EE313: Wireless Communications

Lecture 2

Professor WANG Rui

Department of **E**lectronic & **E**lectrical **E**ngineering (**EEE**)
Southern **U**niversity of **S**cience & **Tech**nology (**SUSTech**)

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EXAMPLE 2.1: Consider an indoor wireless LAN with $f_c = 900$ MHz, cells of radius 100 m, and nondirectional antennas. Under the free-space path loss model, what transmit power is required at the access point in order for all terminals within the cell to receive a minimum power of 10 μW? How does this change if the system frequency is 5 GHz?

Solution: We must find a transmit power such that the terminals at the cell boundary receive the minimum required power. We obtain a formula for the required transmit power by inverting (2.7) to obtain:

$$P_t = P_r \left[\frac{4\pi d}{\sqrt{G_l}\lambda} \right]^2.$$

Substituting in $G_l = 1$ (omnidirectional antennas), $\lambda = c/f_c = .33$ m, $d = 10$ m, and $P_r = 10\ \mu$W yields $P_t = 1.45$ W $= 1.61$ dBW. (Recall that P watts equals $10\log_{10}(P)$ dbW, dB relative to 1 W). At 5 GHz only $\lambda = .06$ changes, so $P_t = 43.9$ kW $= 16.42$ dBW.

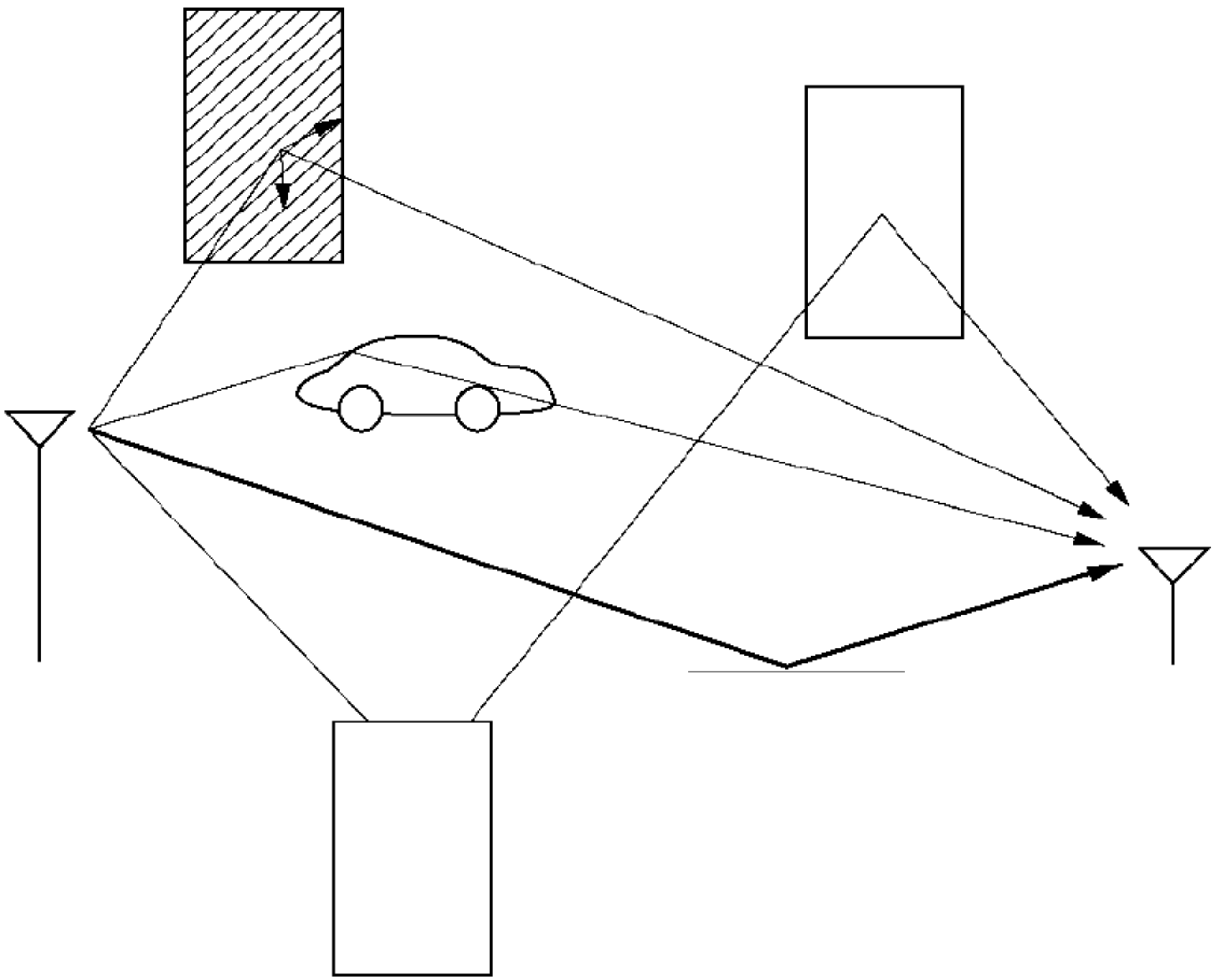
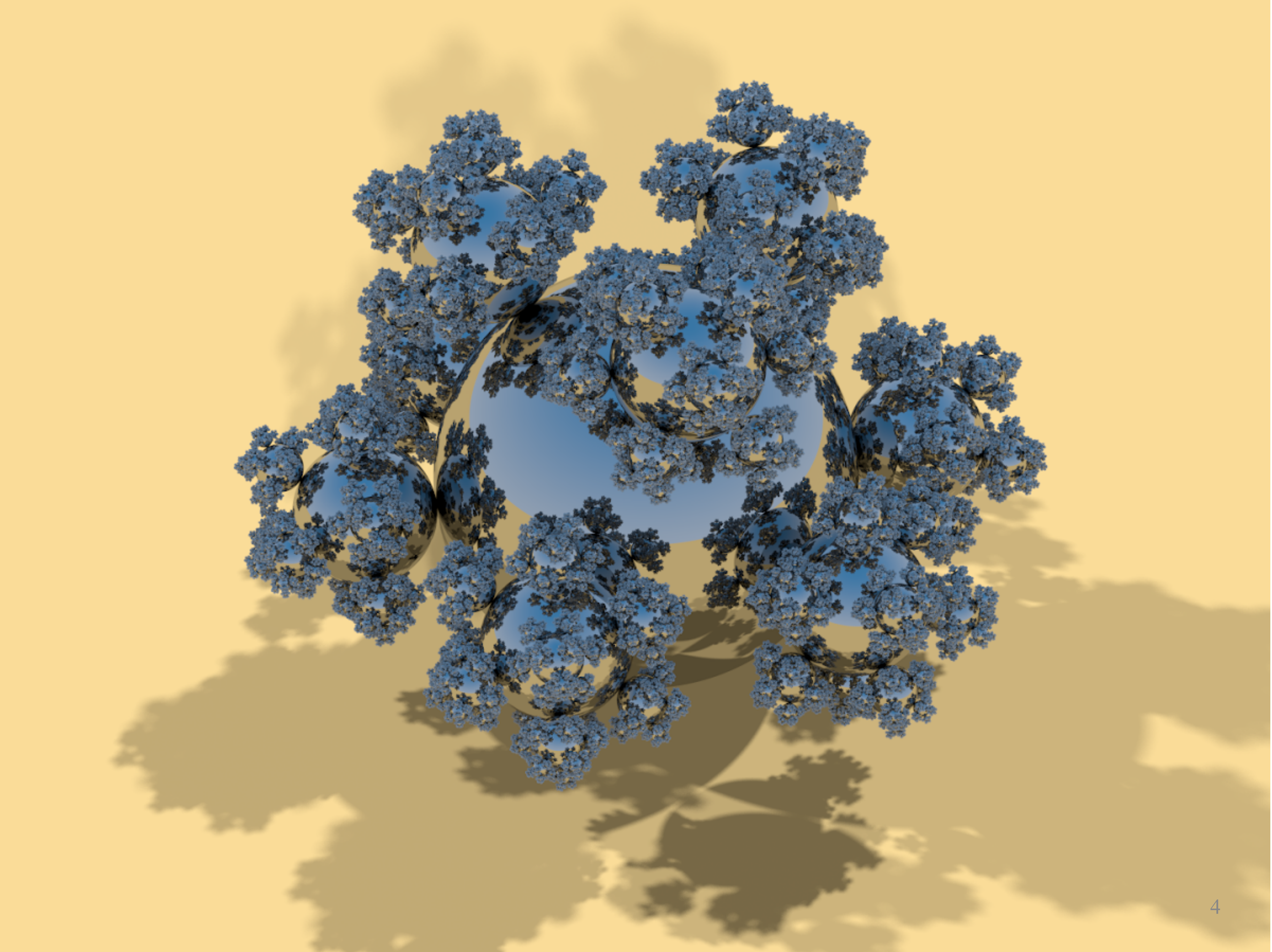


Figure 2.3: Reflected, diffracted, and scattered wave components.



