

Umkhathilibe Ephaketheni Lami



ImiZulendle

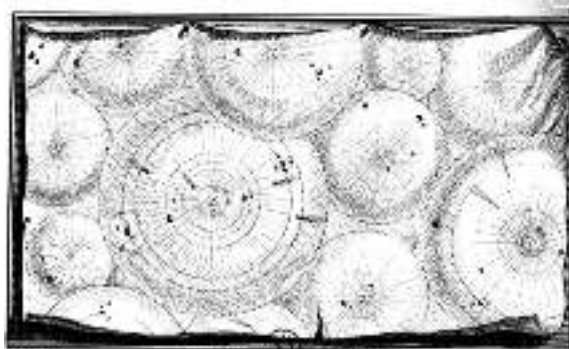


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Grażyna Stasińska

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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, bawuthuthukisa 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.



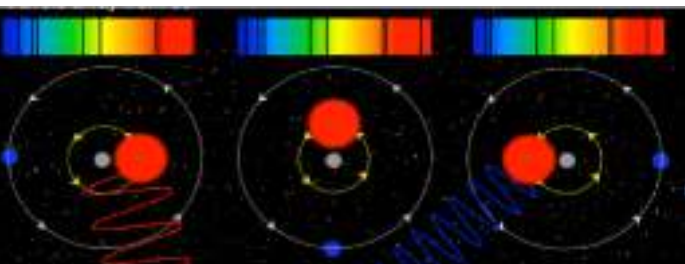
Imizamo yokuqala yezimfundindalo zomkhathi yokuhlonza eminye imihlaba ezungeza ezinye iziNkanyezi yaba ngasekupheleni konyaka we-1930, kodwa kuze kube owe-1989 babexhaka utalagu nje.

Icingwe lani ImiZulendle ?

KuneziNkanyezi cishe eziyizigidigidi eziyi-100 kuMthalakazi wethu, uMzilafasimbe. Mingaki imiZulendle - imiZulane engaphandle kohlelo lweLanga lethu - esilindele ukuba ibekhona ? Kungani ezinye iziNkanyezi zizungezwa imiZulane ? Izinhleo 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).

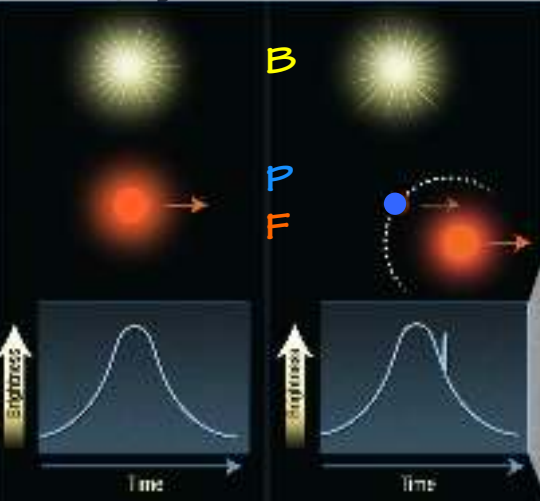
Ezomdiki :



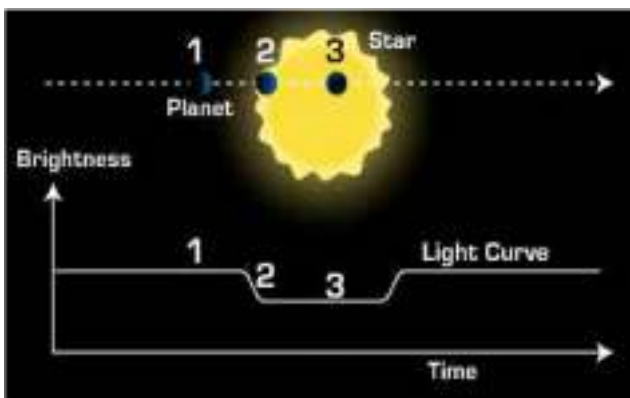
ozimeni kuhlengwa ngokukhwebuka kwemnyele yayo(bheka iTUIMP yesi-2 kanye neye-1 O).

