

Kevin Bodge, Ph.D., P.E.

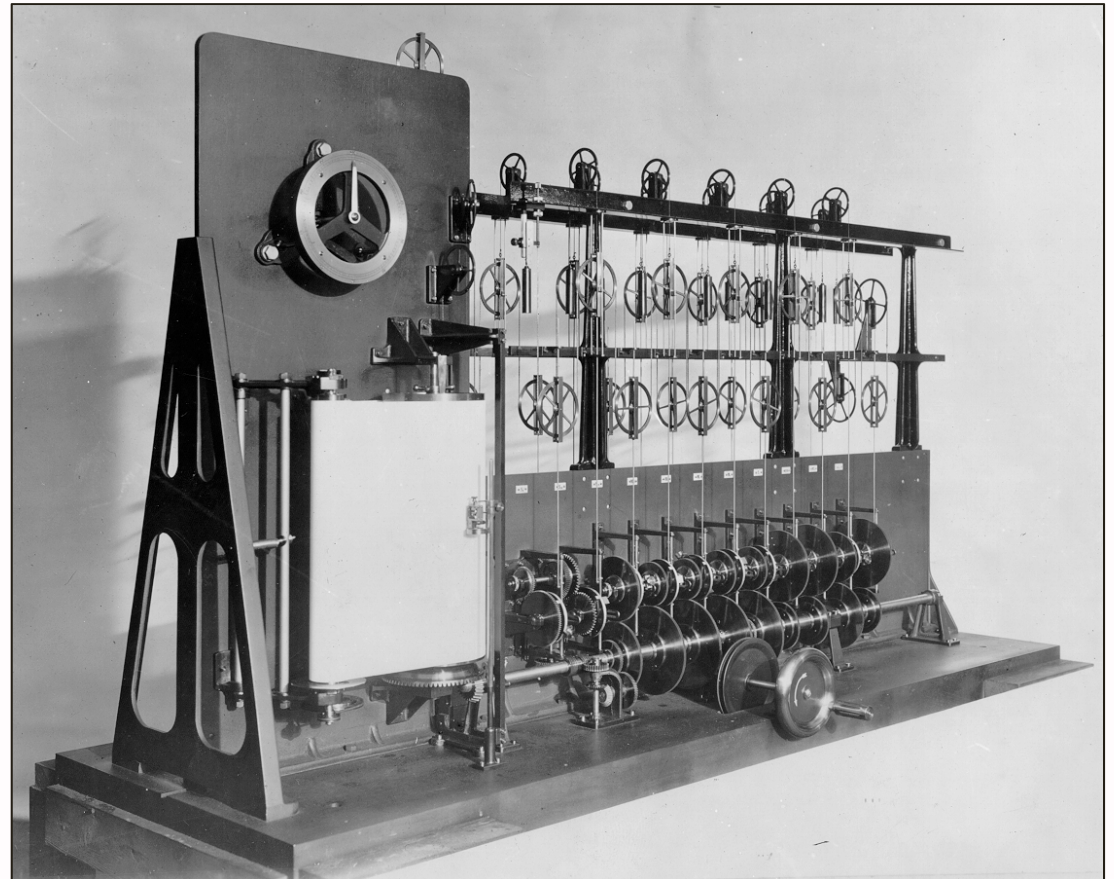
Olsen Associates, Inc.
Jacksonville, Florida



Tide Predicting Machines



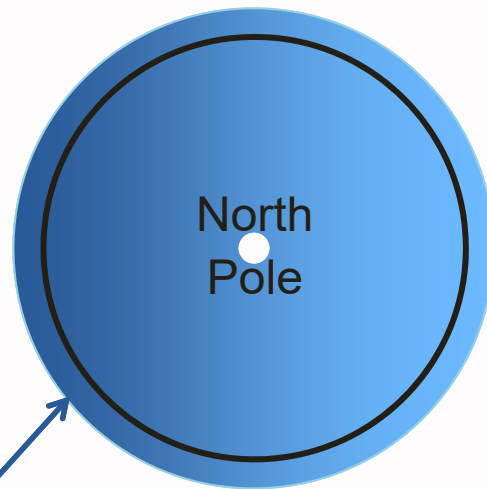
Lord Kelvin, c. 1890



National Observatory, Brazil, c. 1950

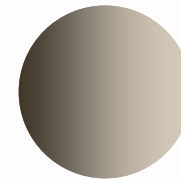
What causes the tides?

Earth



North
Pole

Moon

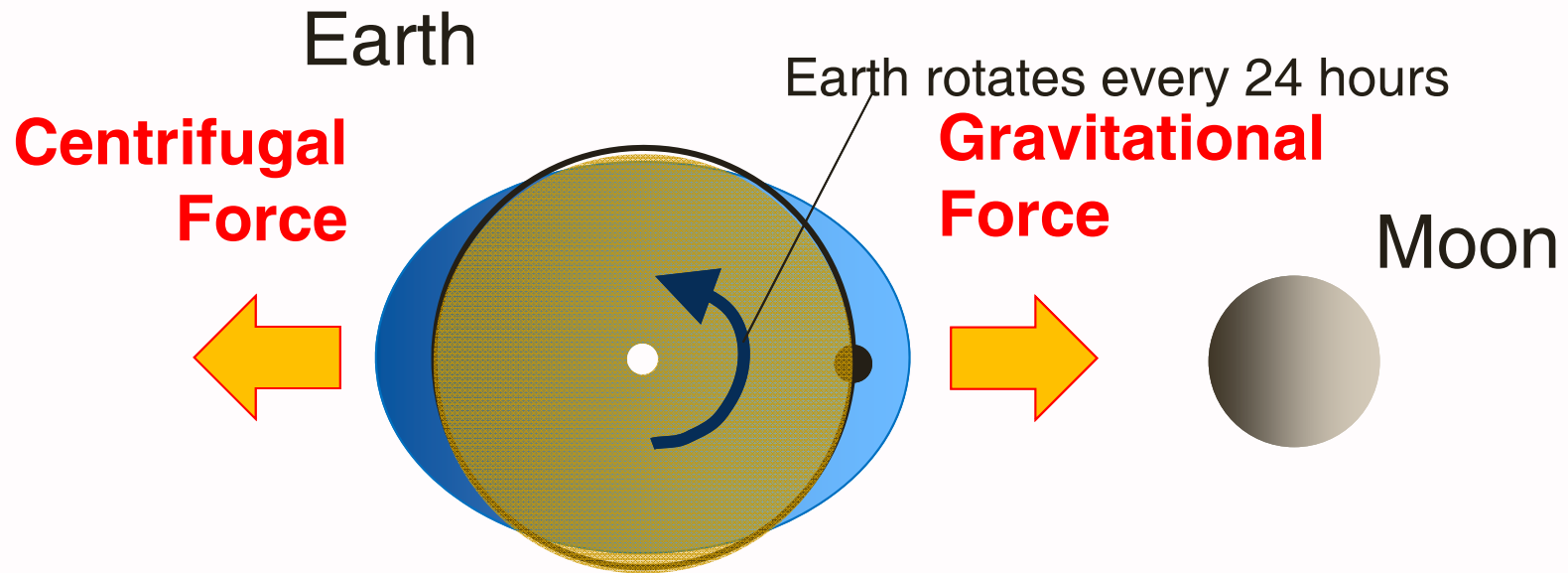


Cover earth's surface
uniformly with water.

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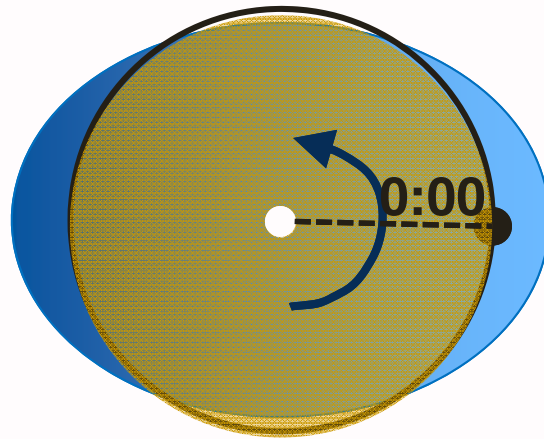


Why are there two highs and two lows each day?

