

Phy 520: Problem Set 1
(Due: September 7, 2018)

- 1). What might our world be like if h , Planck's constant, were large? Suppose for argument sake that $h \sim 10^{-7}$ J-s.
- 2). Gasiorowicz, Chap. 1, Problem 5.
- 3). Gasiorowicz, Chap. 1, Problem 6.
- 4). Gasiorowicz, Chap. 1, Problem 7.

(It is useful to recall that energy and momentum conservation yields four *independent* constraints.)

- 5). Gasiorowicz, Chap. 1, Problem 14.
- 6). Gasiorowicz, Chap. 1, Problem 16.
- 7). Consider the Boltzmann distribution for black-body radiation described in lecture:

$$P(n\varepsilon) = \frac{\exp\left(-\frac{n\varepsilon}{k_B T}\right)}{\sum_{n=0}^{\infty} \exp\left(-\frac{n\varepsilon}{k_B T}\right)}, \quad (1)$$

where the energy E can be any of $n\varepsilon$ values (with $\varepsilon = h\nu$). Compute $\langle E \rangle$, $\langle E^2 \rangle$, and the standard deviation σ of the distribution in E . How do these quantities behave in the $T \rightarrow \infty$ limit? What about $\sigma/\langle E \rangle$? What does this tell you about the shape of the distribution in that limit? (Please refer to Griffiths, Sec. 1.3.)