$$\left(S_n^{(1)} - np_1\right) \quad + \left(S_n^{(2)} - np_2\right) \quad + \cdots + \ \left(S_n^{(8)} - np_8\right)$$

$$\left(S_n^{(1)} - np_1\right)^2 + \left(S_n^{(2)} - np_2\right)^2 + \cdots + \left(S_n^{(8)} - np_8\right)^2$$

$$\frac{\left(S_n^{(1)} - np_1\right)^2}{np_1} + \frac{\left(S_n^{(2)} - np_2\right)^2}{np_2} + \cdots + \frac{\left(S_n^{(8)} - np_8\right)^2}{np_8}$$

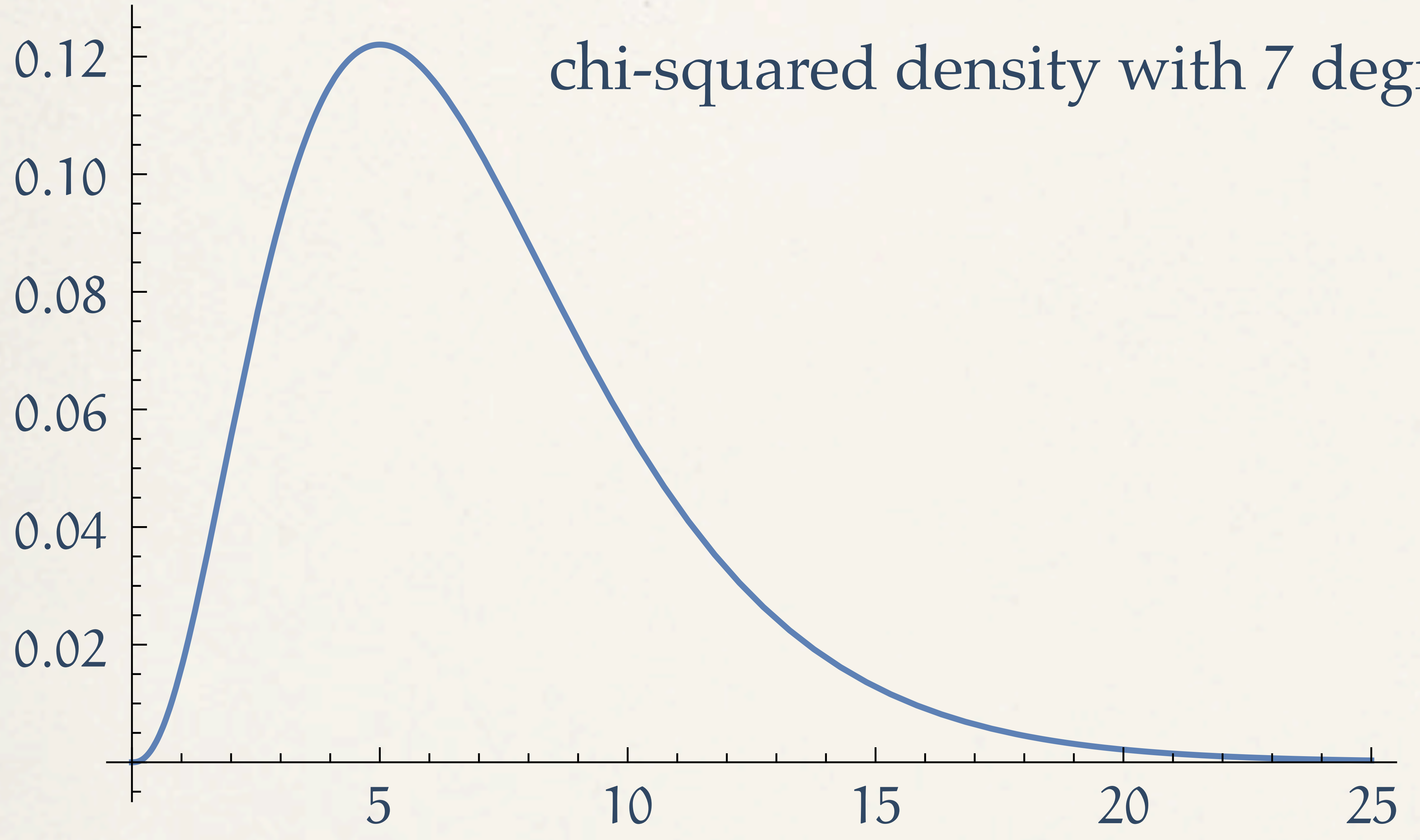
$$\chi^2 = \frac{\left(S_n^{(1)} - np_1\right)^2}{np_1} + \frac{\left(S_n^{(2)} - np_2\right)^2}{np_2} + \cdots + \frac{\left(S_n^{(8)} - np_8\right)^2}{np_8}$$