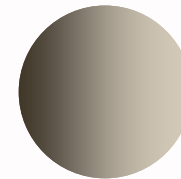


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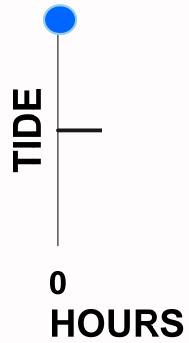
Earth



Moon



0:00 hrs
HIGH Tide

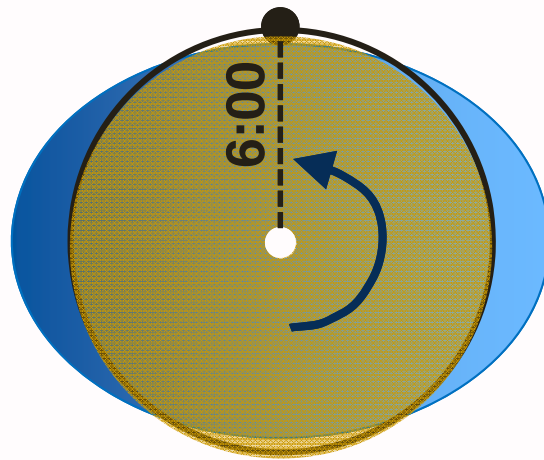


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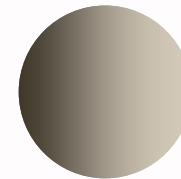


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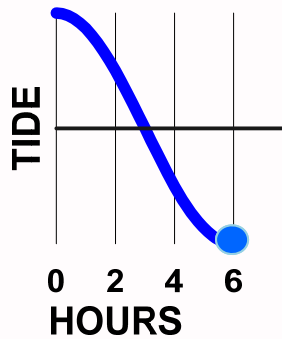
Earth



Moon



6:00 hrs
LOW Tide

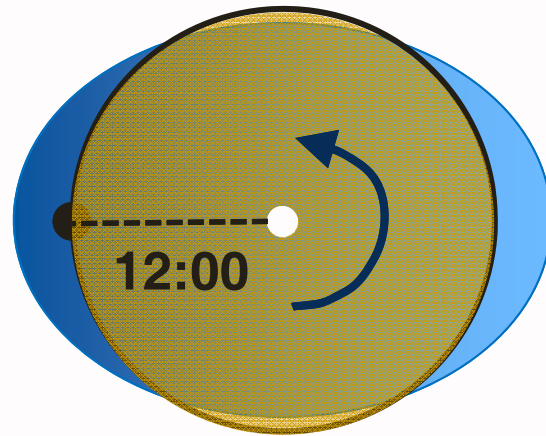


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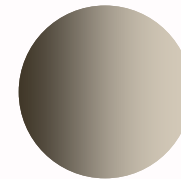


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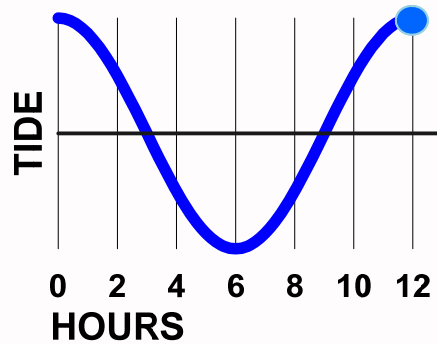
Earth



Moon



12:00 hrs
HIGH Tide

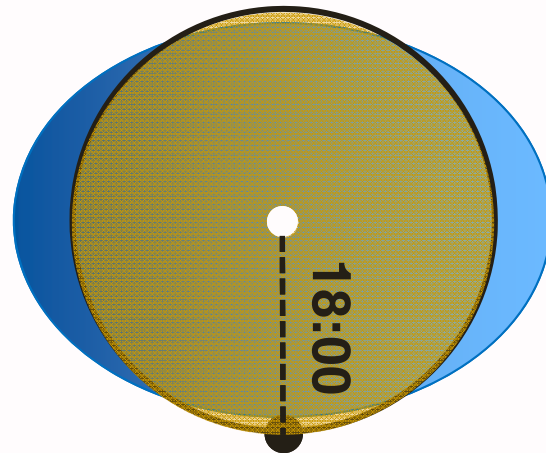


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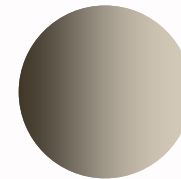


Why are there two highs and two lows each day?

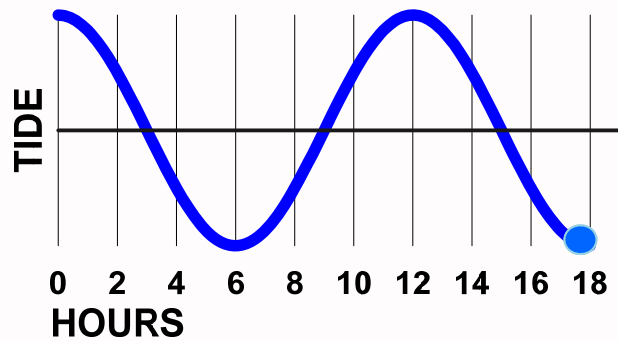
Earth



Moon



18:00 hrs
LOW Tide

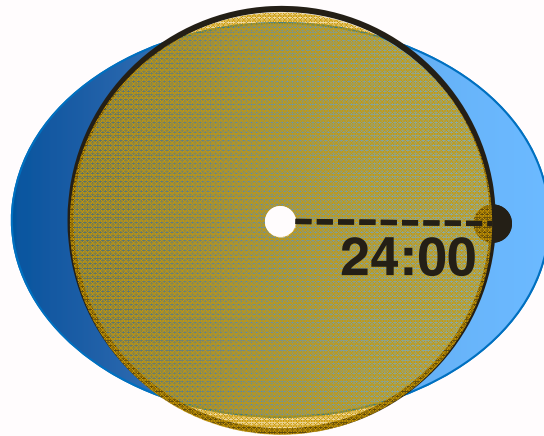


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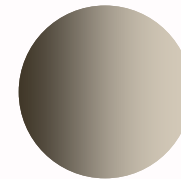


Why are there two highs and two lows each day?

Earth

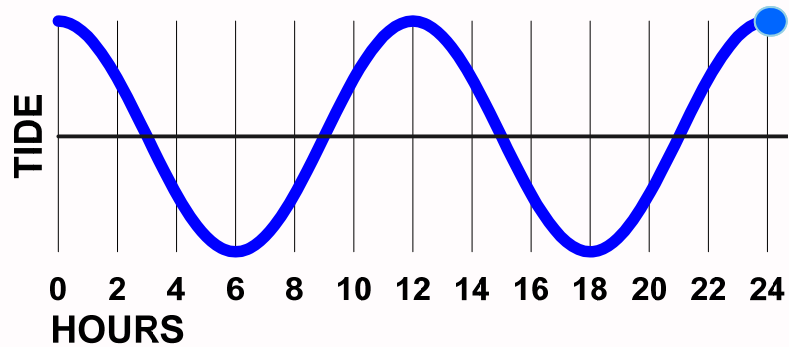


Moon



24:00 hrs
HIGH Tide

... but ...

