

Umkhathilibe Ephaketheni Lami



ImiZulendle

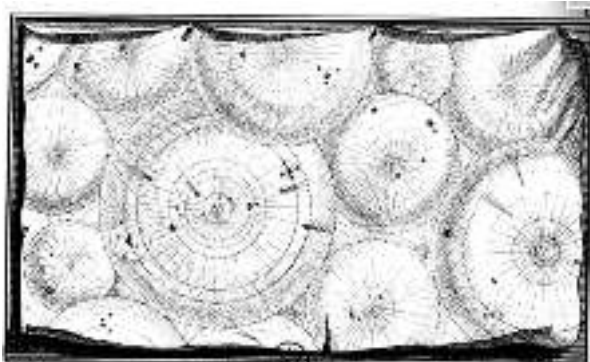


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Grażyna Stasińska

Paris Observatory

Umbono wokuthi kukhona 'eminye imihlaba' ngaphandle kohlelo lweLanga waphakanyiswa iFilosofa yaseGrikhi u-Epicure, eminyakeni eyizi-2,300 eyedlule. Ngowe-1584 iFilosofa uGiordano Bruno wazakuzisa ukuthi iziNkanyezi zingama Langa, njenga lena yethu. Ngowe-XVII kanye nowe-XVIII, osoSayensi abaningi kanye nama Filosofa, afana noCharles Huygens beno-Immanuel Kant, bawuthukisa wafinyelela kwimiHlaba engaphandle kohlelo lwe Langa.

Umdwebo okhombisa 'ubufuthu bemihlaba' ngokucabanga kombhali waseFulansi uFontenelle ngowe-1686.



Uhlobo lomdwebo onomubala ocashunwe kwisifaxa esitholakala encwadini kaCamille Flammarion eyashicilelwa ngowe-1888. ukhombisa umhambuma ukhuphula omunye umhlaba.



Imizamo yokuqala yezimfundindalo zomkhathi yokuhlonza eminye imihlaba ezungeza ezinye iziNkanyezi yaba ngasekupheleni konyaka we-1930, kodwa kuze kube owe-1989 babekhaka utalagu nje.

Icingwe lani imiZulendle ?

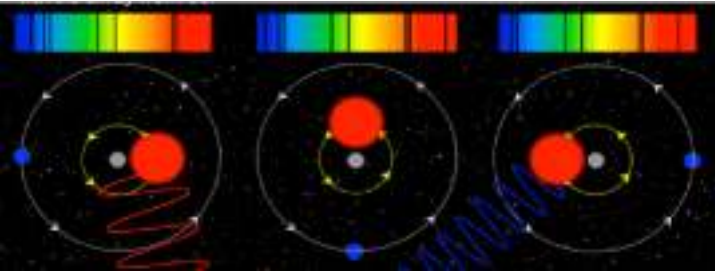
KuneziNkanyezi cishe eziyizigidigidi eziyi-1 00 kuMthalakazi wethu, uMzilafasimbe. Mingaki imiZulendle - imiZulane engaphandle kohlelo lweLanga lethu - esilindele ukuba ibekhona ?

Kungani ezinye iziNkanyezi zizungezwa imiZulane ? Izinhlelo zamaLanga zihluke kangakanani ? Ngabe lokhu ukwehluka kusitshela into thizeni ngokudaleka kwemiZulane ? Lena eminye yemibuzo egqugquzela lolu ucwaningo lwemiZulendle.

Eminye yalemiZulane ingase ibe nezigubo ezinhle (ukukhanya okusuka kwiNkanyezi kanye nobungako bakho, amazinga okushisa, isigubo somoya) ezivumela ubukhona beKhemistry ebucayi yomcalahle kanti futhi engase ivumele ukuthuthuka kwempilo (Engase ihluke kuna leyo yasemHlabeni wethu).

