Forthcoming occultations of astrometric radio sources by planets

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Abstract. Astrometric VLBI observations of the radio source occultations by solar system bodies may be of large interest for testing gravity theories, dynamical astronomy, and planetary physics. In this paper, we present an updated list of the occultations of astrometric radio sources by planets expected in the nearest years. Such events, like the solar eclipses, can be only observed in a limited region. The map of the shadow path is provided for the events occurred in regions with several VLBI stations and hence the most interesting for radio astronomy experiments.

Introduction

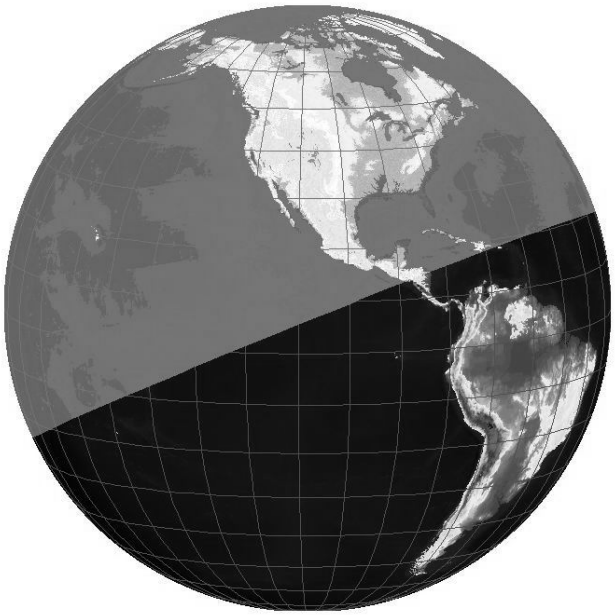
Our previous computations of occultations of astrometric radio sources by planets and their close approaches were published by Malkin et al., 2009. In this paper we present the updated list of the forthcoming occultations, which may be interesting for radio astronomy observations. The main differences with the previous work are using an extended astrometric source list compiled by Leonid Petrov (http://astrogeo.org/vlbi/solutions), and computation of event maps to help better planning of observations.

Forthcoming occultations

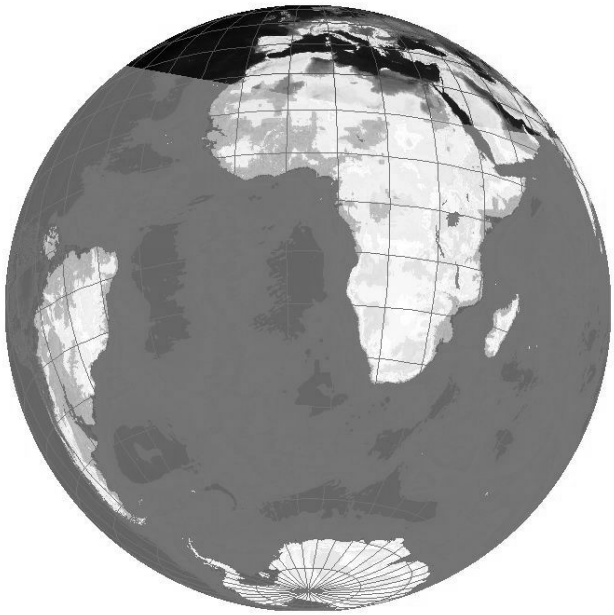
The list of occultations is presented in Table 1 with their basic circumstances. One can see that most of the events are visible in regions with radio astronomy observatories, and several of them can be observed on many antennas. The nearest most interesting event is the occultation of the source 1946–200 by Mars in February 2011 visible in North America with VLBA, VLA, GBT and other radio astronomy facilities. Figure 1 shows the maps of the visibility for several events.

Table 1. Occultations of radio sources by planets in 2011–2030. (*d* is the angular distance from the Sun)

Planet	Date Y M D	Source	*d*, deg	Visibility
Venus	2011 02 26	1946–200	42W	Antarctic, S. America
Mars	2011 05 03	0127+084	19W	N. America
Venus	2012 12 24	1631–208	23W	S. America, Antarctic, Africa
Venus	2015 08 06	0947+064	15E	America
Jupiter	2016 04 10	1101+077	144E	Australia, SE Asia
Venus	2020 01 16	2220–119	38E	S. America, Africa
Venus	2020 07 17	0446+178	42W	N. America
Mercury	2022 11 14	1529–195	4E	S. America
Jupiter	2025 09 18	0725+219	65W	America
Mercury	2027 03 21	2220–119	27W	N. America
Saturn	2028 10 24	0223+113	173W	by ring; Asia, Europe, N. Africa
Mercury	2029 01 14	1958–179	5E	Australia, Antarctic, S. Africa
Venus	2029 02 28	2221–116	6W	Africa, SE Asia, Australia
Mercury	2029 04 16	0243+181	19E	Asia, N. America
Mercury	2029 12 27	1858–212	8E	S. America, Australia
Mercury	2030 02 27	2208–137	9W	S. America, Africa

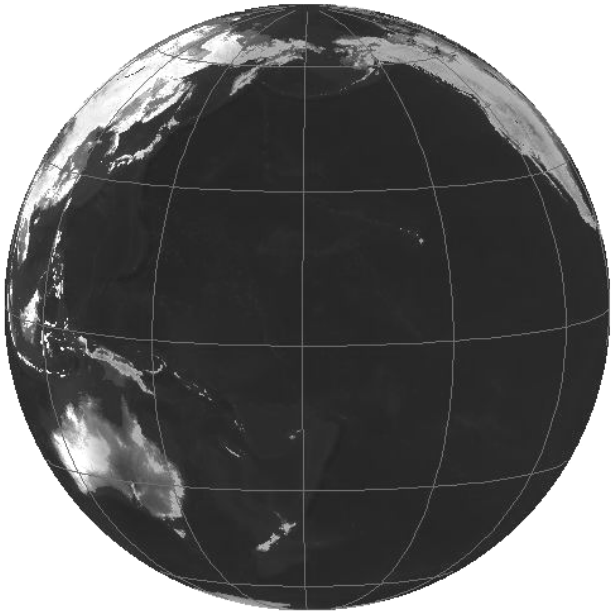


Mars, May 03, 2011



Venus, Dec 24, 2012

Venus, Aug 06, 2015



Jupiter, Apr 10, 2016

Figure 1. Visibility of selected nearest occultations. The region of visibility is shown in light (in the last case, the shadow covers the whole hemisphere shown in the picture).

Conclusion

Observations of the occultations of radio sources by planets are of interest for several interesting applications in physics and planetary sciences. The list of occultations presented in this paper can be used for scheduling such observations in different modes: with VLB and connected-element interferometers, and single antennas, depending on the scientific task.

The list of occultations as well as updated list of close approaches of planets to radio sources is available at http://www.gao.spb.ru/english/as/ac_vlbi/.

References

Malkin Z. M., L'vov V. N., Tsekmejster S. D. Forthcoming Close Angular Approaches of Planets to Radio Sources and Possibilities to Use Them as GR Tests. Solar System Research, 2009, V. 43, No. 4, pp. 313–318.