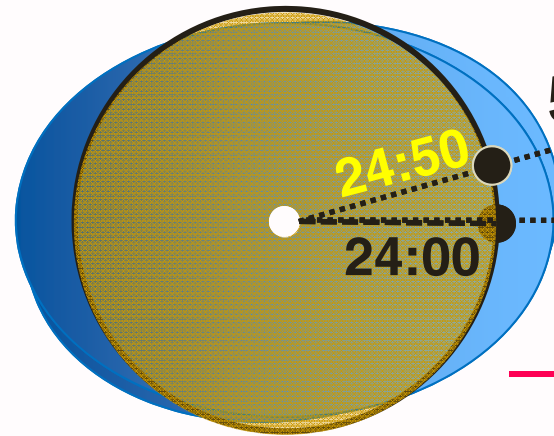


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Why does the tide lag each day?

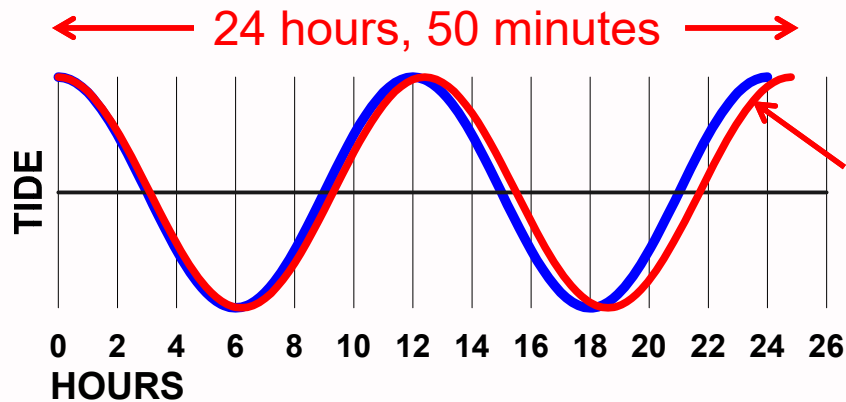
Earth



50 mins

In 24 hours,
Moon
rotated
12.6°

~~24:00 hrs~~ **24:50 hrs**
HIGH Tide



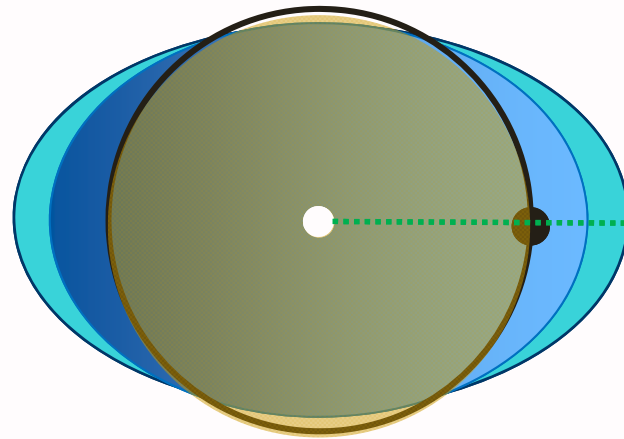
*This is why tides occur about
50 minutes later each day.*

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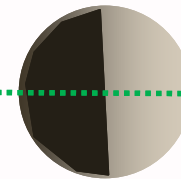


Why do the tides vary through the month?

Earth

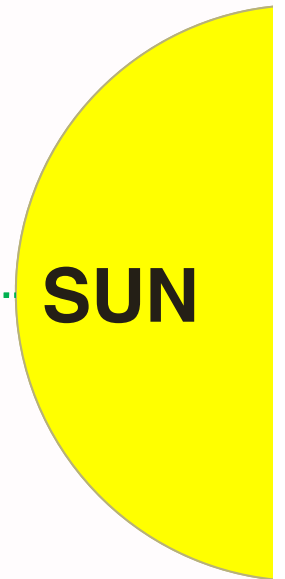


**NEW
MOON**



Moon

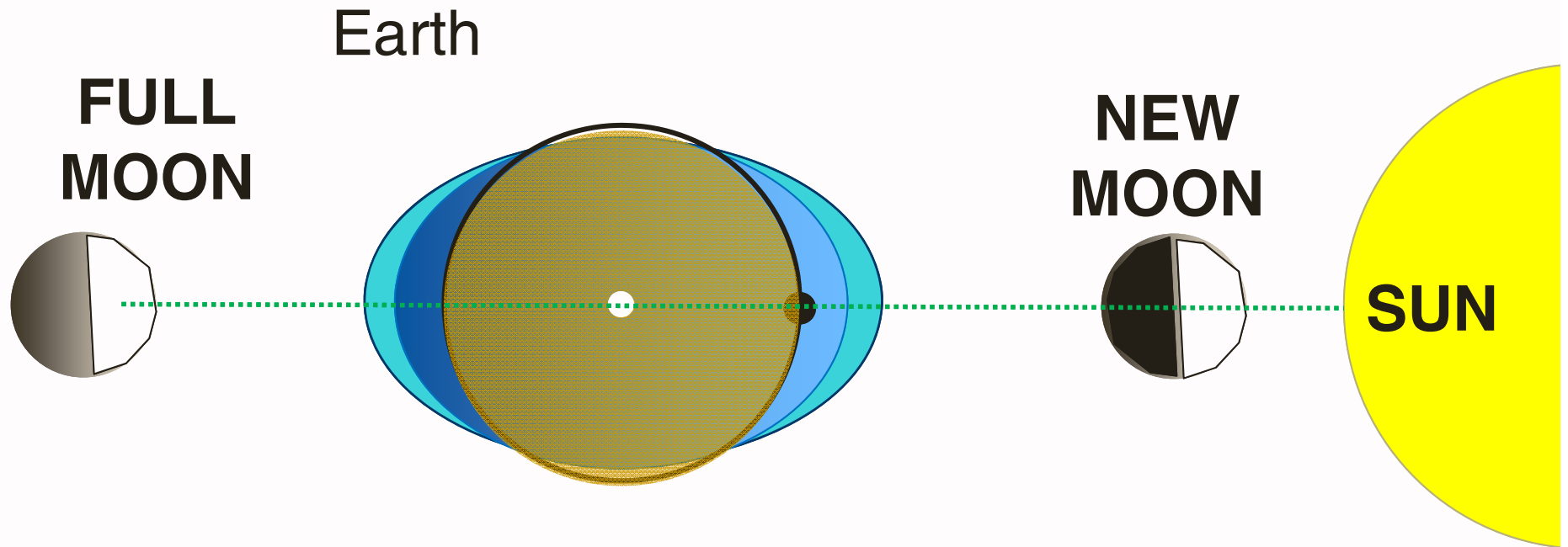
SUN



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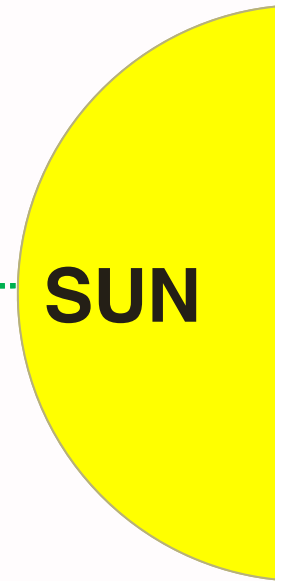
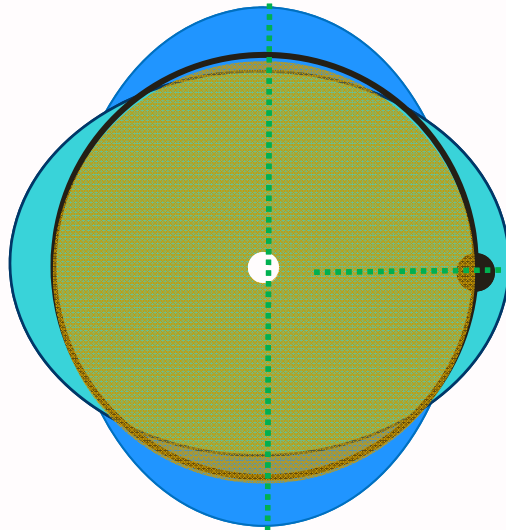
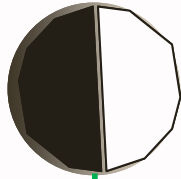
Why do the tides vary through the month?



