

Space, Gravity, and other Cool Spacey Stuff

Compiled by Bryce L Meyer

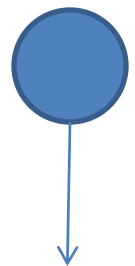
Big Space Questions for Today

- What is Gravity?
- Why are planets and stars round?
 - What are stars?
 - What if it isn't round?
- What is an 'orbit'?
 - the Sun
 - Sun and Earth
 - The Moon
 - Moon and Earth and moon phases
- What about seasons?
 - Clue: The North Star is important...
- Space Ships, Rockets, moon bases, satellites and you!

Gravity

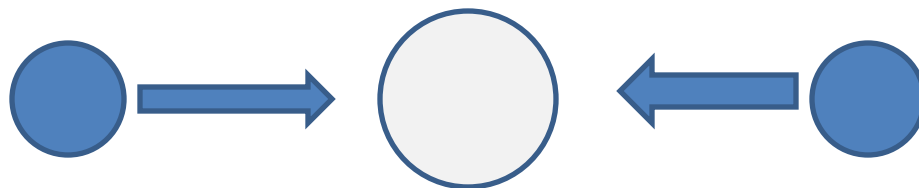
- Gravity is the pull (a force) that
 - everything that
 - weighs anything
 - **pulls**
 - on everything else!
- On Earth: The more mass it has, the more it weighs, because the more mass it has the more gravity pulls it!
- The More Mass anything in space has, the more it pulls on anything near it
- The closer two things are, the more gravity pulls them together.

Ball: Ball drops to floor



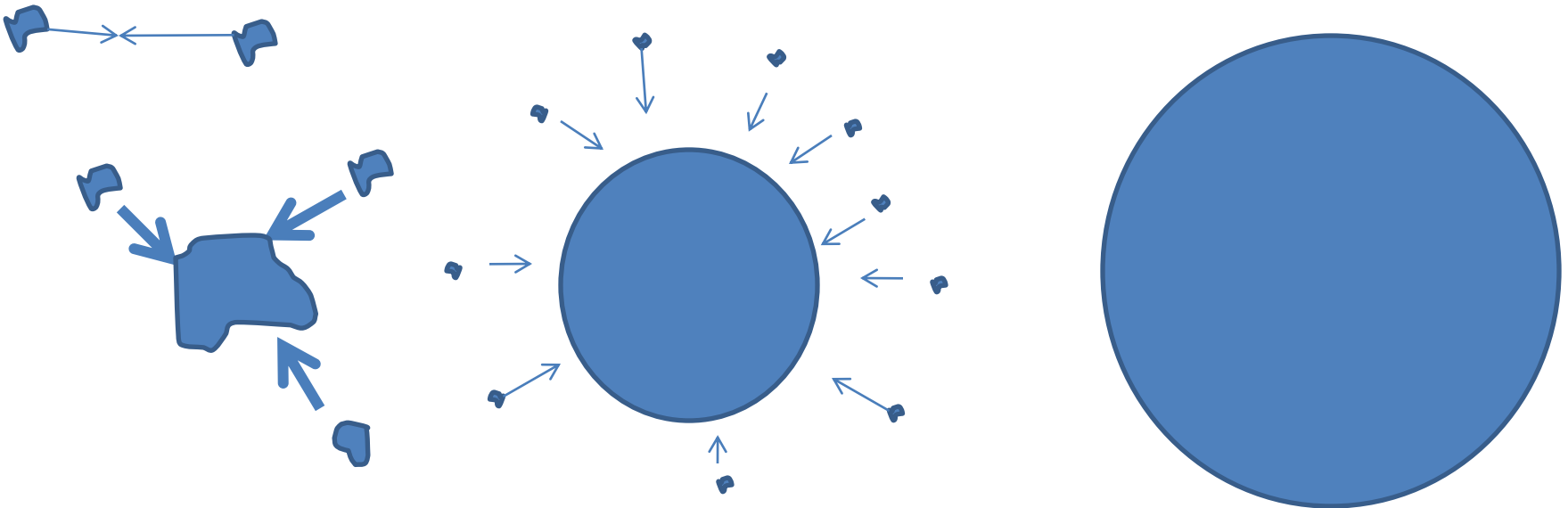
Why are Planets and Stars Round?

