Radiometer Equation

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20241106

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Integration Time Calculation

- **The observing time required to achieve a specific Signal to Noise ratio can be calculated using the radiometer equation (Dicke 1946).**

- ***Ignoring the effects of Radio Frequency Interference (RFI) on the noise floor (Tsys).***

$$T_{int} = \left(\frac{T_{sys}(S/N)}{G S_{psr} \sqrt{n_{pol} B_w}} \right)^2$$

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Key Parameters for an observation

$$T_{int} = \left(\frac{T_{sys}(S/N)}{G S_{psr} \sqrt{n_{pol} B_w}} \right)^2$$

Target:

- S_{psr}: Strength of the radio signal from the target in Janskys (Watts per m^2 per Hz)

Telescope:

- T_{sys}: System temperature, a measure of the background noise level of the telescope in degrees Kelvin (K)
- Gain: proportional to the size (collecting area) of the telescope dish and the performance of the amplifier (K per Jansky)
- n_{pol}: Number of polarisations observed (generally 2)
- B_w: Bandwidth of the receiver in MHz

Variable parameters:

- T_{int}: Integration time or duration of the observation in seconds
- S/N: Signal to Noise ratio, how much of a signal do we need for a detection?

Key Parameters for a pulsar observation

Pulsar Target:

- *S_{psr}: Strength of the radio signal from the pulsar in Janskys (Watts per m^2 per Hz)*
- **P: Pulse Period in seconds**
- **W: Pulse width in seconds**

Telescope:

- *T_{sys}: System temperature, a measure of the background noise level of the telescope in degrees Kelvin (K)*
- *Gain: proportional to the size (collecting area) of the telescope dish and the performance of the amplifier (K per Jansky)*
- *n_{pol}: Number of polarisations observed (generally 2)*
- *B_w: Bandwidth of the receiver in MHz*

Variable parameters:

- *T_{int}: Integration time or duration of the observation in seconds*
- *S/N: Signal to Noise ratio, how much of a signal do we need for a detection?*

Integration Time Calculation

- **The observing time required to achieve a specific Signal to Noise ratio can be calculated using the radiometer equation (Dicke 1946).**
- **As we do not receive radio emissions for the whole of the pulsar period a duty cycle correction, $\sqrt{(W/(P-W))}$, is used to adapt the basic radiometer equation for pulsar observations**
- ***Ignoring the effects of Radio Frequency Interference (RFI) on the noise floor (Tsys).***

$$T_{int} = \left(\frac{T_{sys}(S/N)}{G S_{psr} \sqrt{n_{pol} B_w}} \sqrt{\frac{W}{P - W}} \right)^2$$