Umdabulo:
Uma umZulane udlula ngaphambi kwenkanyezi iyasitheka, lokhu ukusitheka kwenkanyezi.

Isangqo:



UmZulane kanye neNkanyezi bazungeza uzime. Ukubulunga kweNkanyezi



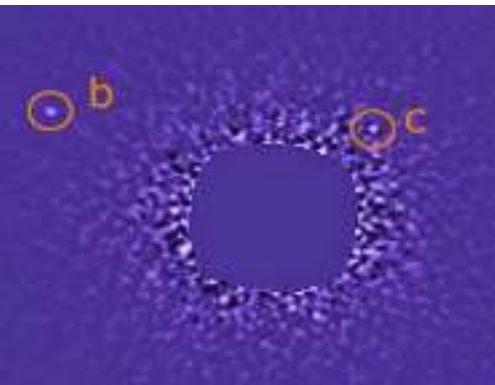
Uma inkanyezi F idlula ngaphambi kwenkanyezi B, kukhiqizeka 'usonteko lomnyando' olukhulisa ukukhanya. uma umzulane P uyingiliza inkanyezi F, nawo uzosonta umnyondo weNkanyezi B, kodwa isikhathini esimafuphi.

Izindlela zokukhuphulula ezingashayi khona ngqo

Ukuhlongwa kokuqala ngqa 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
- Ngosonteko 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.

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.

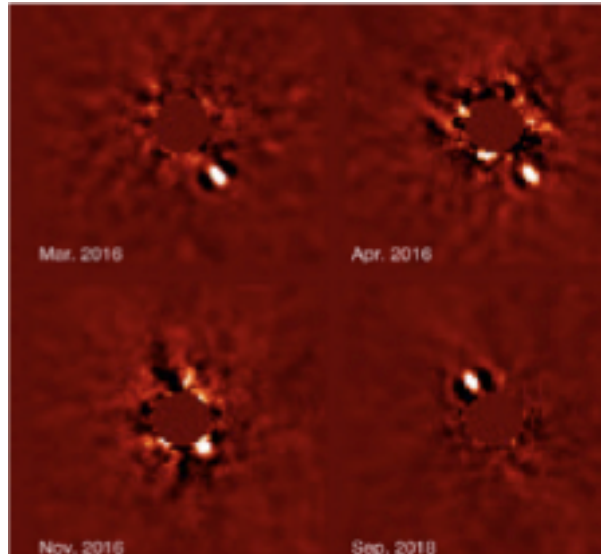
Ukuhlonga ngqo, songahle kwenzeka, kuba nemiphumela emihle, ngokuba ngezithombe ezimbalwa singawuthola wonke umzila wokuyingiliza.

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.

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 somZulandle, sathwetshulwa eESO VLT ngowezi-2004. Uyingiliza 'isiThomiyana esiNgamunwe' i-2M1207, okuyinkanyezi eluvivi, futhi enesisindo esincane ekhonjiswe lapha ngombala omhlophe.

umchachambiso: Credit:

Chauvin et al.



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

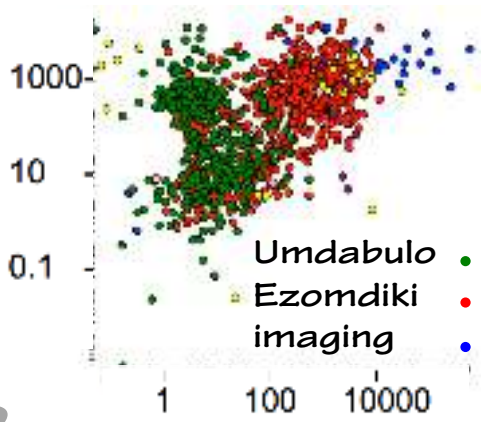
Inana lezipopolo ikepler
labheka izinkanyezi
eziyizinkulungwane
ezingama-530,
lathola ongasibe
abayizi-2500
abasalinde ukuqazwa.