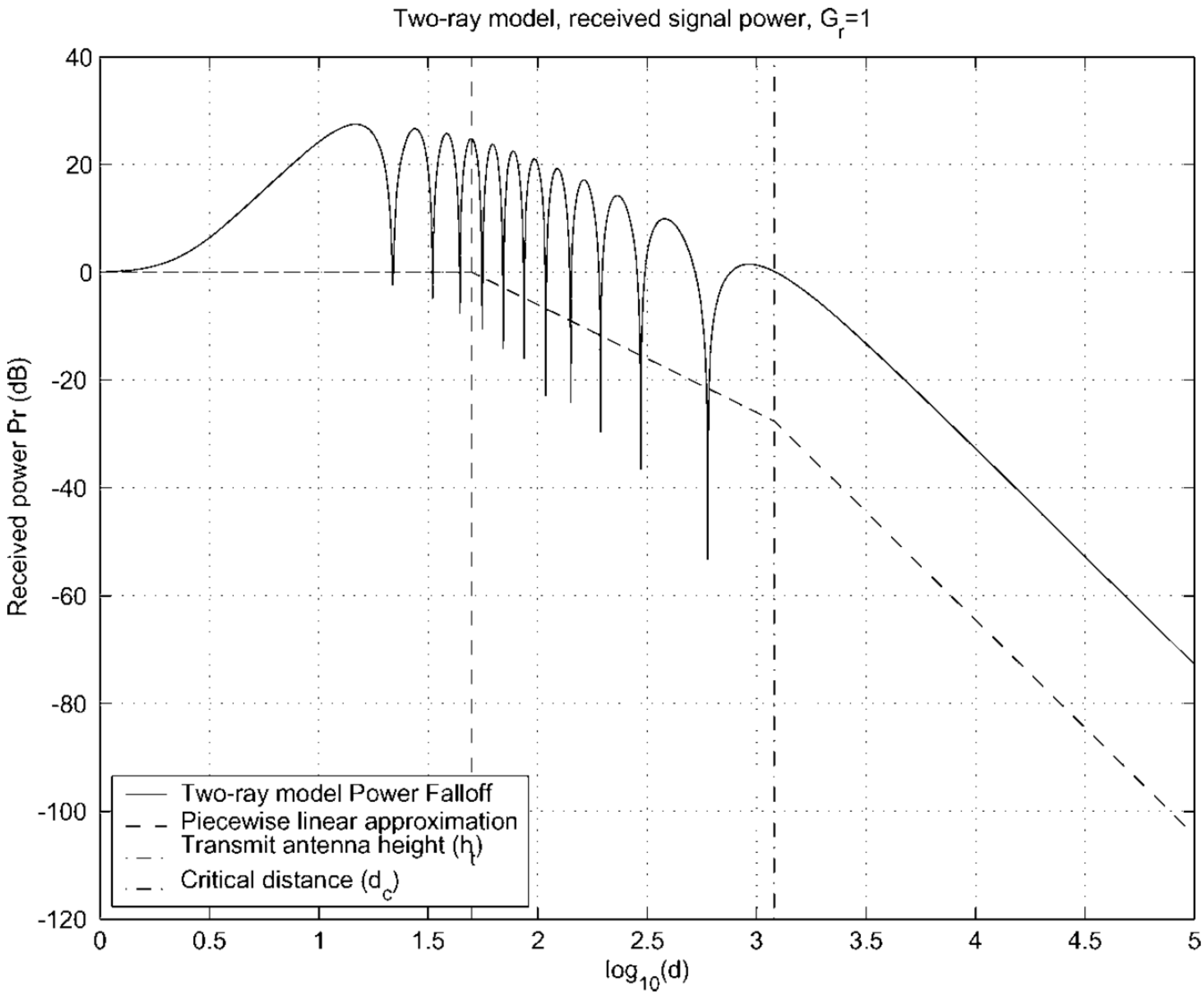


Figure 2.5: Received power versus distance for two-ray model.