Solar luminosity

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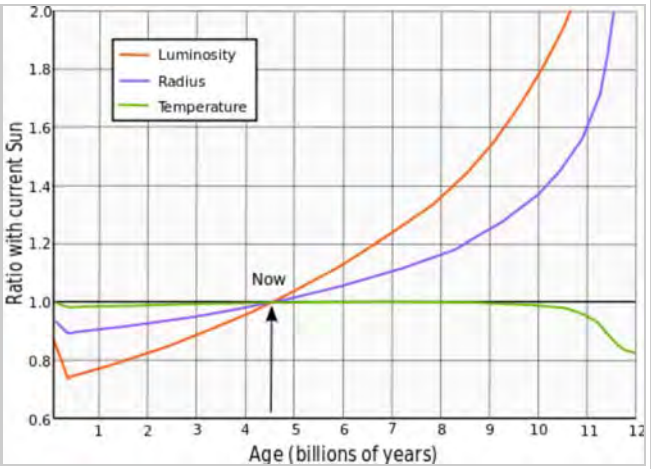
The **solar luminosity**, $L_\odot$, is a unit of radiant flux (power emitted in the form of photons) conventionally used by astronomers to measure the luminosity of stars. It is defined in terms of the Sun's output. One solar luminosity is 3.828×10^{26} W.[2] This does not include the solar neutrino luminosity, which would add $0.023\ L_\odot$.[3] The Sun is a weakly variable star, and its luminosity therefore fluctuates.[4] The major fluctuation is the eleven-year solar cycle (sunspot cycle) that causes a periodic variation of about ±0.1%. Other variations over the last 200–300 years are thought to be much smaller than this.[5]



Evolution of the solar luminosity, radius and effective temperature compared to the present-day Sun. After Ribas (2010)[1]

Contents

Determination

Solar luminosity is related to solar irradiance (the solar constant). Solar irradiance is responsible for the orbital forcing that causes the Milankovitch cycles, which determine Earthly glacial cycles. The mean irradiance at the top of the Earth's atmosphere is sometimes known as the solar constant, $I_\odot$. Irradiance is defined as power per unit area, so the solar luminosity (total power emitted by the Sun) is the irradiance received at the Earth (solar constant) multiplied by the area of the sphere whose radius is the mean distance between the Earth and the Sun:

$$L_\odot = 4\pi k I_\odot A^2$$

where A is the unit distance (the value of the astronomical unit in metres) and k is a constant (whose value is very close to one) that reflects the fact that the mean distance from the Earth to the Sun is not exactly one astronomical unit.

See also

- Solar mass
- Solar radius
- Nuclear fusion

- Triple-alpha process

References

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2. Williams, David R. (1 July 2013). "Sun Fact Sheet — Sun/Earth Comparison". National Aeronautics and Space Administration. Retrieved 13 April 2014.
3. Bahcall, John N. (1989). *Neutrino Astrophysics*. Cambridge University Press. p. 79. ISBN 978-0-521-37975-5.
4. Vieira, L. E. A.; Norton, A.; Dudok De Wit, T.; Kretzschmar, M.; Schmidt, G. A.; Cheung, M. C. M. (2012). "How the inclination of Earth's orbit affects incoming solar irradiance". *Geophysical Research Letters*. **39** (16): n/a. Bibcode:2012GeoRL..3916104V. doi:10.1029/2012GL052950.
5. Noerdlinger, Peter D. (2008). "Solar Mass Loss, the Astronomical Unit, and the Scale of the Solar System". *Celestial Mechanics and Dynamical Astronomy*. **801**: 3807. arXiv:0801.3807. Bibcode:2008arXiv0801.3807N.

Further reading

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- Pelletier, Jon D. (1996), "Variations in Solar Luminosity from Timescales of Minutes to Months", *Astrophys. J.*, **463** (1): L41–L45, arXiv:astro-ph/9510026, Bibcode:1996ApJ...463L..41P, doi:10.1086/310049
- Stoykova, D. A.; Shopov, Y. Y.; Ford, D.; Georgiev, L. N.; et al. (1999), "Powerful Millennial-Scale Solar Luminosity Cycles and Their Influence Over Past Climates and Geomagnetic Field", *Proceedings of the AGU Chapman Conference: Mechanisms of Millennial Scale Global Climate Change*

External links

- LISIRD: LASP Interactive Solar Irradiance Datacenter (http://lasp.colorado.edu/lisird/)
- Stellar Luminosity Calculator (http://astro.unl.edu/classaction/animations/stellarprops/stellarlum.html)
- Solar Luminosity (http://www.universetoday.com/guide-to-space/the-sun/solar-luminosity/)
- Variation of Solar Luminosity (http://web.sfc.keio.ac.jp/~masudako/edu/text/quatbook/variat/node4.html)

Categories: Sun | Stellar astronomy | Units of power | Units of measurement in astronomy

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