Re: Solar absorption lines

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Scott replied to William Hamblen:

> > Electrons also can become unbound from atoms and
> > radiate freely.
>
> Can you elaborate on what you mean by "radiate freely"?

He means "radiate at any wavelength".

This is just a repackaging of what others have said here:

Imagine a thin gas in front of a black background. The gas is too thin and too cold to have significant blackbody emission, so all you see is black.

The gas is illuminated by a very strong source of light off to one side, where you can't see it. This is the same as looking at the solar chromosphere during an eclipse. Most of the light of particular wavelengths entering the gas is absorbed, heating the gas (raising its temperature and increasing its blackbody radiation) and causing the gas to emit light at the same particular wavelengths. The result is a low−intensity blackbody glow from the gas, with a bright−line spectrum superimposed on it. The bright−line spectrum isn't especially bright. Only a small fraction of the light of a particular wavelength which is absorbed is then re−emitted at one of the particular wavelengths toward your eye. The vast majority of it is emitted either in other directions or at other wavelengths, or both.

Now move the source of light behind the gas. You now see a very strong, high−temperature blackbody radiation, with the cooler gas again absorbing particular wavelengths of that light, which causes a dark−line spectrum. As before, the light heats the gas, increasing its blackbody radiation,

and creating a bright−line spectrum of modest brightness. As before, the light emitted at the particular wavelengths toward your eye is very much less than the light absorbed at the particular wavelengths. So the bright−line spectrum does not send enough light toward your eye to make up for the light removed from the very bright background source at those same wavelengths.

−− Jeff, in Minneapolis

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