

## Quantum Mechanics Exercises :

### L I G H T   Q U A N T A   &   U N C E R T A I N T Y

- [medium] 1. If 5% of the energy supplied to an incandescent light is radiated as visible light, how many visible quanta are emitted per second by a small 10-watt bulb? Assume the wavelength of the light to be 520 nm. How many would enter a human eye (diameter of the pupil is 0.7cm) 1000 m distant from the light bulb? Supposing that it takes at least 1000 photons per second for the eye to be able to register a light signal, could the eye, in principle, see the light from the bulb at a distance of 1000 m?
- [medium] 2. The energy gap in silicon is 1.1 eV and in diamond it is 6eV. The eye is sensitive to light in the range of 400-700 nm. Do you expect either silicon or diamond or both to be transparent to visible light?
- [hard] 3. Classical mechanics works well when the quantum uncertainties are small compared to the positions and momenta. In an old television tube the accelerating voltage is 15 000 volts and the electron beam passes through an aperture 0.4 mm in diameter to a screen 0.35 m away. Find the approximate uncertainty in position of the point where the electrons strike the screen. Does this uncertainty significantly affect the clarity of the picture?