Ezomdiki :

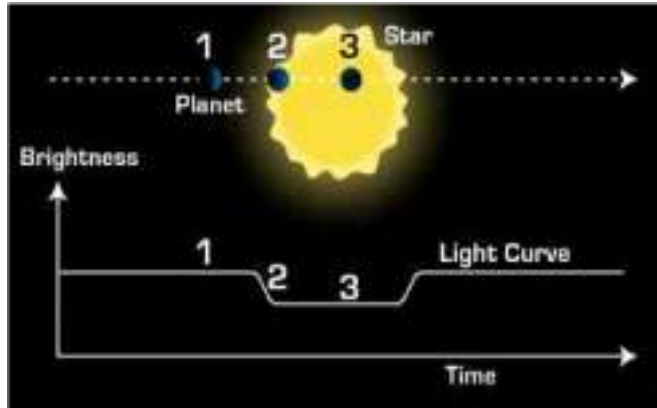
UmZulane kanye neNkanyezi bazungeza uzime. Ukubulunga kweNkanyezi



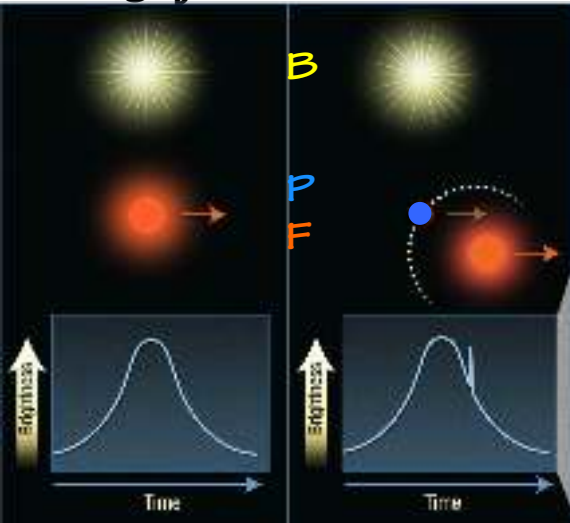
ozimeni kulongwa ngokukhwebuka kwemnyele yayo (bheka iTUIMP yesi-2 kanye neye-1 O).

Umdabulo:

Uma umZulane udlula ngaphambi kwenkanyezi iyasitheka, lokhu ukusitheka kwenkanyezi.



Isangqo:



Uma inkanyezi **F** idlula ngaphambi kwenkanyezi **B**, kukhiqizeka 'usonteko lomunyando' olukhulisa ukukhanya. Uma umzulane **P** uyingiliza inkanyezi **F**, nawo uzosonta umnyondo weNkanyezi **B**, kodwa isikhathini esimafuphi.

Izindlela zokukhuphulula ezingashayi khona ngqo

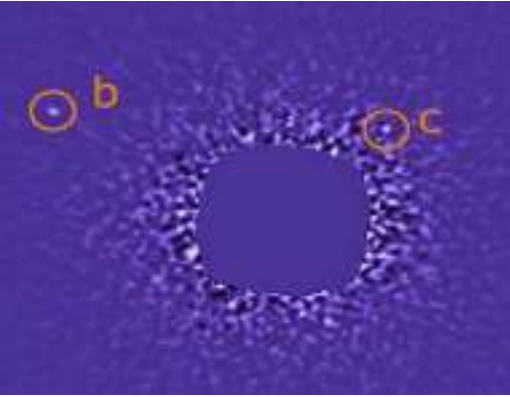
Ukuhlongwa kokuqala ngqo kwemizulendle kwakusebenzisa imiphumela yomdonsiswano phakathi kweNkanyezi kanye noMzulane (Bheka ikhasi elilungisana naleli), okwa vumela ukuthi kunyulwe izinsimbi eziningi ngeMzulane.