Karl Pearson's chi-squared test statistic:

$$\chi^2 = \frac{\left(S_n^{(1)} - np_1\right)^2}{np_1} + \frac{\left(S_n^{(2)} - np_2\right)^2}{np_2} + \cdots + \frac{\left(S_n^{(8)} - np_8\right)^2}{np_8}$$

Karl Pearson's chi-squared test statistic:

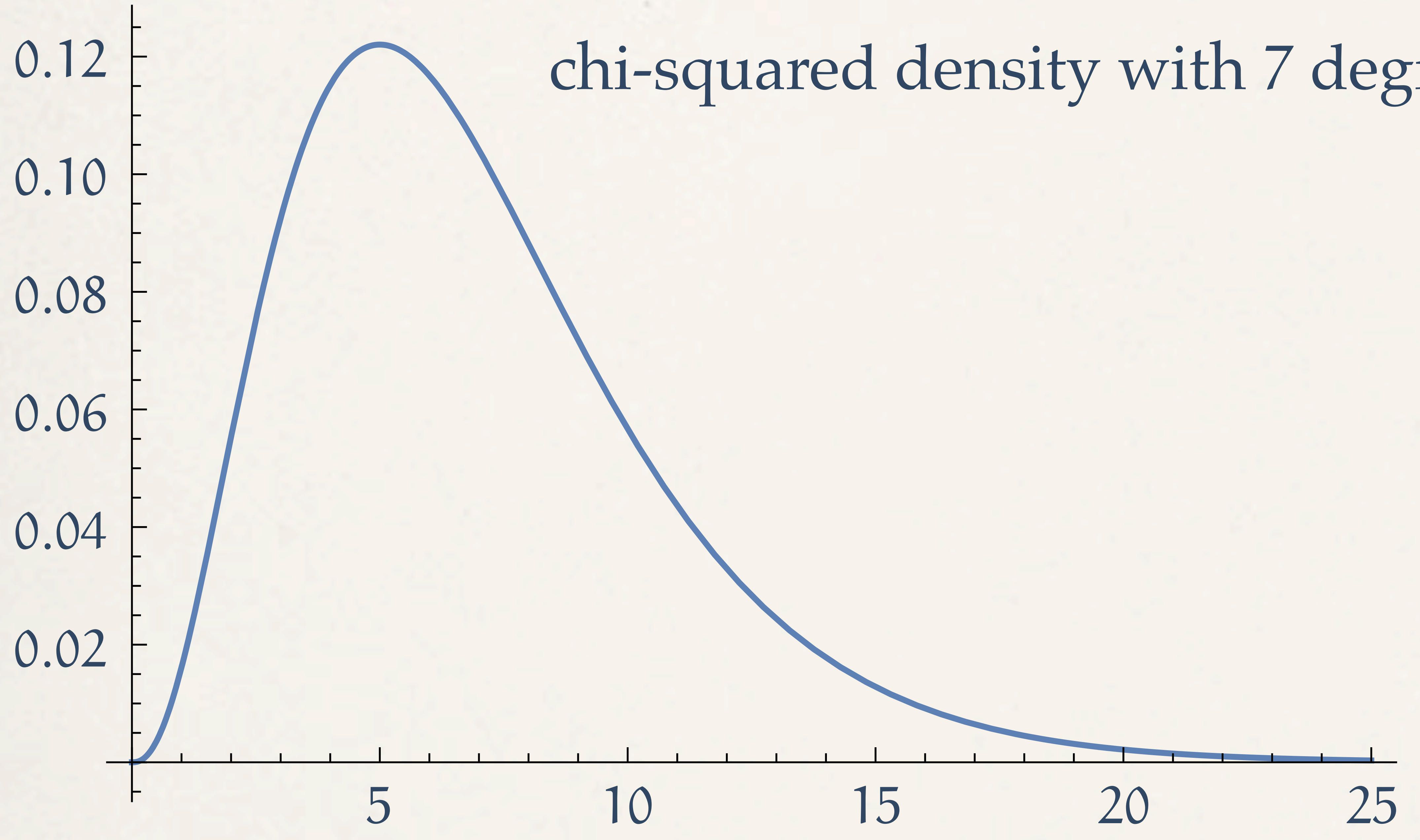
$$\chi^2 = \frac{\left(S_n^{(1)} - np_1\right)^2}{np_1} + \frac{\left(S_n^{(2)} - np_2\right)^2}{np_2} + \cdots + \frac{\left(S_n^{(8)} - np_8\right)^2}{np_8}$$



chi-squared density with 7 degrees of freedom

Karl Pearson's chi-squared test statistic:

