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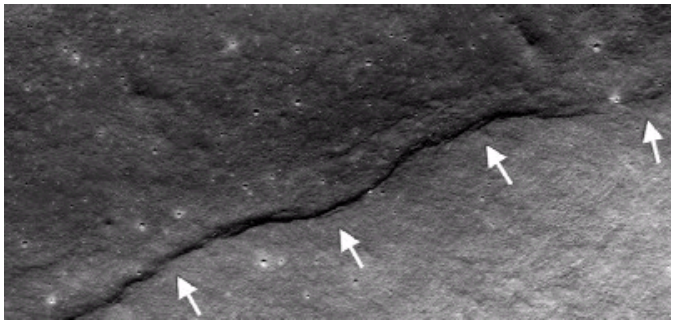
Astronomers discover the Moon is shrinking

Aug 19, 2010 14 comments



Increasing numbers of cracks have begun to appear on the Moon

Freshly discovered scars on the face of the Moon reveal that this rocky satellite is shrinking at a relatively rapid pace, say researchers based in Germany and the US. Images collected by NASA's Lunar Reconnaissance Orbiter show surface faulting that, they say, reflects significant contraction in the Moon's recent geological past.

The research team used the Lunar Reconnaissance Orbiter Camera (LROC), launched in 2009 aboard the Lunar Reconnaissance Orbiter, the first spacecraft to be launched as part of NASA's "return to the Moon" initiative. It contains three different cameras designed to deal with both narrow and wide angle high-resolution photography. This high level of detail revealed 14 lunar landforms known as lobate scarps, similar to thrust faults on Earth that result from compressional forces such as plate tectonics.

Half of the located scarps are at high latitudes (±60°), proving that they are globally distributed and not clustered near the equator as previously thought. These factors indicate "recent contraction of the whole Moon, likely due to cooling of the lunar interior," says Thomas Watters of the Smithsonian Institution's National Air and Space Museum, lead author of the paper.

A squeezed body

> I think there is a general impression that the Moon is geologically dead
>
> **Thomas Watters**

Lobate scarps occur when the surface of the body experiences a compressional force, causing one part of the upper surface to fold and fracture above the other part. In the absence of significant tectonics on the Moon, the researchers believe this is due to cooling of the lunar core. As the core of the Moon cooled it also shrunk, applying surface stress to the brittle lunar crust and causing it to rupture and split.

"On relatively small planetary bodies, like Mercury, the Moon, and possibly some of the icy satellites, it's long been thought that the original cooling of the body very early in its history could cause a global contraction in the size of the body," explains Dr Peter Grindrod of the Department of Earth Sciences at University College London, who was not involved in this report. "This is a fairly easy concept, as it's just to do with the volume decreasing as the temperature decreases."

However, in the case of the Moon, this faulting appears to have been

delayed. Through analysis of the scarps' interaction with other nearby surface features of known age, including craters, the researchers infer that the Moon has contracted radially by 100 m in the past 1 billion years. This is in keeping with the "crisp, un-degraded appearance" of the scarps, which Watters says is the strongest evidence of their young age.

More comprehensive picture

Lobate scarps have been observed on the surface of the Moon before, from images taken by the panoramic cameras aboard the Apollo 15, 16 and 17 missions. However, these earlier missions were confined to the equatorial zone of the Moon's surface. Using the LROC the team has managed to acquire comprehensive images of the lunar surface at higher latitudes.

The Moon's surface is stressed and marked by many different geological features. Most large-scale crustal deformation is associated with surface features such as basins and maria – dark, basaltic plains formed by ancient volcanic eruptions. The lunar lobate scarps are generally found outside of these mare-filled basins, and they are the most common tectonic landform on the far side of the Moon. They are relatively small-scale structures with a maximum relief of less than 100 m, unlike those found on Mercury and Mars.

"I think there is a general impression that the Moon is geologically dead – that everything of geologic significance that happened to the Moon happened billions of years ago," says Watters. "Our results suggest this is not the case. The Moon may still be geologically and tectonically active and still contracting today."

This research is described in *Science*.

About the author

Nicola Guttridge is an intern with *physicsworld.com*

14 comments

Comments on this article are now closed.

1 **GEORGEP**
Aug 20, 2010 4:05 AM

Author's Affiliation

Thomas Watters is with the Smithsonian INSTITUTION, not Institute. See for yourself (footnote 1):

<www.sciencemag.org…936;

I think the Smithsonian is quite sensitive about its name

Offensive? Unsuitable? Notify Editor

2 **LokiClock**
Aug 20, 2010 7:38 AM

Quote:

> *Originally posted by* ***GEORGEP***
> Thomas Watters is with the Smithsonian INSTITUTION, not Institute. See for yourself (footnote 1):
>
> <www.sciencemag.org…936;
>
> I think the Smithsonian is quite sensitive about its name

"I've got the Smithsonian Institution blues," doesn't roll off the tongue so well.

Offensive? Unsuitable? Notify Editor

3 **James Dacey**
Aug 20, 2010 10:00 AM
United Kingdom

Quote:

> *Originally posted by* ***GEORGEP***
> Thomas Watters is with the Smithsonian INSTITUTION, not Institute. See for yourself (footnote 1):
>
> <www.sciencemag.org…936;
>
> I think the Smithsonian is quite sensitive about its name

Thanks for pointing that out. The article has now been updated.