Ngezomdiki, ngokufunda ukwehluka phakathi kwesivinini esingoni seNkanyezi, sithola ubungako kanye nobuqanda bomzila wokuzungeza, isikhathi osithatha ukumpininiza kanye nomnqamulo omuncane kwisisindo soMzulane. Isisindo okuyisona kanye nokuma kwendlela yompininizo koMzulane kwenyulwa ekusululeni kweNkanyezi mayiqhathaniswa neziNkanyezi esondelene nazo (ulinganiso banga).

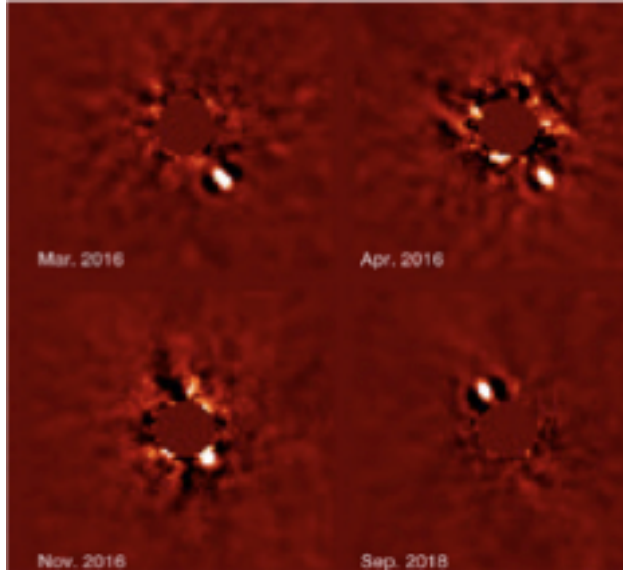
- Ngendlela yokudabula ubuso, sithola ubungako bomzulane ngokubuka ukujula komgungu wokukhanya ngesikhathi sokusithwa kwenkanyezi kanye nesikhathi sokumpininiza ngaphakathi kokusithwa kweNkanyezi

- Ngo sorteko lomnyondo sithola isisindo somzulane kanye nomgamu phakathi kweNkanyezi nomzulane.

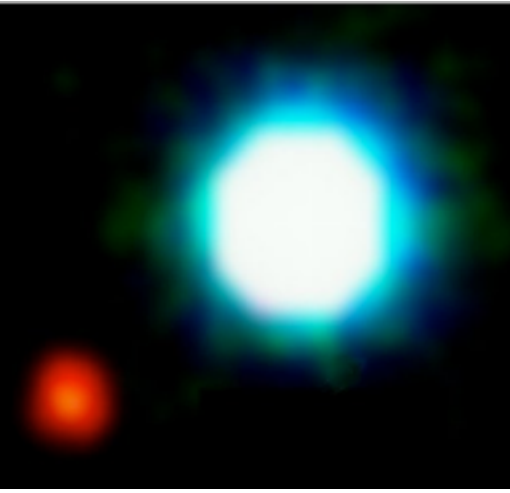
Imizulane emibili ezungeza iNkanyezi iHR 8799, yakhushululwa ngowezi-2008 kusetshenzisa icina kukhanya kwinsibomvu besebenzisa izipopolo iGemini North eHawaii.



Ulando lwezithombe olathwetshulwa izipopolo iESO Very Large Telescope eChile. Lukhombisa umnyakazo womzulane iBeta Pictoris b lapho uyingiliza inkanyezi yawo.
Credit: Lagrange et al.



IsiThombe sokuqala ngqa somZulendle, sathwetshulwa eESO VLT ngowezi-2004. Uyingiliza 'isiThomiyana esiNgamunwe' i-2M1207, okuyinkanyezi eluvivi, futhi enesisindo esincane ekhonjiswe lapha ngombala omhlophe. umchachambiso: Credit: Chauvin et al.



Izindlela zokukhuphulula ezingashayi khona ngqo

Ukuhlonga imizulandle ngqo kunzima ngoba imizulane mincane futhi ilufiphi kanti futhi isondele kakhulu ezinkanyezeni zayo, ezikhanya cishe ngokuphindwe ngokwezinkulungwane eziyi-10. Ngakho-ke, sidinga ukucina ukukhanya kweNkanyezi ngokusebenzisa izicina kukhanya.

