

27. 设有以波源为球心半径为 r 的球面，单位时间通过球面的能量为 $\overline{P} = \overline{S} \cdot A =$

$$\overline{S} \cdot 4\pi r^2, \text{ 得 } r = \sqrt{\frac{\overline{P}}{4\pi \overline{S}}} = \sqrt{\frac{35000}{4\pi \times 7.9 \times 10^{-15} \times 3 \times 10^8}} m = 3.45 \times 10^4 m$$

28. 火车速率 $v_s = \frac{90 \times 10^3}{3600} = 25 m s^{-1}$

$$\text{观察者速率 } v_R = \frac{54 \times 10^3}{3600} = 15 m s^{-1}$$

$$\text{运动时, } v_R = \frac{u+v_R}{u-v_s} v_s$$

$$(1) \text{ 当 } v_R = 0, v_s > 0 \text{ 时, } v_1 = \left(\frac{u}{u-v_s} \right) v_s = \left(\frac{340}{340-25} \right) \times 500 Hz = 540 Hz$$

$$v_s = 0 \text{ 时, } v_2 = 466 Hz$$

$$\therefore \Delta v = v_1 - v_2 = 74 Hz$$

$$(2) \text{ 当 } v_R > 0, v_s > 0 \text{ 时, } v = \frac{u+v_R}{u-v_s} v_s = \frac{340+15}{340-25} \times 500 Hz = 563.5 Hz$$

29. (1) $v_1 = \frac{u}{u-v_s} v_s = \frac{331}{331-30} \times 1080 Hz = 1188 Hz$

$$\lambda_1 = \frac{u}{v_1} = \frac{u-v_s}{v_s} = 0.28 m$$

$$v'_1 = \frac{u}{u+v_s} v_s = 990 Hz$$

$$\lambda'_1 = \frac{u}{v'_1} = \frac{u+v_s}{v_s} = 0.33 m$$

$$(2) v_R = \frac{u+v_R}{u-v_s} v_s = 1421 Hz$$

$$(3) u = 331 m s^{-1}$$

$$(4) \lambda_2 = \frac{u-v_R}{v_R} = 0.187 m$$