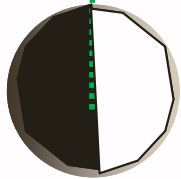
**NEW MOON and FULL MOON are largest tides:
“SPRING TIDES”**

Why do the tides vary through the month?

**1st Qtr
MOON**



**3rd Qtr
MOON**

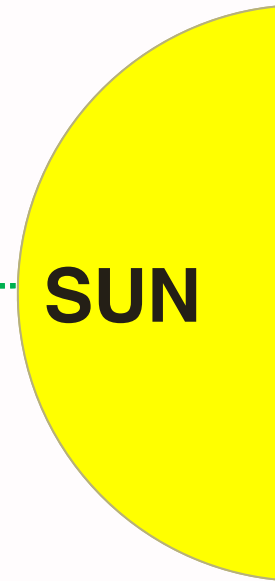
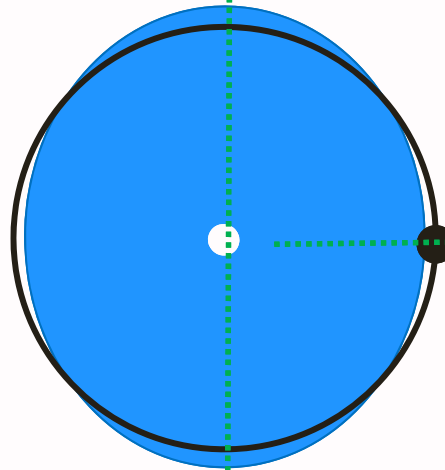
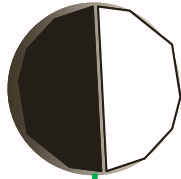


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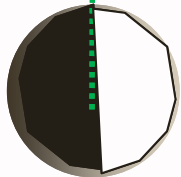
Why do the tides vary through the month?