- Clue 1:
 - Since Gravity pulls everything towards everything else, if you have lots of something in space, it all pulls to the center.
 - Two or more things in space that have the same mass pull to each other at the same time, meeting in the middle.
 - Then they stick together!



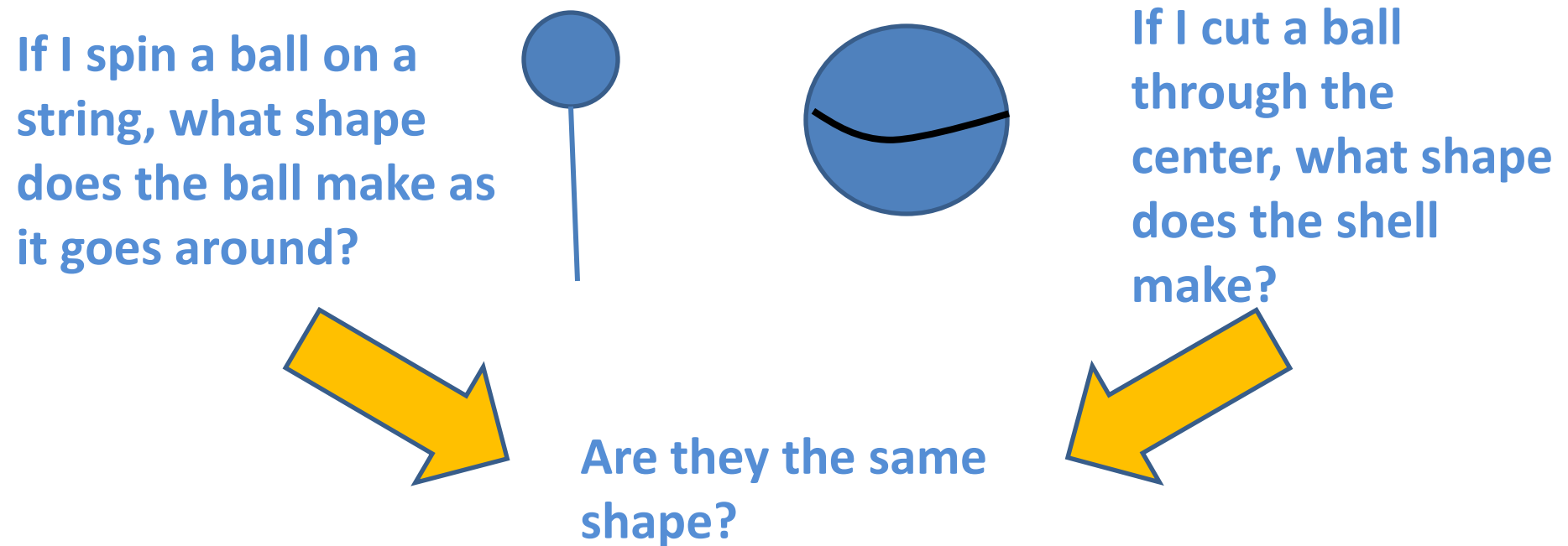
Planets are Stars: Why are they round?

- Clue 2: Snowballs get bigger!
 - The bigger the pile of stuff in the middle gets, the more it can pull in due to gravity
 - The bigger the snowball gets the more snow it can pick up when you roll it...
 - The more it can pull in, the bigger it gets!



Why are Stars and Planets round?

- Eventually they pull in so much stuff (dust, gas, rocks) that gravity pulls everything at the same time, the same amount on the surface.



Asteroids, Planets, and Stars

- If there is enough gas, dust, rocks nearby, they form such a big round pile, that gravity pulls the stuff really hard against the middle
 - If it presses in hard enough, it may get hot enough to make a star (like our Sun)!



Stars are giant gas balls of nuclear fire!

The sun is a million times bigger than the Earth...it takes a lots of stuff to make a star!