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).

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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 nezinhlalo 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.

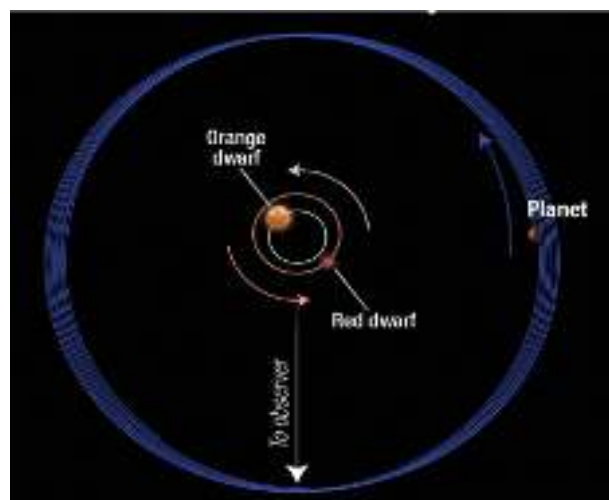
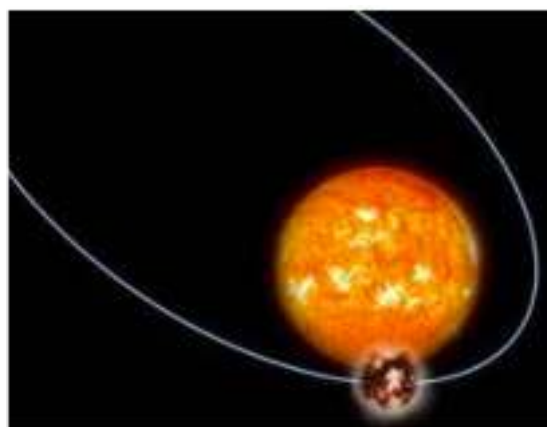
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Umbukiso
wokuzicabangel
a (ongethobo)
womzulendle
omkhulu oshisa
uthi fene-fene i-
CoRoT-7 b.

Umdwebo kaG.

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



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

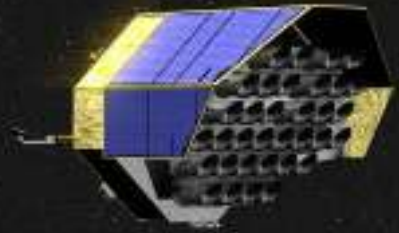
Ukuhlukahluka kweMzulendle

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



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 ukuhlonga imzulendle ngokuthwebula izithombe kanye nokubala ukwehluka kwezivinini zezinkanyezi. Izipopolo zasemkhathini, okubalwa kuzo iCheops, iJWST, iPlato kanye ne-Ariel, zizonyakulwa ngenhloso yokuhlonga 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.



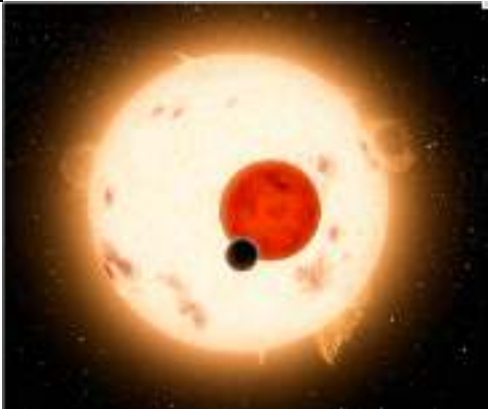
Imibuzo



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-

<http://www.tuimp.org>

Ihumushwe: Nhlanhla Mbambo
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