**1st Qtr
MOON**



SUN

**3rd Qtr
MOON**

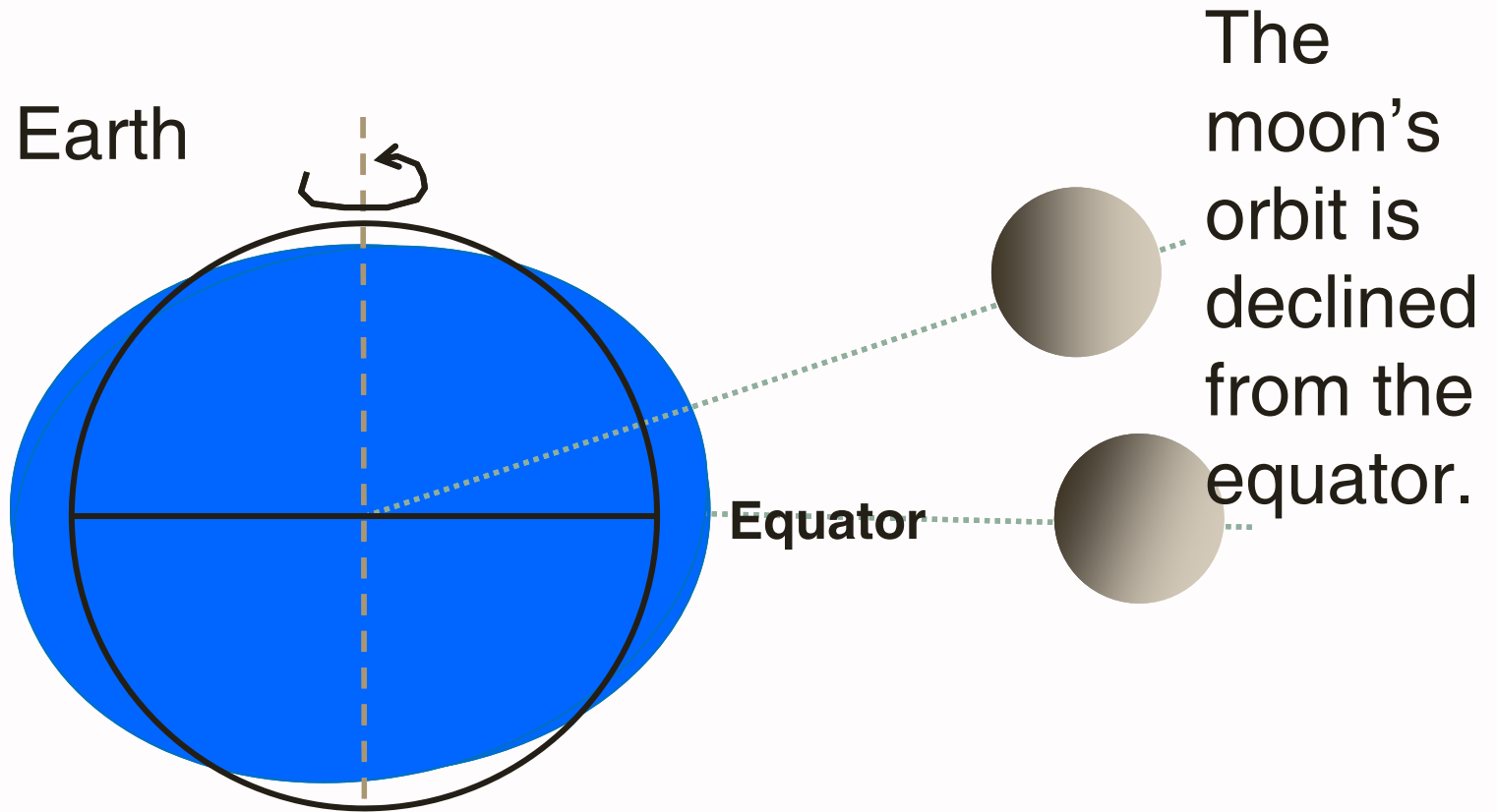


**QUARTER MOONS are
least tides:
“NEAP TIDES”**

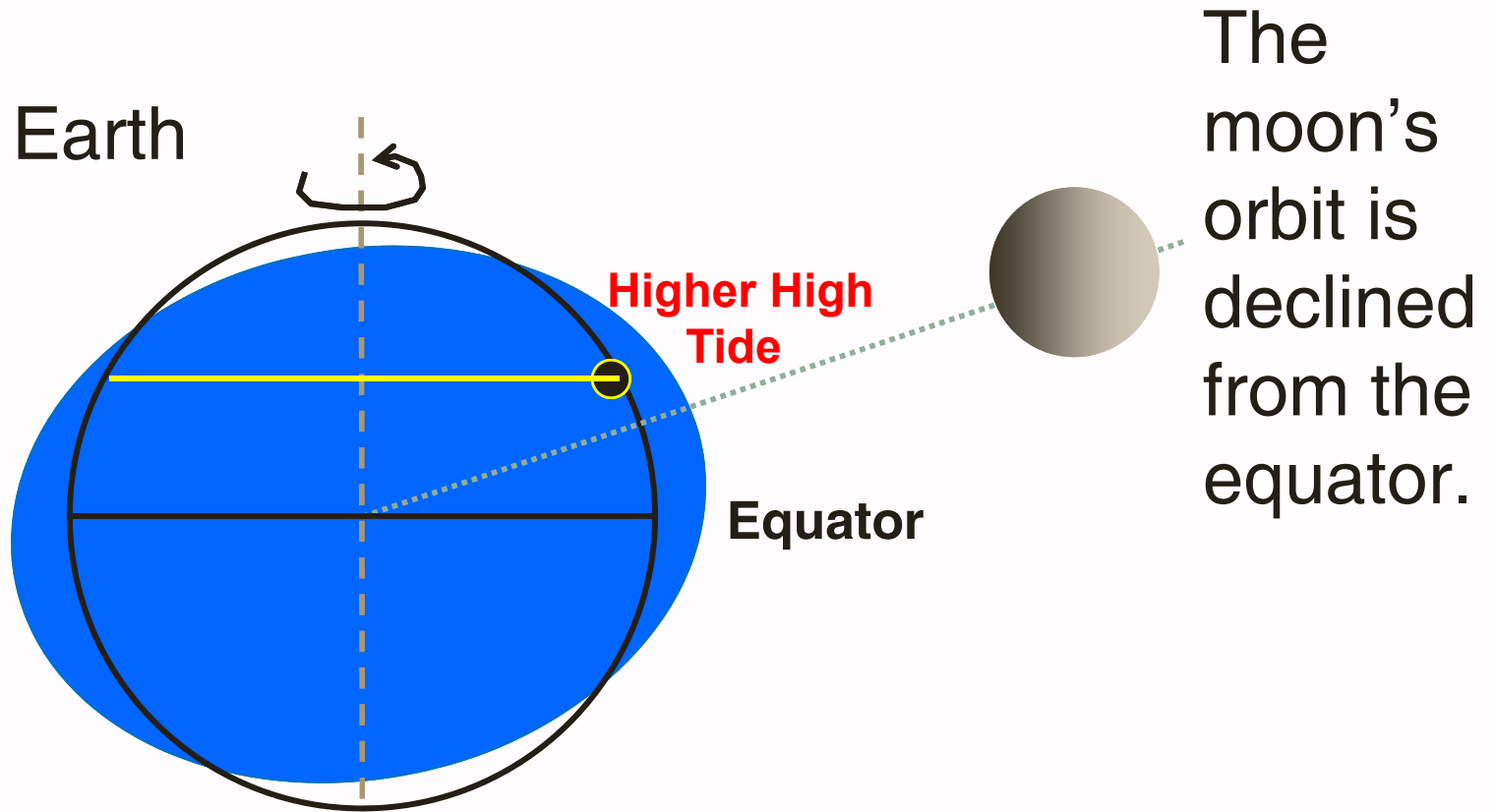
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Why do the two tides vary each day?

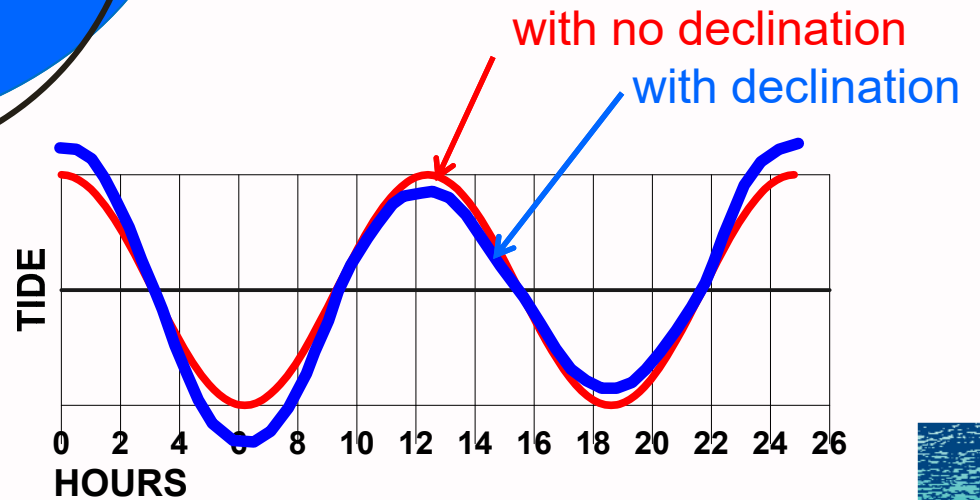
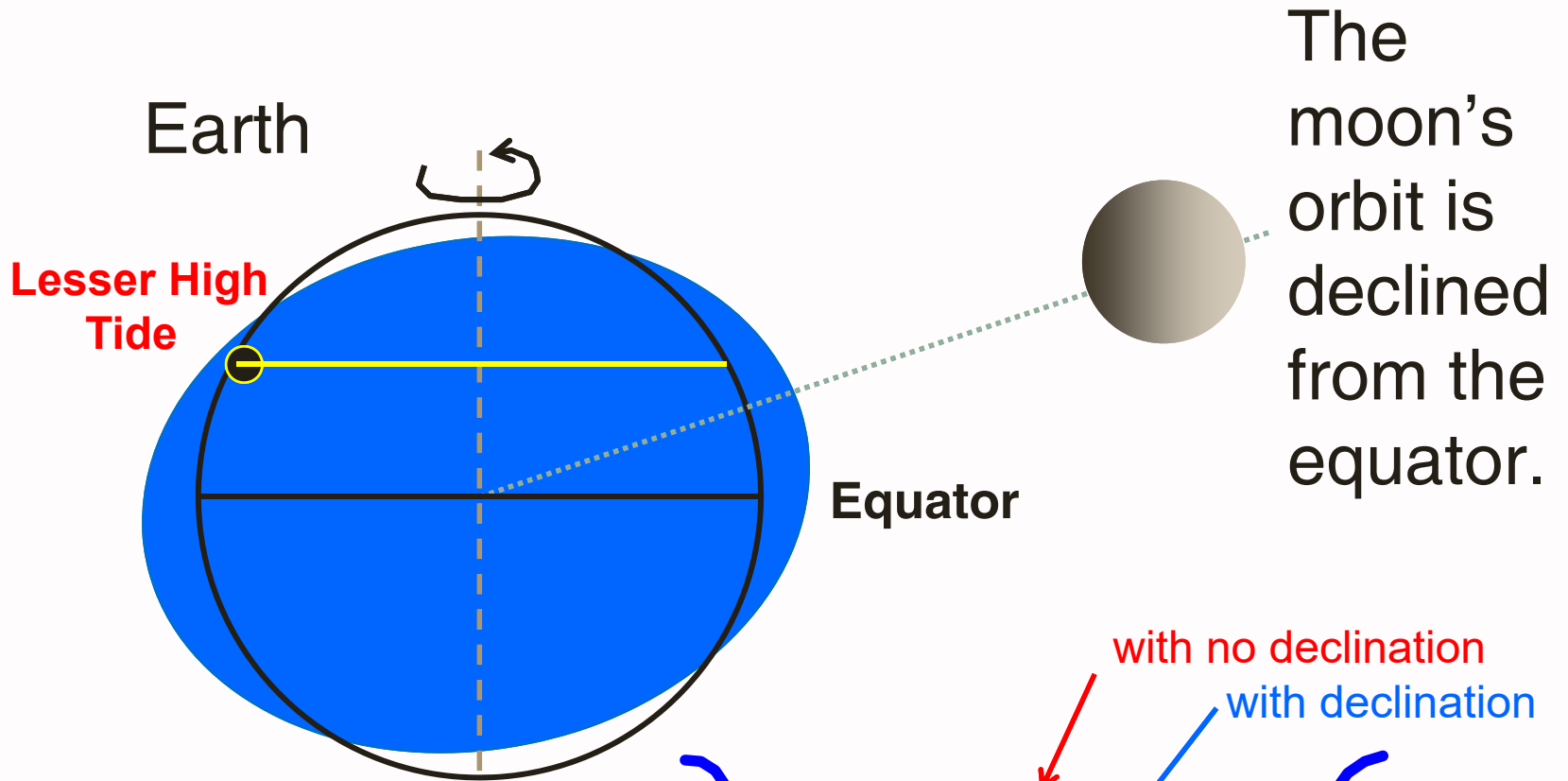


Why do the two tides vary each day?



The moon's orbit is declined from the equator.

