# reading7

November 16, 2025

[1]:
```
import numpy as np
```

### 0.0.1 a) Calculate the Fried parameter r_0 at 500 nm given seeing of 0.5 arcseconds

### 0.0.2 The relationship between seeing (FWHM) and Fried parameter is:

### 0.0.3 seeing (arcsec) 0.98 * lambda / r_0

[2]:
```
lam = 500e-9                # wavelength 500 nm
FWHM_arcsec = 0.5
FWHM_rad = np.deg2rad(FWHM_arcsec/3600.0)  # convert arcsec to radians
r0 = 0.98 * lam / FWHM_rad
print("Fried parameter r0 at 500 nm: {:.3f} m ({:.1f} cm)".format(r0, r0*100))
```

```
Fried parameter r0 at 500 nm: 0.202 m (20.2 cm)
```

### 0.0.4 b) Calculate r_0 at 1.65 microns using Kolmogorov turbulence scaling

### 0.0.5 For Kolmogorov turbulence: r_0 lambda^(6/5)

### 0.0.6 Therefore: r_0(lambda_2) = r_0(lambda_1) * (lambda_2 / lambda_1)^(6/5)

[3]:
```
lam_ir = 1.65e-6  # wavelength 1.65 microns
r0_ir = r0 * (lam_ir/lam)**(6/5)
print("Fried parameter r0 at 1.65  m: {:.3f} m ({:.1f} cm)".format(r0_ir,␣
 ↪r0_ir*100))
```

```
Fried parameter r0 at 1.65  m: 0.847 m (84.7 cm)
```

### 0.0.7 c) Calculate number of sub-apertures for a 10 m telescope

### 0.0.8 Number of sub-apertures (D / r_0)^2

### 0.0.9 where D is the telescope diameter

[4]:
```
D = 10.0  # telescope diameter in meters
subapertures = (D / r0_ir)**2
print("Number of sub-apertures (approx): {:.0f}".format(subapertures))
```

```
Number of sub-apertures (approx): 139
```