Ukuhlonga ngqo, songahle kwenzeka, kuba nemiphumela emihle, ngokuba ngezithombe ezimbalwa singawuthola wonke umzila wokuyingiliza.

Uqheshulomvange lomzulane lukhombisa isigubo somoya, isimo sezulu, kanye nomoya womzulane.

Ukwaluswa kokukhanya komzulane kusinikeza isikhathi esiwuthatha ukundiyaza, lokho kusho ukuthi, kusinika ubude bosuku kulowomzulane. Ubungako kanye nesisindo somzulane singatholakala kuphela ngezindlela ezishaya ngqo.

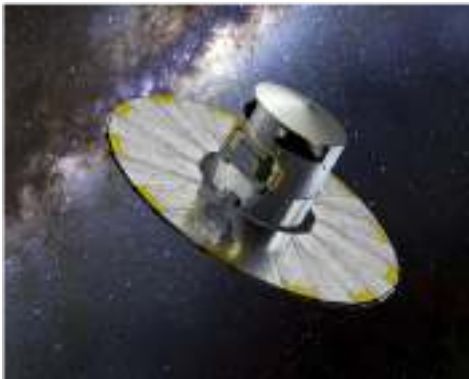


Iduna lokuzakhela iCoRoT lakhuphulula imizulendle eyama-36. Kanti ongasibe abama-600 basalinde ukuqazwa.

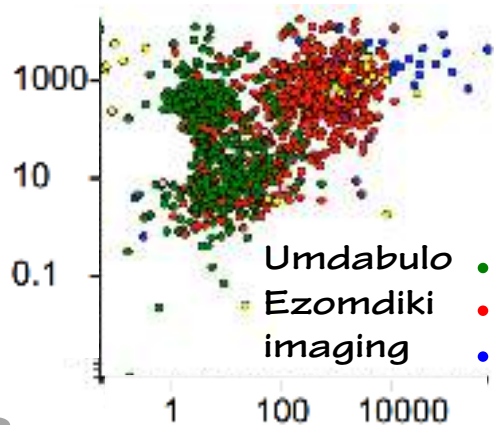


Inana lezipopolo ikepler labheka izinkanyezi eziyizinkulungwane ezingama-530, lathola ongasibe abayizi-2500 abasalinde ukuqazwa.

Iduna lase-Yulophu uGaia, la nyakulwa ngowezi-2013, lizosebenza kuze kube ngowezi-2022. Lizofunda ngesizihundla kanye neomdiki wezinkanyezi ezingaphezulu kwesigidigidi kanti futhi linomnembo ocilikishayo.



Izisindo (uma ziqhathaniswa nesomhlaba wethu) ziqhathaniswa nobude bonyaka (ngokwezinsuku zomhlaba) yayo yonke imizulendle eyaziwayo kuze kufinyelele kuNhlolanja kunyaka wezi-2019. (isangulo sicashunwe kwi-exoplanet.eu).



Umlando Omafuphi ngomvubukulo

Umvubukulo wokuqala ngqa wemzulendle wenziwa lapha emhlabeni ngokusebenzisa indlela **yesivinini esingoni** okuyilapho khona kwakusetshenziswa isibhecamvange esasinemba. HD1 14762 b kwaba umzulendle wokuqala ngqa, ngowe-1989. Ngowe-1992, imzulendle emi-3 yase ikhushuliwe iyingiliza uNyazima. Emva kwalokho inani lemzulendle eyayihlongwa lavele leva. Kusukela ngowezi-2019, sekuvubukulwe imzulendle engaphezulu kwama-800 kanye nezinhlelo nkanyezi ezinemzulendle eminingi ezilinganiselwe kuma-600 ngokusebenzisa le ndlela.