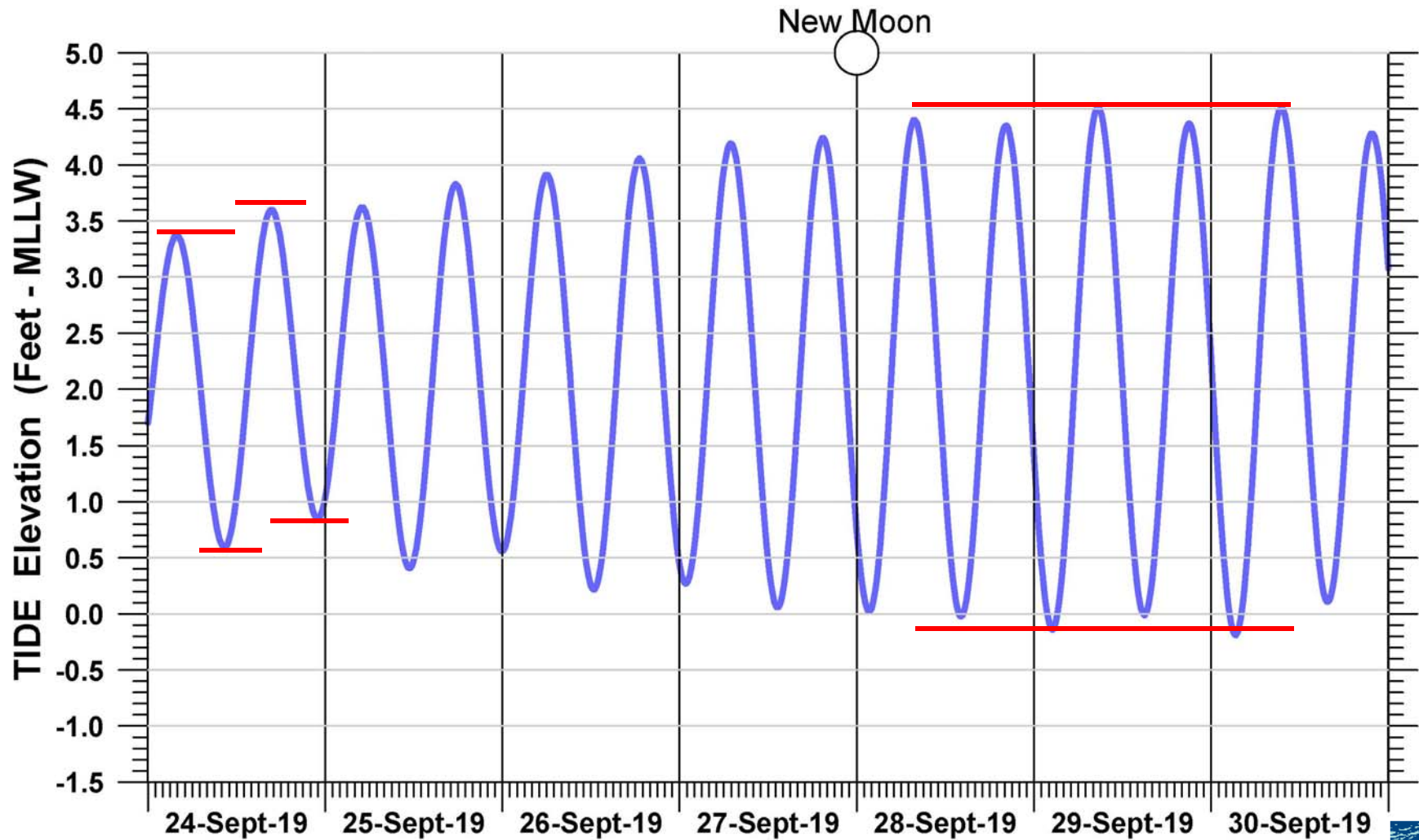
Why do the two tides vary each day?



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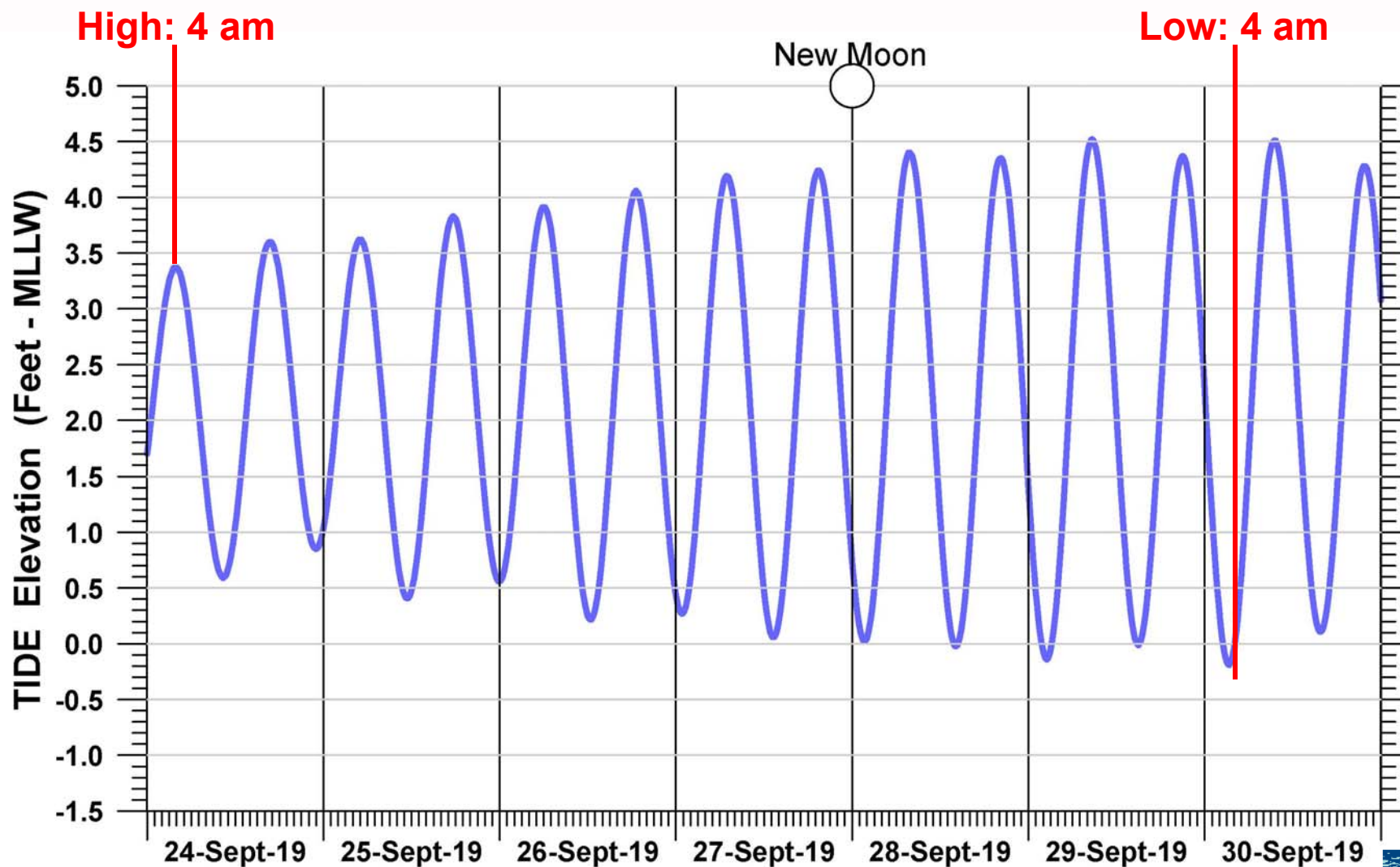
Martin County, Florida: 7-Day Predicted Tides