Baby Stars

- Stars have nurseries just like babies.
- Places with lots of gas and dust allow gravity to pull together stars



From NASA (ESA): **Stellar Nursery in the Rosette Nebula**

http://www.nasa.gov/images/content/450093main_hobys_rosette_05_A3_3d_full.jpg

Non-round things

- If there is not enough to make a round object (like a star or planet), the object may not have enough gravity to be round
 - Asteroids
 - Meteoroids

A radar image of asteroid 2010 JL33, generated from data taken by NASA's Goldstone Solar System Radar on Dec. 11 and 12, 2010. Image credit: NASA/JPL-Caltech



Planets (and other round things)?

- If there isn't enough dust, gas, and rocks to pull together a star, but there is enough to make a round object that isn't a star it can become a:
 - Planet (like Earth, Venus, Mars, Jupiter)
 - Moon
 - (Lots of planet-like objects like Pluto and big Comets)

What are the little dots?



What planet is this?

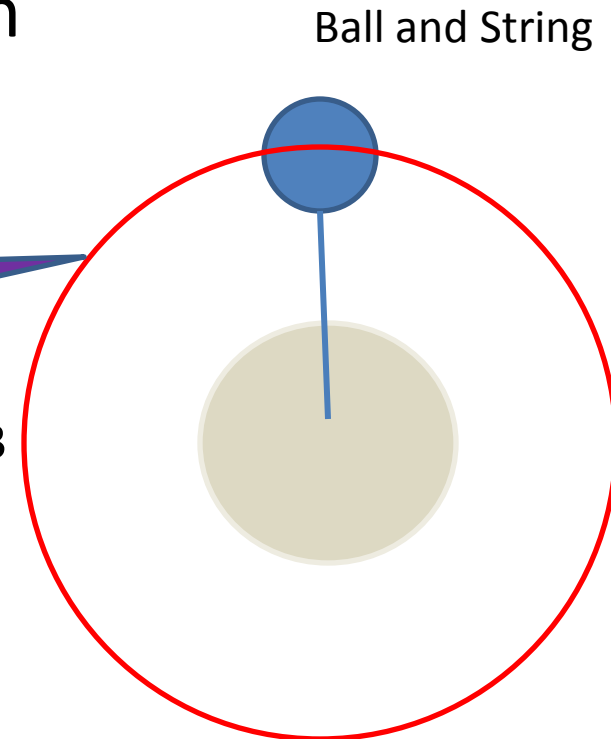
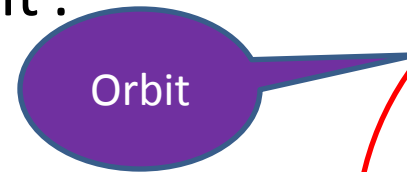
(both pictures show the same planet- look for the big red spot)



Both Taken from my telescopes September and October , 2010

Orbits

- Littler objects near bigger objects that go fast enough do not get pulled in by gravity
- instead they make a circle-like path around the bigger object
 - The path is called an 'orbit'.
 - Examples:
 - Moons around Jupiter
 - (The little white dots in the last slide are 3 of the moons of Jupiter)
 - Moon around the Earth
 - Earth around the Sun



The Moon

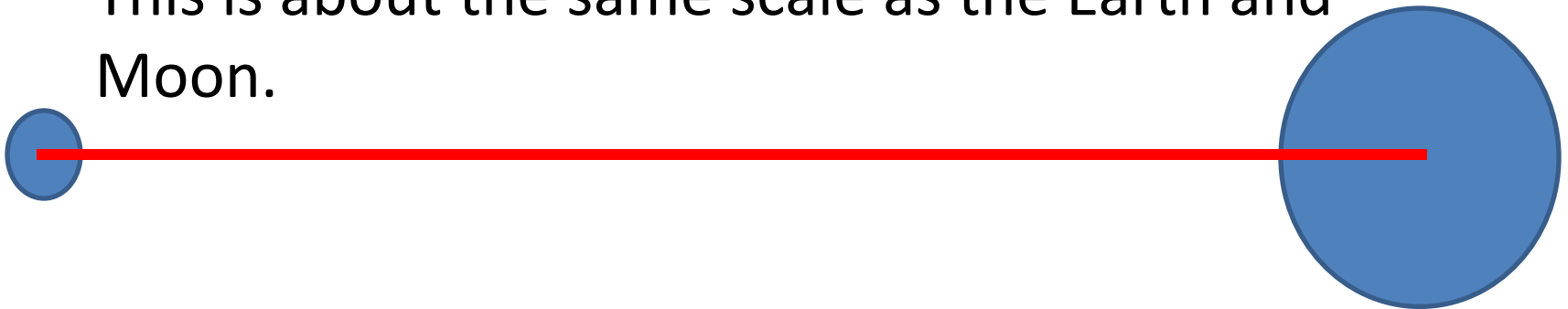
Taken from my small telescope September 2009

