

# 射电天文学笔记

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# 第一章 射电信号的探测方法

射电 (10MHz–1THz)  $\neq$  无线电 (3kHz–3GHz).

白天可测: 波长远大大气尘埃, 无散射; 太阳射电信号少.

排除水汽: 高地, 旱地.

- 镜面精度低 ( $\lambda/20$ ).
- $\lambda$  大, 在  $\lambda^3$  范围内放很多带点粒子, 形成相干辐射.
- 波长远大星际尘埃, 透明.
- $h\nu/kT \ll 1$ , 所有天体都辐射.
- $\theta \sim \lambda/D$ , 需要大  $D$ .



## 第二章 射电辐射基础<sup>1</sup>

$I_\lambda$ : 垂直于单位面积方向的单位立体角内单位时间通过的单位波长的能量.  $F_\lambda$ : 单位面积的所有立体角内单位时间通过的单位波长的能量.

$$I_\lambda = \frac{dE}{\cos \theta d\sigma d\Omega dt d\lambda}. \quad (2.1)$$

$$F_\lambda = \int I_\lambda \cos \theta d\Omega. \quad (2.2)$$

$$1 \text{ Jy} = 10^{-26} \text{ W}/(\text{m}^2 \cdot \text{Hz}), \quad 1 \text{ erg} = 10^{-7} \text{ J}.$$

$$\frac{dI_\nu}{I_\nu} = -\kappa_\nu ds. \quad (2.3)$$

$$\tau_\nu = \int_{s_{\text{in}}}^{s_{\text{out}}} \kappa_\nu ds. \quad (2.4)$$

$$I_\nu(s_{\text{out}}) = I_\nu(s_{\text{in}})e^{-\tau_\nu}. \quad (2.5)$$

$$dI_\nu = j_\nu ds. \quad (2.6)$$

$$\frac{dI_\nu}{ds} = -\kappa_\nu I_\nu + j_\nu. \quad (2.7)$$

低频  $B_\nu \approx \frac{2kT\nu^2}{c^2}$ , 亮温度

$$T_{\text{b}} := \frac{I_\nu c^2}{2k\nu^2}. \quad (2.8)$$

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<sup>1</sup>梦回天体物理导论.