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J/A+A/584/A104 Luhman 16AB Lucky imaging photometry & astrometry (Mancini+ 2015)

Rotation periods and astrometric motions of the Luhman 16AB brown dwarfs by high-resolution lucky-imaging monitoring.

Mancini L., Giacobbe P., Littlefair S.P., Southworth J., Bozza V., Damasso M., Dominik M., Hundertmark M., Jorgensen U.G., Juncher D., Popovas A., Rabus M., Rahvar S., Schmidt R.W., Skottfelt J., Snodgrass C., Sozzetti A., Alsubai K., Bramich D.M., Calchi Novati S., Ciceri S., D'Ago G., Figuera Jaimes R., Galianni P., Gu S.-H., Harpsoe K., Haugbolle T., Henning T., Hinse T.C., Kains N., Korhonen H., Scarpetta G., Starkey D., Surdej J., Wang X.-B., Wertz O.
<Astron. Astrophys. 584, A104 (2015)>
[=2015A&A...584A.104M](#) (SIMBAD/NED BibCode)

ADC_Keywords: Stars, double and multiple

Keywords: binaries: visual - brown dwarfs - stars: variables: general - techniques: photometric - techniques: image processing

Abstract:

Photometric monitoring of the variability of brown dwarfs can provide useful information about the structure of clouds in their cold atmospheres. The brown-dwarf binary system Luhman 16AB is an interesting target for such a study, as its components stand at the L/T transition and show high levels of variability. Luhman 16AB is also the third closest system to the Solar system, allowing precise astrometric investigations with ground-based facilities.

The aim of the work is to estimate the rotation period and study the astrometric motion of both components.

We have monitored Luhman 16AB over a period of two years with the lucky-imaging camera mounted on the Danish 1.54 m telescope at La Silla, through a special i+z long-pass filter, which allowed us to clearly resolve the two brown dwarfs into single objects. An intense monitoring of the target was also performed over 16 nights, in which we observed a peak-to-peak variability of 0.20mag and 0.34mag for Luhman 16A and 16B, respectively.

We used the 16-night time-series data to estimate the rotation period of the two components. We found that Luhman 16B rotates with a period of 5.1-hr, in very good agreement with previous measurements. For Luhman 16A, we report that it rotates slower than its companion and, even though we were not able to get a robust determination, our data indicate a rotation period of roughly 8-hr. This implies that the rotation axes of the two components are well aligned and suggests a scenario in which the two objects underwent the same accretion process. The 2-year complete dataset was used to study the astrometric motion of Luhman16AB. We predict a motion of the system that is not consistent with a previous estimate based on two months of monitoring, but cannot confirm or refute the presence of additional planetary-mass bodies in the system.

Description:

Photometric light curves and astrometric motion curves of Luhman 16A and Luhman 16B.

Objects:

RA	(2000)	DE	Designation(s)
10 49 19.0	-53 19 10		Luhman 16A = ** LUH 16A
10 49 18.9	-53 19 09		Luhman 16B = ** LUH 16B

File Summary:

FileName	Lrecl	Records	Explanations
ReadMe	80	.	This file
astrom.dat	119	24	Astrometry of Luhman 16A and Luhman 16B
luh16a.dat	39	708	Photometric light curves of Luhman 16A
luh16b.dat	39	708	Photometric light curves of Luhman 16B

Byte-by-byte Description of file: [astrom.dat](#)

Bytes	Format	Units	Label	Explanations
1-	9	F9.5	d	JD
11-	22	F12.10	d	Julian Date (JD-2456000.0)
24-	36	F13.10	deg	Xi16A Measured Xi standard coordinate of Luhman 16A (1)
24-	36	F13.10	deg	Eta16A Measured Eta standard coordinate of Luhman 16A (1)
38-	50	E13.8	deg	e_Xi16A Uncertainty on Xi16A
52-	64	E13.8	deg	e_Eta16A Uncertainty Eta16A
66-	77	F12.10	deg	Xi16B Measured Xi standard coordinate of Luhman 16B (1)
79-	91	F13.10	deg	Eta16B Measured Eta standard coordinate of Luhman 16B (1)
93-	105	E13.8	deg	e_Xi16B Uncertainty on Xi16B
107-	119	E13.8	deg	e_Eta16B Uncertainty Eta16B

Note (1): see equations in Sec 3.2.

Byte-by-byte Description of file: [luh16a.dat](#) [luh16b.dat](#)

Bytes	Format	Units	Label	Explanations
3- 15	F13.7	d	BJD	Barycentric JD for the midpoint of observation (TDB, BJD-2400000)
18- 27	F10.7	mag	izmag	PSF photometry i+z mag of Luhman 16 A
31- 39	F9.7	mag	e_izmag	Measurement error of the i+z band magnitude

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Luigi Mancini, [mancini\(at\)mpia.de](mailto:mancini(at)mpia.de)

History:

- * 30-Nov-2015: First on-line version
- * 16-Feb-2016: Astrometric table added (from author)

(End) Luigi Mancini [MPIA, Germany], Patricia Vannier [CDS] 27-Oct-2015

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