- The Moon orbits the Earth in a not-quite circular orbit
- On average, the distance to the Moon from the center of the Earth is about **30 times** the distance from Saint Peters, Missouri to Hong Kong, China!
 - Or about 10 trips around the equator.



What's that look like?

- Basketball, small ball, and string
 - Wrap the string 10 times around the middle of the basketball.
 - Hold one end of the string at the top of the basketball.
 - Hold the other end on the racket ball, walk until tight.
 - This is about the same scale as the Earth and Moon.



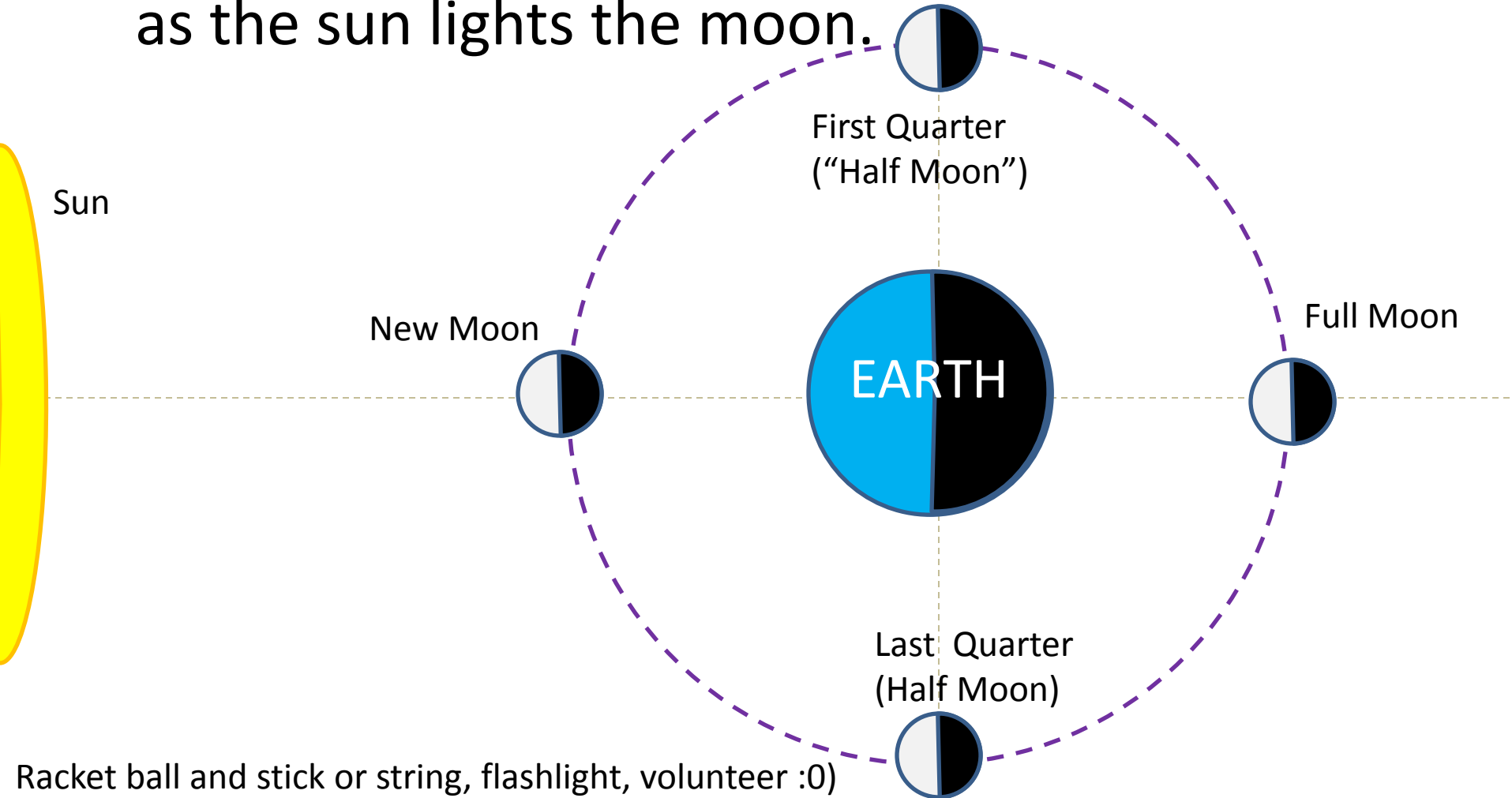
Note: doesn't have to be a basketball for a simple comparison...the Moon is $\frac{1}{4}$ the diameter of the Earth...any ball will do.
Earth Diameter $\sim 24,000$ Miles, Distance to moon from Earth Center is Around 238,000 miles on average