Ngowezi-2006, isipopolo zamaFulenshi, i-CoRoT yanyakulwa, kwalandela esamaMelikana i-keplar ngowezi-2009. Zombili zazisebenzisa indlela **yokusitha ubuso**. I-CoRoT kwaba ngesokuqala ukuhlonga umzulendle omatshe. I-Kepler isikhuphulule izinkulungwane zemzulendle.

Imzulendle eyama-90 yatholwa ngo**talagu**, kuthi eyi-100 yatholwa ngo**buko-ngqo** lapha emhlabeni.

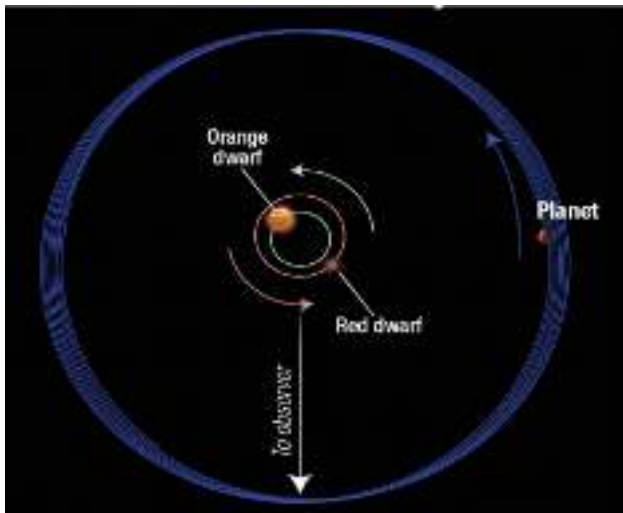
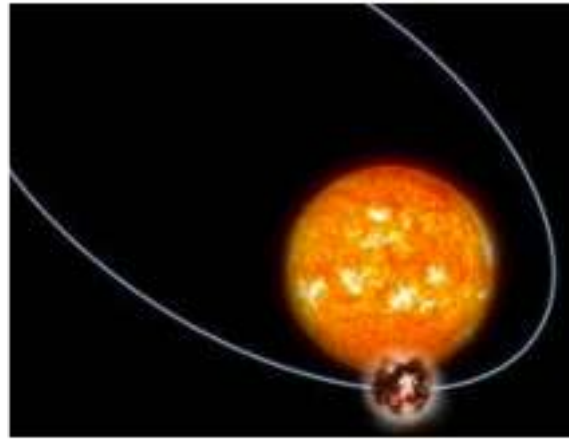
I-Gaia izosinika **umlinganiso banga** kanye **nomdiko** wezinkanyezi ezingaphezulu kwesigidimbili.

Klindeleke ukuba ihlonze izinkulungwane zemzulendle emisha.



Umbukiso wokuzicabangela (ongethobo) womzulendle omkhulu oshisa uthi fene-fene i-CoRoT-7 b.

Umdwebo kaG. Thimm womzulendle iKepler-432b, kanye nomzila wokuyingiliza obuqanda kakhulu okhiqiza iminyaka enzima.



Umsulendle iKepler-413b, oyingiliza izinkanyezi ezimbili: eluhlala kanye nebomvu.

Ukuhlukahluka kweMzulendle

AKusukela ngowezi-2019, ingaphezulu kwezi-4000 imzulendle esiqinisekisiwe kuthi engaphezulu kwezi-3000 isalinde ukuqinisekiswa ukuthi iyiyona imzulendle.

