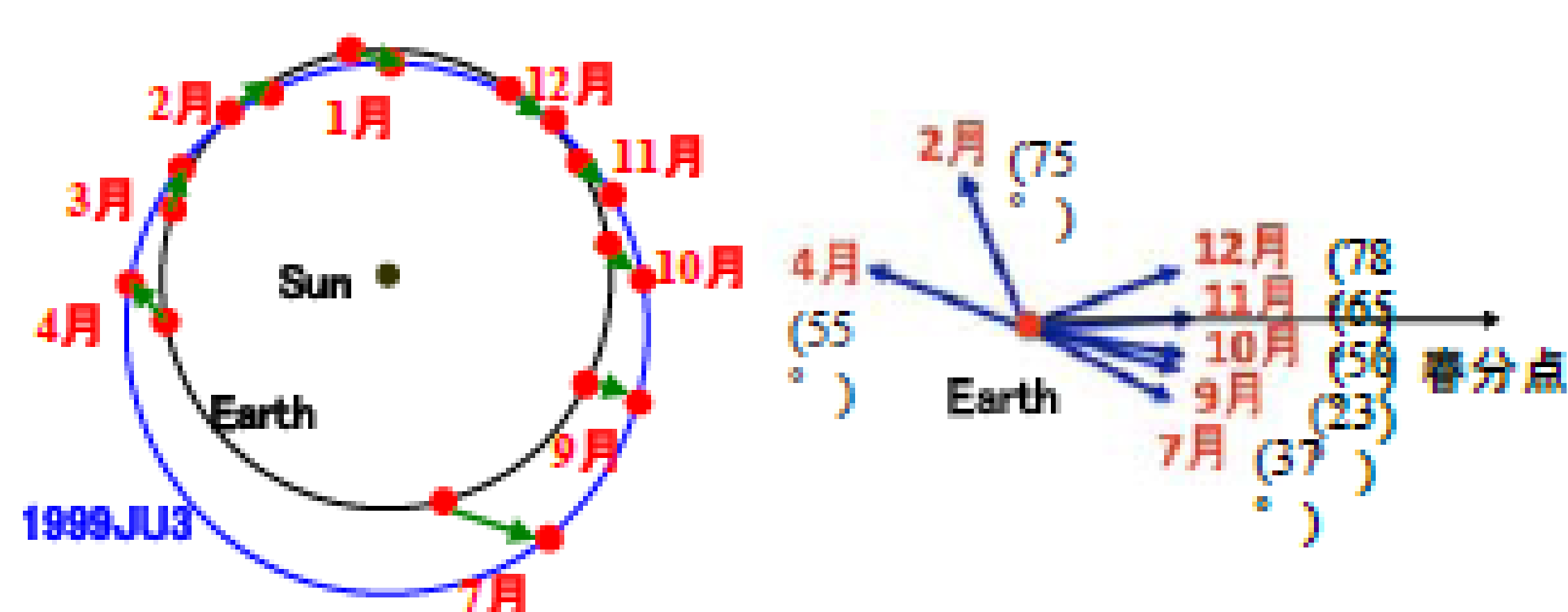


Figure 1: Orbits of the Earth and the asteroid (left). Direction of the asteroid from the Earth (right).

Physical property of 1999 JU3

<Visible photometry & lightcurve data>

Rotational period: 7.672 hours

Small amplitude of brightness variation: ~ 0.1 mag

H=18.82 \pm 0.021, G=-0.110 \pm 0.007

<Visible & near infrared spectroscopy>

Flat and featureless spectrum: typical C-type

<Mid infrared photometry>

Diameter: 0.922 \pm 0.048 km

Albedo: 0.063 \pm 0.006

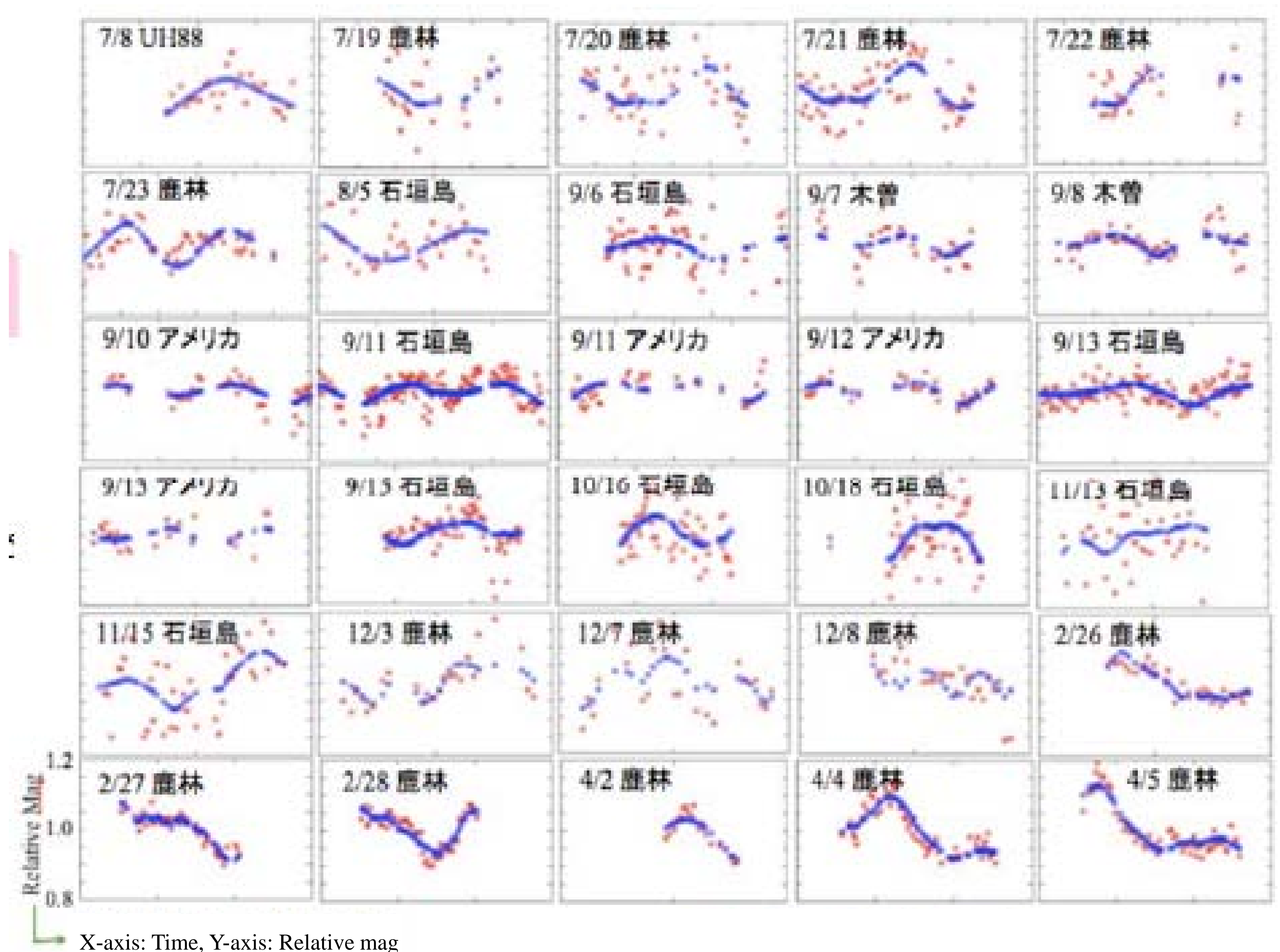


Figure 4: Comparison of the lightcurve predicted from the shape model (blue), and the actually observed light curve (red).