

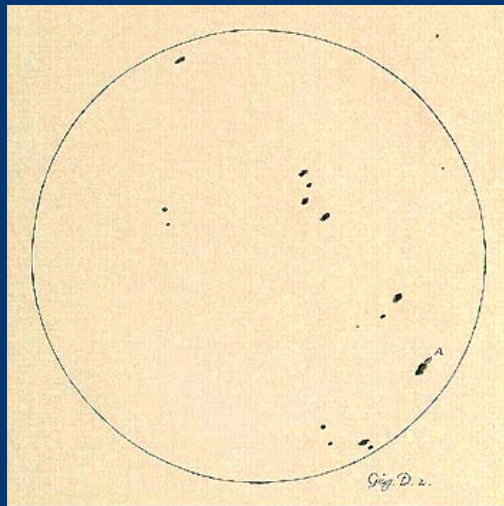
# Physics 681: Solar Physics and Instrumentation – Lecture 18

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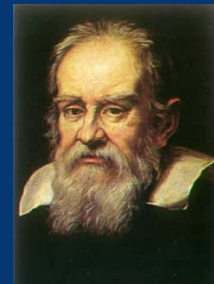
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## Galileo Galilei (1564 – 1642)



First telescopic observations of the Sun!



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# Rotation

- ❑ Axis of Rotation
- ❑ Oblateness
  - Origin
  - Measurement
- ❑ Rotational History
  - The Initial State
  - Torques
  - Evolution of Solar Rotation
- ❑ The Angular Velocity of the Sun
- ❑ Models of a Rotating Convection Zone



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# Axis of Rotation

- ❑ Invention of the telescope in 1610 (Galileo Galilei, Johannes Fabricius, Christoph Scheiner, and Thomas Harriot)
- ❑ Sunspots as tracers to measure differential rotation
- ❑ Rotation elements: (1)  $i = 7.25^\circ$  angle of inclination between the ecliptic plane and the equatorial plane of the Sun and (2)  $\Omega$  the ecliptic longitude of the ascending node of the Sun's equator
- ❑ Precession of the Earth's axis
- ❑ Heliographic coordinates
- ❑ Solar latitude  $\psi$  is the angular distance from the equator
- ❑ Colatitude:  $\theta = \pi/2 - \psi$  (often used in theoretical work)
- ❑ Carrington rotations: intervals of 27.27 days starting 9 November 1853 ( $\phi = 0$  at the beginning of a new rotation)
- ❑ Conversion to ecliptic coordinates

$$\sin \psi = \cos i \sin \beta - \sin i \cos \beta \sin(\lambda - \Omega)$$

$$\tan \phi = \cos i \tan(\lambda - \Omega) + \sin i \tan \beta \sec(\lambda - \Omega)$$



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