Miningi imizulane eqabuqabu esikhushuliwe engatholakali kuhlelo lweLanga lethu:

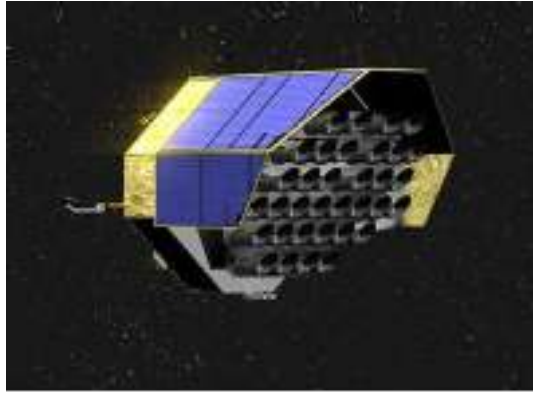
- Imizulane enamazinga okushisha engaphezulu kwe- 1000°C eyingilizza inkanyezi yayo isikhathi esiyizinsukwana ezimbalwa nje (lapho iqhathaniswa nonyaka owodwa lapha kuNomkhubulwane)

- Ehwamukayo

- Enesisindo esiphindwe kabili kunaleso sikaNomkhubulwane, ebizwa ngokuthi onondumezulu bemzulendle, enezinkathi ezibangabanga (-100°C ebusika, $+100^{\circ}\text{C}$ ehlobo).

- Imzulendle enamaLanga amabili.

- Imzulendle esondele kakhulu eLangeni vaso.



Plato, okuyisizingeli semzulendle enkathini ezayo saseYulophu, esilindeleke ukuthi siyingilizwe ngowezi-2026. Izobukela amakhulu ezinkulungwane zezinkanyezi, ngenhloso yokubheka imzulendle ngendlela

yokudabula ubuso.

Umdwebo wozonce lwezipopolo zaseYulophu ezinkulukazi, ezonce zisebenza ngowezi-2025 eTshile. Sizozoqa ukukhanya okuphindwe ngokwe-13 uma ziqhathaniswa nezinye ezinkulukazi ezikhona siphinde sikhiqize izithombe ezinomfifiyelo ophindeke okwe-16 uma siqhathaniswa nezipopolo zeHubble.



Umdwebo woqwanga lwezipopolo ka-A. Labeyrie. Izipopolo zesiyakade, uluqwanga olukhulukazi emkhathini olunogqavo olungwedo olulinganiselwe kwi-100 lamamitha, ngenhloso yokubala imzulendle.

Isiyakade

Eminyakeni eyi-10 ezayo, kulindeleke ukuba izpopolo ezinobubanzi obungama-30 kuya kobama-40 wamamitha ziyobe zisebenza lapha emhlabeni ukuhlunga imzulendle ngokuthwebula izithombe kanye nokubala ukwehluka kwezivinini zezinkanyezi.

Izipopolo zasemkhathini, okubalwa kuzo iCheops, iJWST, iPlato kanye ne-Ariel, zizonyakulwa ngenhloso yokuhlunga imzulendle ngokusebenzisa indlela yokudabula ubuso. IJWST izophinde ithwebule izithombe.

izipopolo ezinkulu, ezinobubanzi obulinganiselwe kwisi-8 kuya kwi-18 emamitheni (iLUVOIR, iHabex) zisaklanywa eNASA ukuze zihlonge izinkomba zempilo kwimzulendle ngowezi-2050.

Kwisiyakade, uqwanga lwezipopolo lyobala imzulendle. Mhlawumbe, izigaqanqeke ziyonyakulelwa kwimzulendle eseduze neLanga lethu ngenhloso yokuthwebula izithombe. Onjiniyela sebeqalile ukusebenza kwizikulukuzeli za lezi izigaqanqeke ukuze zifinyelele lapho.



