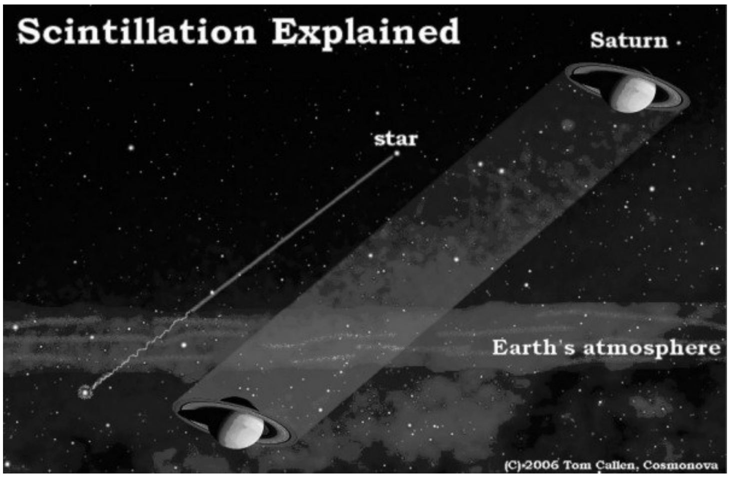
WHY STARS TWINKLE, BUT PLANETS DON'T



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Why do stars twinkle, while planets shine steadily. Astronomers use the term 'scintillation' to describe the twinkling of stars.

Stars twinkle because they're so far away from Earth that, even through large telescopes, they appear only as points of light. And thermal density fluctuations in the Earth's atmosphere disturb this pinpoint light of a star. Instead of the straight path the light would travel if Earth had no atmosphere, the light travels a zig-zag path of refractions to our eyes through the constantly varying atmosphere.

Planets shine more steadily because they are closer to Earth and so appear not as pinpoints of light, but as tiny disks in our sky. The light from these little disks is also refracted by Earth's atmosphere, as it travels toward our eyes. But the zigs and zags of lights from a planetary disk cancel each other out across the disk, and that's why planets appear to shine steadily. This means that if you increase the magnification of a section of the planet to a fine enough point, that point would also twinkle.

Twinkling becomes more pronounced when you see the object low in the sky, because then you're seeing them through more atmosphere than when they are overhead.

Twinkling of starlight is of course a big problem with telescope observations and with exact positioning of distant objects in the sky. The minute movements or density changes in the air above us causes the image of a pinpoint star to wiggle or twinkle. This makes it impossible to focus exactly. It has always been so. But when, with the manufacture of larger telescopes, when the measurement resolution reached the sub-arc-seconds range, the consistency of air became a major hurdle. Increasing the size of a telescope, while increasing the light-collecting power (it can see more distant objects), also increases the ultimate resolution capacity of the telescope (the ability to separate closely spaced objects). Astronomers try to minimise the twinkling effect by placing their observatories on mountain tops, where the high altitude reduced the thermal activities of the atmosphere, or at the Antarctica where the air is drier and more stable. **But the only way to eliminate twinkling altogether is to go above Earth's atmosphere, which was done with the Hubble Space Telescope.**. Or is there another way? Yes, the process is called Adaptive Optics. **Adaptive optics works by measuring the distortions in a wavefront and compensating for them with a device that corrects those errors, such as a deformable mirror or a liquid crystal array**. Using a guide star (or laser beam point) for reference, it instantly adjusts the incoming light by deforming a mirror to compensate for any distortion of the reference point.

The absolute resolution of any telescope at visible light (whether on Earth or in Space) can be approximated by: Resolution in arcseconds = 11.6/D, where D is the diameter of the lens in centimetres. For instance, for a resolution of ~ 0.1 arcsecond we need D = 1.2 metres. The Hubble Space Telescope, with a diameter of 2.4m has (again at visible light) a diffraction limit of 0.05 arcsecond. So, it can achieve resolutions down to one twentieth of an arcseconds at visible light. Remembering that an arcsecond is the width of a human hair seen at 10metre distance, this means the Hubble can measure the width of a human hair at a distance of 200 metres.

AK, from Wikipedia Notes