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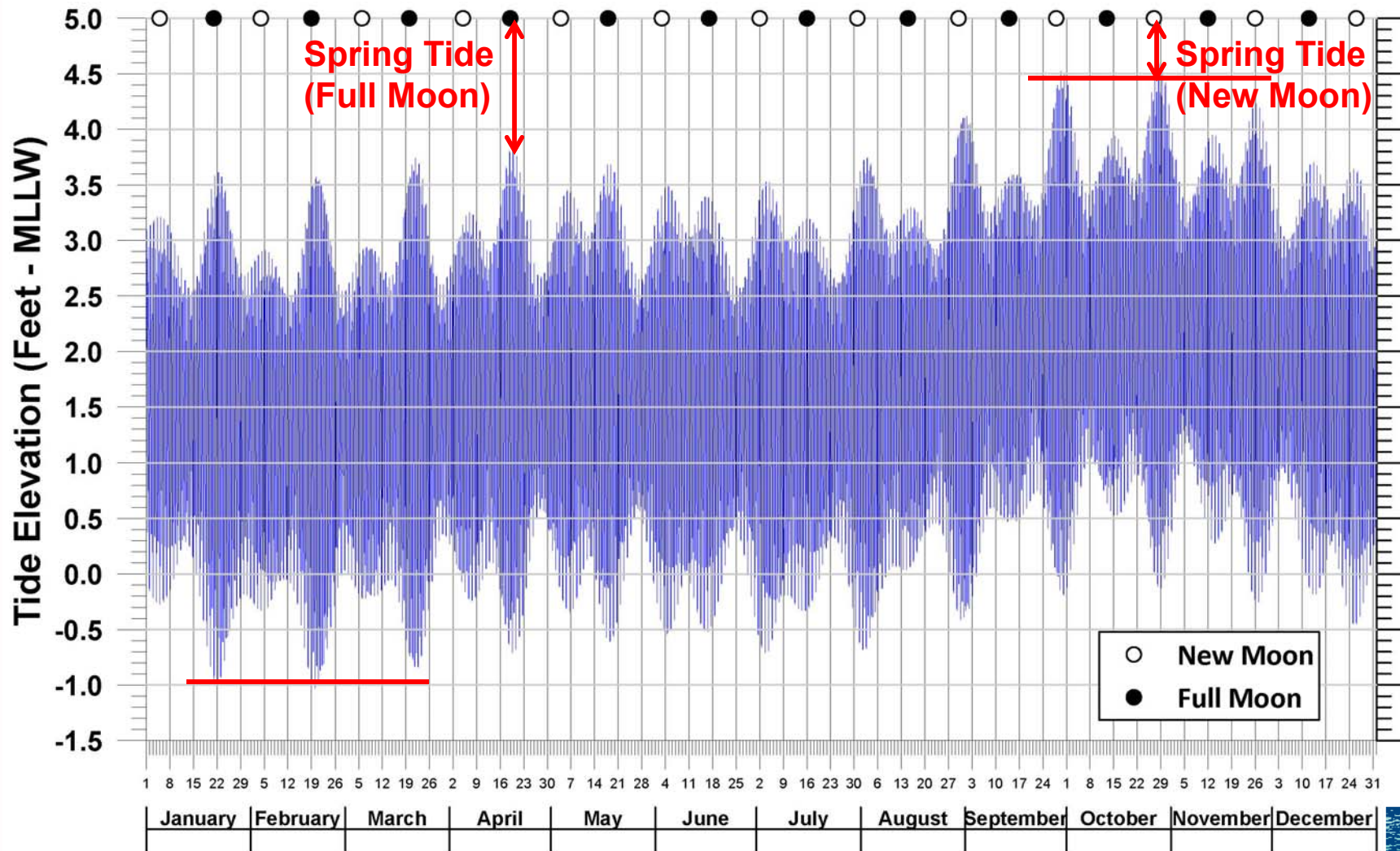
Martin County, Florida: 7-Day Predicted Tides



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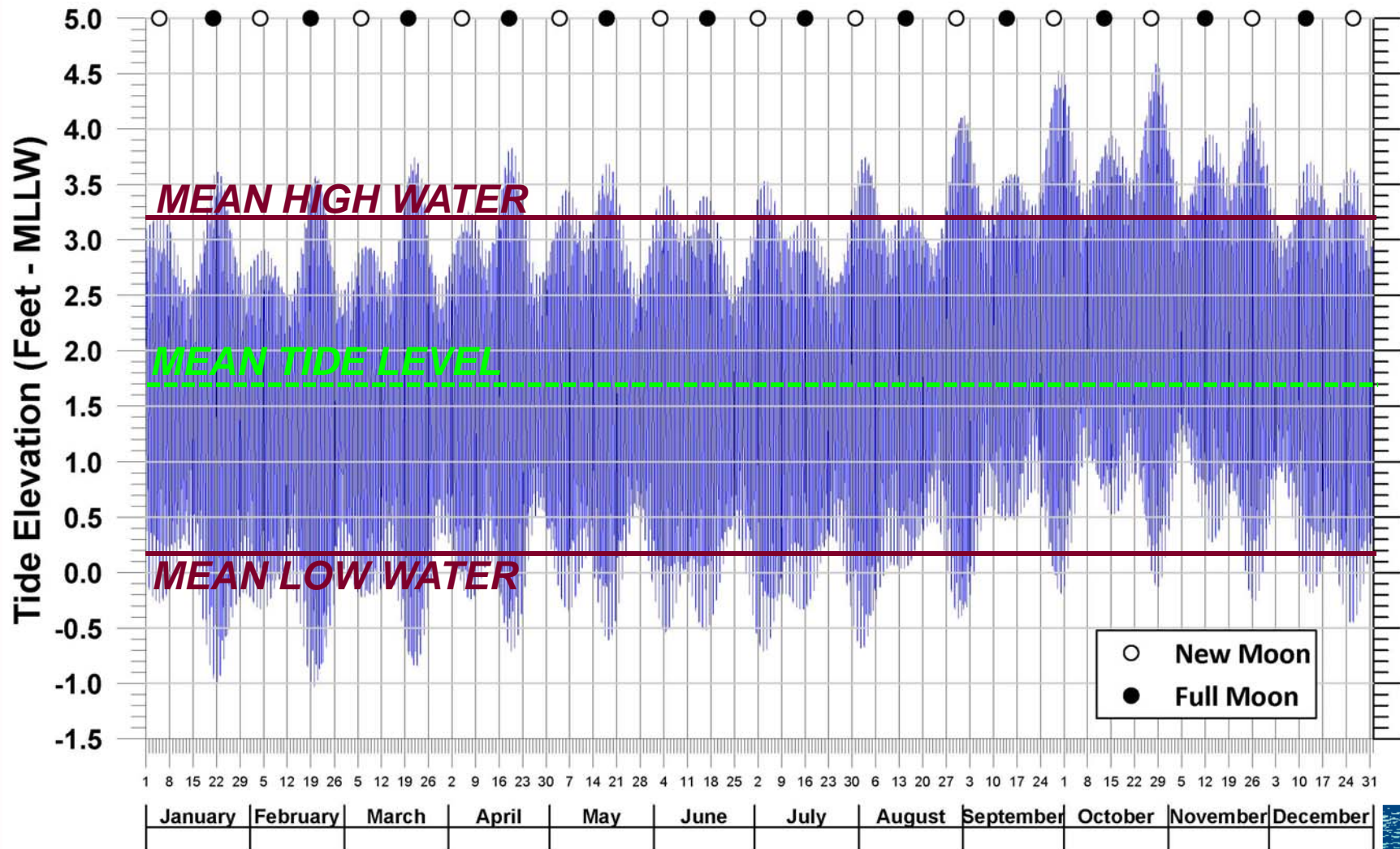
Martin County, FL: 2019 Predicted Tides