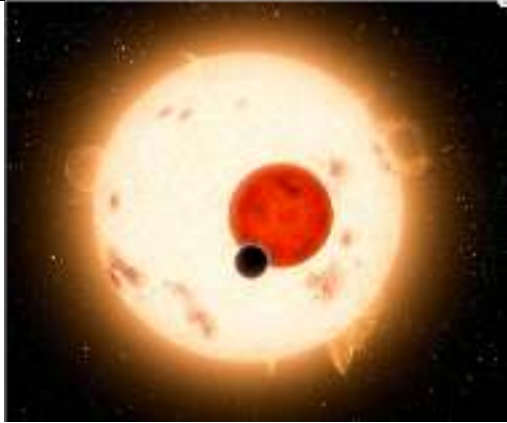
Imibuzo

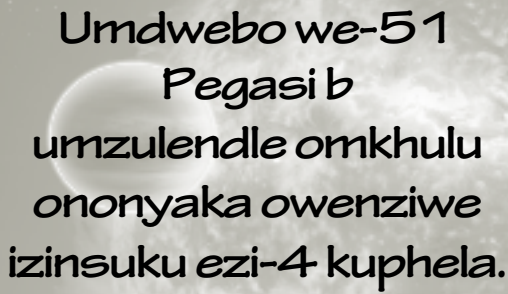


Isiphi isithombe
kulezi
esikhombisa
umzulane wohlelo
lweLanga?

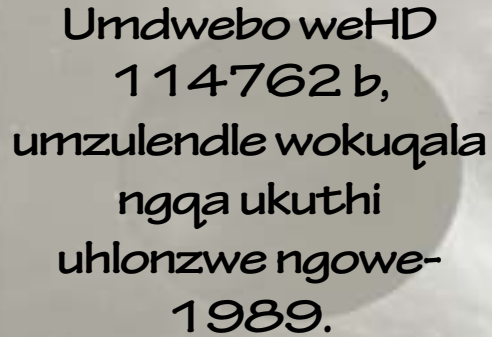


Izimpendulo zikwi
overleaf

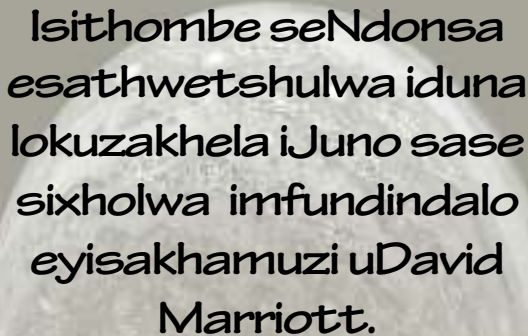




Umdwebo we-51
Pegasi b
umzulendle omkhulu
ononyaka owenziwe
izinsuku ezi-4 kuphela.

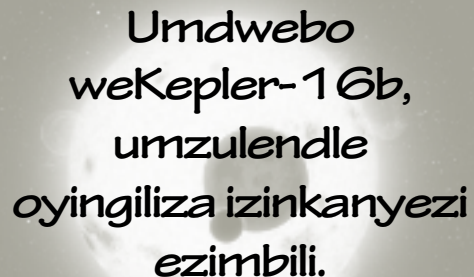


Umdwebo weHD
114762 b,
umzulendle wokuqala
ngqa ukuthi
uhlonzwe ngowe-
1989.



Isithombe seNdonsa
esathwetshulwa iduna
lokuzakhela iJuno sase
sixholwa imfundindalo
eyisakhamuzi uDavid
Marriott.

NASA / JPL-Caltech / SwRI /
MSSS / Marriott



Umdwebo
weKepler-16b,
umzulendle
oyingiliza izinkanyezi
ezimbili.

Umkhathilibe Ephaketheni Lami No. 8

Le Ncwajana ilotshwe ngowezi-2019 ilotshwa nguJean Schneider kanye noGrażyna Stasińska baseParis Observatory (eFrance).

IsiThombe esisekhaveni: Lesi isiThombe sikhombisa umbono wokuthi imzulane ematshe ingase ibe miningi futhi ibe nokuhluka okukhulu kuMkhathilibe (umchachambiso iJPL). Zonke izithombe zemzulendle kanye namaDuna kuleNcwajana kuyimdwebo. umchachambiso: iNASA, i-ESA kanye ne-ESO.



Ukufunda kabanzi ngalolu uchungechunge kanye nezihloko ezethulwe kuleNcwajana, sicela uvakashele u-

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