How far away would the Sun be from the Earth, if the Earth was the Basketball?

- The sun is on average 93 Million miles from the Earth.
- This is roughly 3875 wraps around the basketball, or...
- if the ball is an NBA Standard basketball (29.5 inches around)...
- About 1.8 Miles away! (A string from here to the Hospital in Cave Springs!)

Moon Phases

- we see the part of the moon facing the Earth as the sun lights the moon.

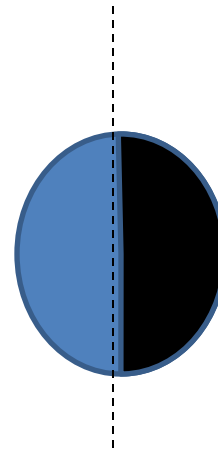


Racket ball and stick or string, flashlight, volunteer :0)

Note: DISTANCE/SIZES NOT TO SCALE! Earth and Moon and Sun are MUCH further apart then shown!

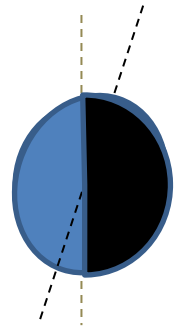
Night and Day...but...

- Every day (in around 24 hours) the Earth spins around its axis (a line that goes through the center to connect the north and south poles)
- The part of the Earth facing the Sun has daytime
- The part facing away from the sun has nighttime

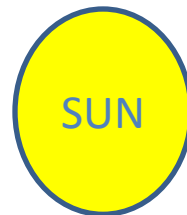
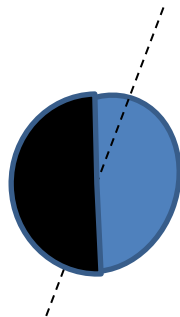


...the Earth's Axis is not straight up and down! (Seasons and Tilt)

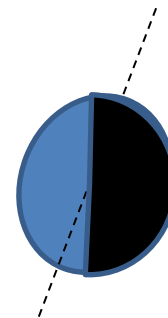
- The axis of the Earth (a line connecting the South Pole, center of the Earth, and the North Pole) point almost at the star Polaris ('the north star')...
 - about $\frac{1}{2}$ of a $\frac{1}{2}$ of an orange slice from straight up and down.



Summer in
the northern
half of the
Earth...
Summer for
Polar bears!



Winter in the
northern half
of the
Earth...
Summer for
penguins and
Kangaroos!



Not to scale...the sun is MUCH further away then shown!

Prop: a Ball on a string and light

Good links

- <http://solarsystem.nasa.gov/planets/profile.cfm?Display=Moons&Object=Jupiter>
- <http://spaceplace.nasa.gov/en/kids/orbits1.shtml>
- <http://starchild.gsfc.nasa.gov/docs/StarChild/StarChild.html>
- <http://www.nasa.gov/audience/forkids/kidsclub/flash/index.html>
- <http://en.wikipedia.org/wiki/Planets>
- <http://www.google.com/moon/>
- <http://www.combat-fishing.com/animationspace/astronomypics/index.html>

BACKUP SLIDES

Apollo missions



Both Taken from my telescope September 2010

Apollo 11 landed July 20, 1969 at the edge of the Sea of Tranquility, on the moon (The 'Sea' is actually a big dusty area with dark flat dirt).



Craters !
(From my 'scope)