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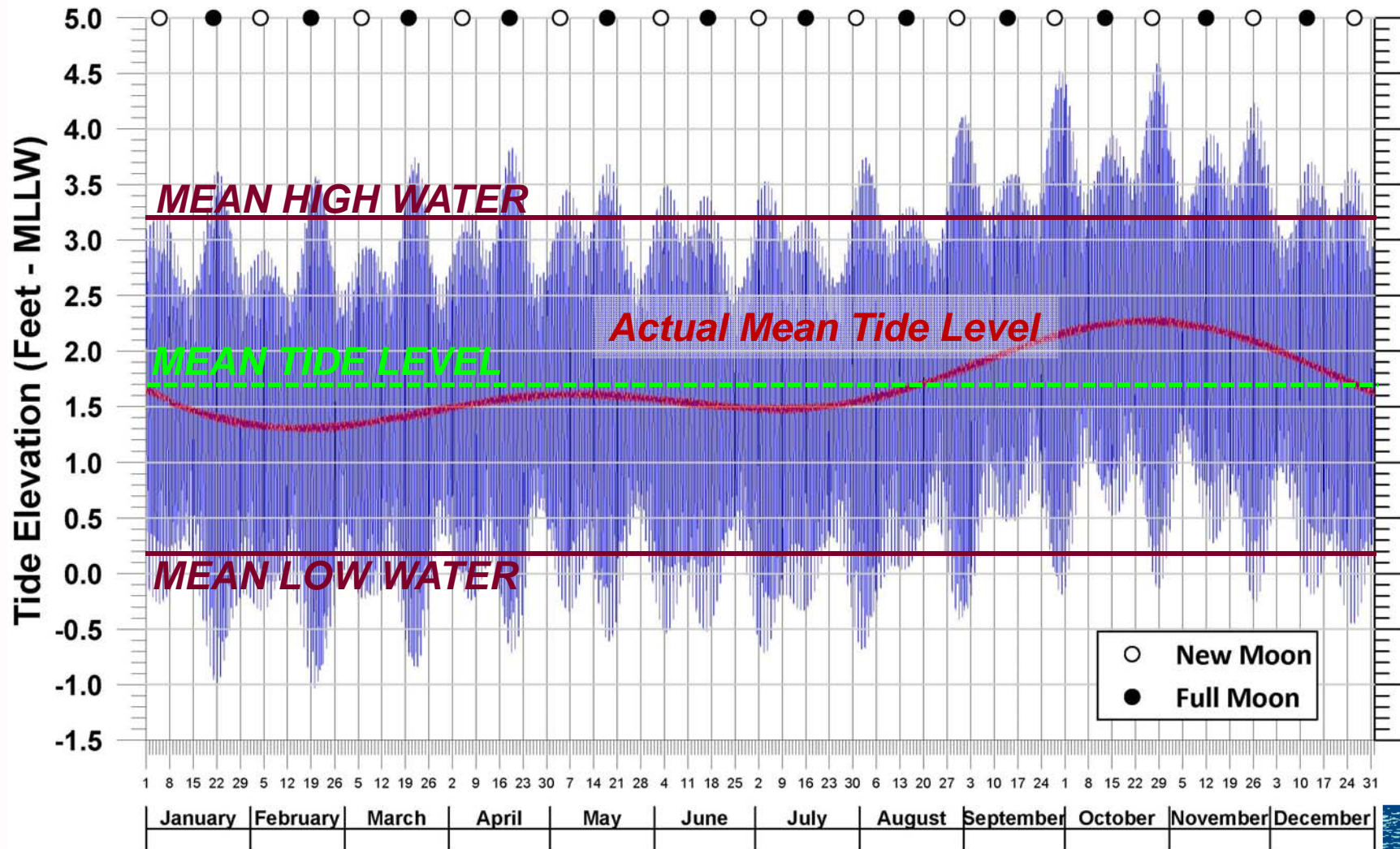
Martin County, FL: 2019 Predicted Tides



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Martin County, FL: 2019 Predicted Tides



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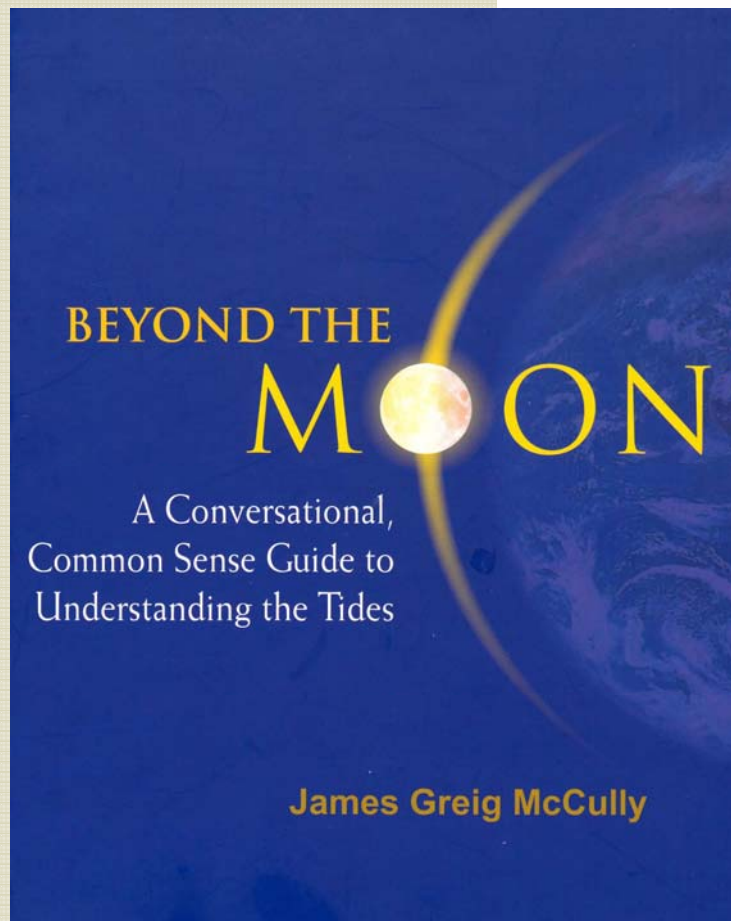




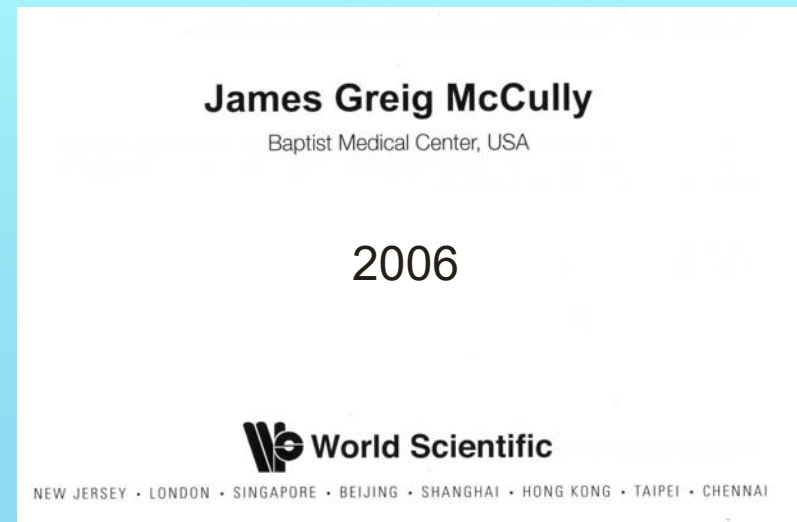
Our simplified explanation of tidal variations assumed a uniform sea atop a spherical globe. Local variations of the number of tides, and the range of the tides, is greatly influenced by the presence of land and the morphology of the seabed around the globe . . . which we do not detail in this short presentation.

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For Additional Reading....



olsen
associates, inc.
Coastal Engineering

Kevin Bodge, Ph.D., P.E.

Olsen Associates, Inc.
Jacksonville, Florida

The Splendor of the Tides