Offensive? Unsuitable? Notify Editor

4 **ElySilk**

Shrinking moon

Aug 20, 2010 5:46 PM
Tamarac, United States

Shrinking? Or is it drying out like a piece of green cheese!

Offensive? Unsuitable? Notify Editor

5 **abduasslam**
Aug 21, 2010 10:13 AM

is rhe shrinking of moon may cause an effect in eartyh surface due to tide waves and may cause destruction in our plant ????

Offensive? Unsuitable? Notify Editor

6 **Crackmonkey74**
Aug 23, 2010 10:00 AM
Germany

Quote:

> *Originally posted by **abduasslam***
> is rhe shrinking of moon may cause an effect in eartyh surface due to tide waves and may cause destruction in our plant ????

As long as the contraction is isotropic and the mass of the moon doesn't change, you won't notice a difference. You could replace the sun with a black hole of the same mass and the orbit of the earth wouldn't change if you just look at the gravitational forces. The only effect concerning tides is that at the moment, the distance earth-moon increases by 3.8 cm per year.

Edited by Crackmonkey74 on Aug 23, 2010 10:16 AM.

Offensive? Unsuitable? Notify Editor

7 **J.incognito**
Aug 24, 2010 7:41 AM
New Delhi, India

Shrinking

Quote:

> *Originally posted by **Crackmonkey74***
> Quote:
> > *Originally posted by **abduasslam***
> > is rhe shrinking of moon may cause an effect in eartyh surface due to tide waves and may cause destruction in our plant ????
>
> As long as the contraction is isotropic and the mass of the moon doesn't change, you won't notice a difference. You could replace the sun with a black hole of the same mass and the orbit of the earth wouldn't change if you just look at the gravitational forces. The only effect concerning tides is that at the moment, the distance earth-moon increases by 3.8 cm per year.

I think thats correct. The tidal effects are known to be caused because of masses, not volumes (or density). Even if the radius changes, as long as the centers of mass do not change positions, there would be no such effects.
The earth-moon distance changing at *that* rate.. I've not heard of it. Is it a fact?

Edited by J.incognito on Aug 24, 2010 7:43 AM.

Offensive? Unsuitable? Notify Editor

8 **Crackmonkey74**
Aug 24, 2010 9:59 AM
Germany

Quote:

> *Originally posted by **J.incognito***
>
> I think thats correct. The tidal effects are known to be caused because of masses, not volumes (or density). Even if the radius changes, as long as the centers of mass do not change positions, there would be no such effects.
> The earth-moon distance changing at *that* rate.. I've not heard of it. Is it a fact?

Paper for lunar orbital parameters:
www.aanda.org…index.php

Offensive? Unsuitable? Notify Editor

9 **andwor**
Aug 24, 2010 8:05 PM

prediction of orbital radius of the moon

Using new equations for gravity it is possible to predict that the orbit of the moon has also shrunk by 1.323 cm, due to the Earth's gravitational binding energy at formation. This result is technically in exact keeping with classical general relativity -but the maths is a lot easier and it is possible to get sensible answers for the singularity. Incidently the gravitational shift would be slightly less if the Sun were at the centre of the solar system, as compared to a black hole. The density of the object makes a slight difference to the garvitational physics.

Available online

1.An advanced dynamic adaptation of Newtonian equations of gravity. Physics Essays 21: 222-228.
dx.doi.org…1.3027501

2. String quintessence and the formulation of advanced quantum gravity. Physics Essays 22: 364-377.
dx.doi.org…1.3182733

3. The formulation of harmonic quintessence and a fundamental energy equivalence equation. Physics

Essays 23: 311-319 dx.doi.org…1.3392799

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10 **nhnhdkinhdg**
Aug 25, 2010 2:28 PM

etradinglife

Quote:

> *Originally posted by* ***andwor***
> Using new equations for gravity it is possible to predict that the orbit of the moon has also shrunk by 1.323 cm, due to the Earth's gravitational binding energy at formation. This result is technically in exact keeping with classical general relativity -but the maths is a lot easier and it is possible to get sensible answers for the singularity. Incidently the gravitational shift would be slightly less if the Sun were at the centre of the solar system, as compared to a black hole. The density of the object makes a slight difference to the garvitational physics.
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>
> 3. The formulation of harmonic quintessence and a fundamental energy equivalence equation. Physics Essays 23: 311-319 dx.doi.org…1.3392799

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11 **debkeglerifeaj**
Aug 27, 2010 11:43 AM

This is really very surprising!! I am really worried what if this Earth starting shrinking.
Paraslim

Offensive? Unsuitable? Notify Editor

12 **ronycooper**
Aug 31, 2010 1:47 PM

May be that will be the end of this world.
Bactium

Offensive? Unsuitable? Notify Editor

13 **HyonFesta**
Sep 4, 2010 1:00 PM

No I don't think so. If this world was to end, it would have ended much earlier.
LeanSpa Acai

Offensive? Unsuitable? Notify Editor

14 **andwor**
Sep 11, 2010 11:07 PM

Quote:

> *Originally posted by* ***HyonFesta***
> No I don't think so. If this world was to end, it would have ended much earlier.
> LeanSpa Acai

You mean like in 1963.

Offensive? Unsuitable? Notify Editor