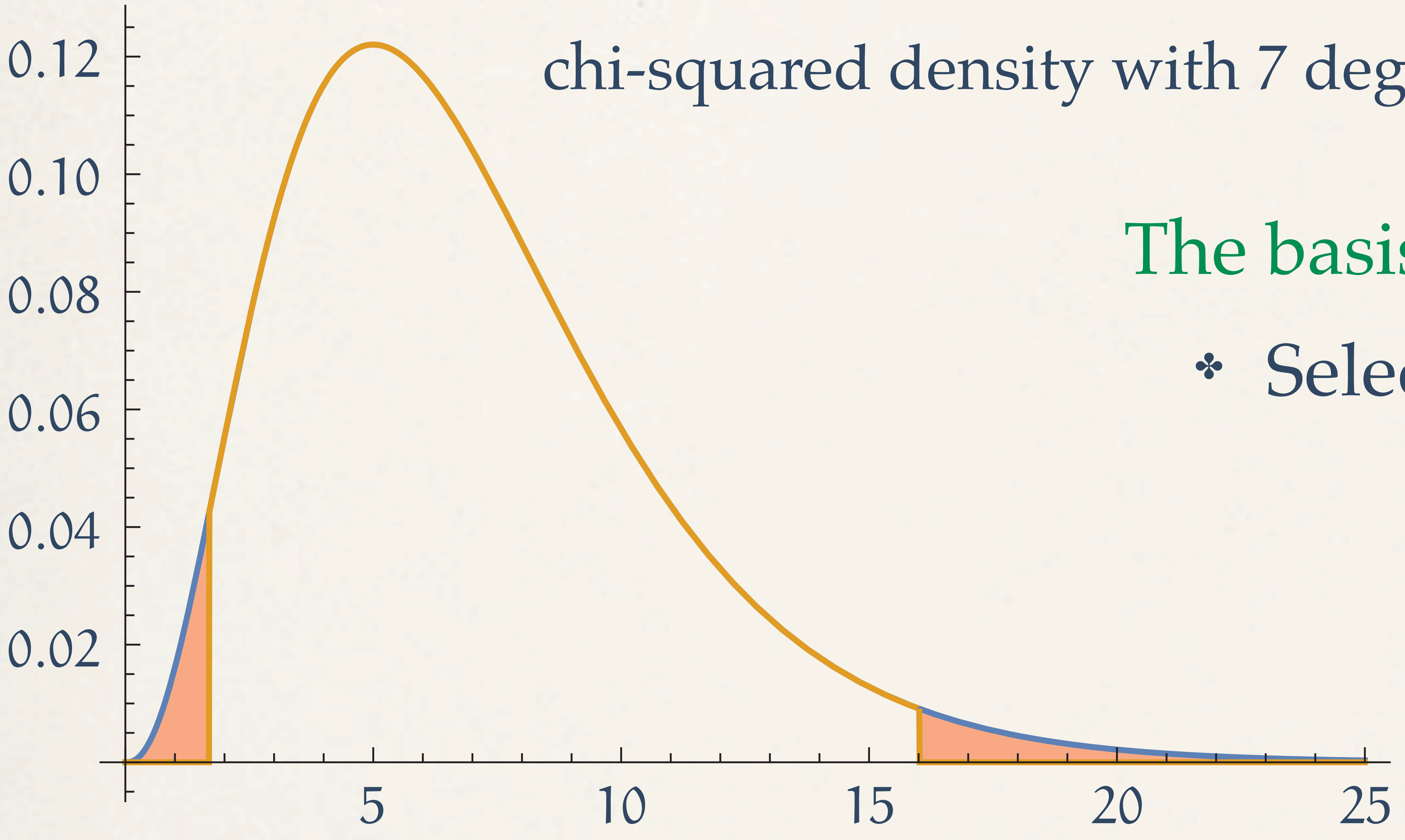
$$\chi^2 = \frac{\left(S_n^{(1)} - np_1\right)^2}{np_1} + \frac{\left(S_n^{(2)} - np_2\right)^2}{np_2} + \cdots + \frac{\left(S_n^{(8)} - np_8\right)^2}{np_8}$$



chi-squared density with 7 degrees of freedom

Karl Pearson's chi-squared test statistic:

$$\chi^2 = \frac{\left(S_n^{(1)} - np_1\right)^2}{np_1} + \frac{\left(S_n^{(2)} - np_2\right)^2}{np_2} + \cdots + \frac{\left(S_n^{(8)} - np_8\right)^2}{np_8}$$

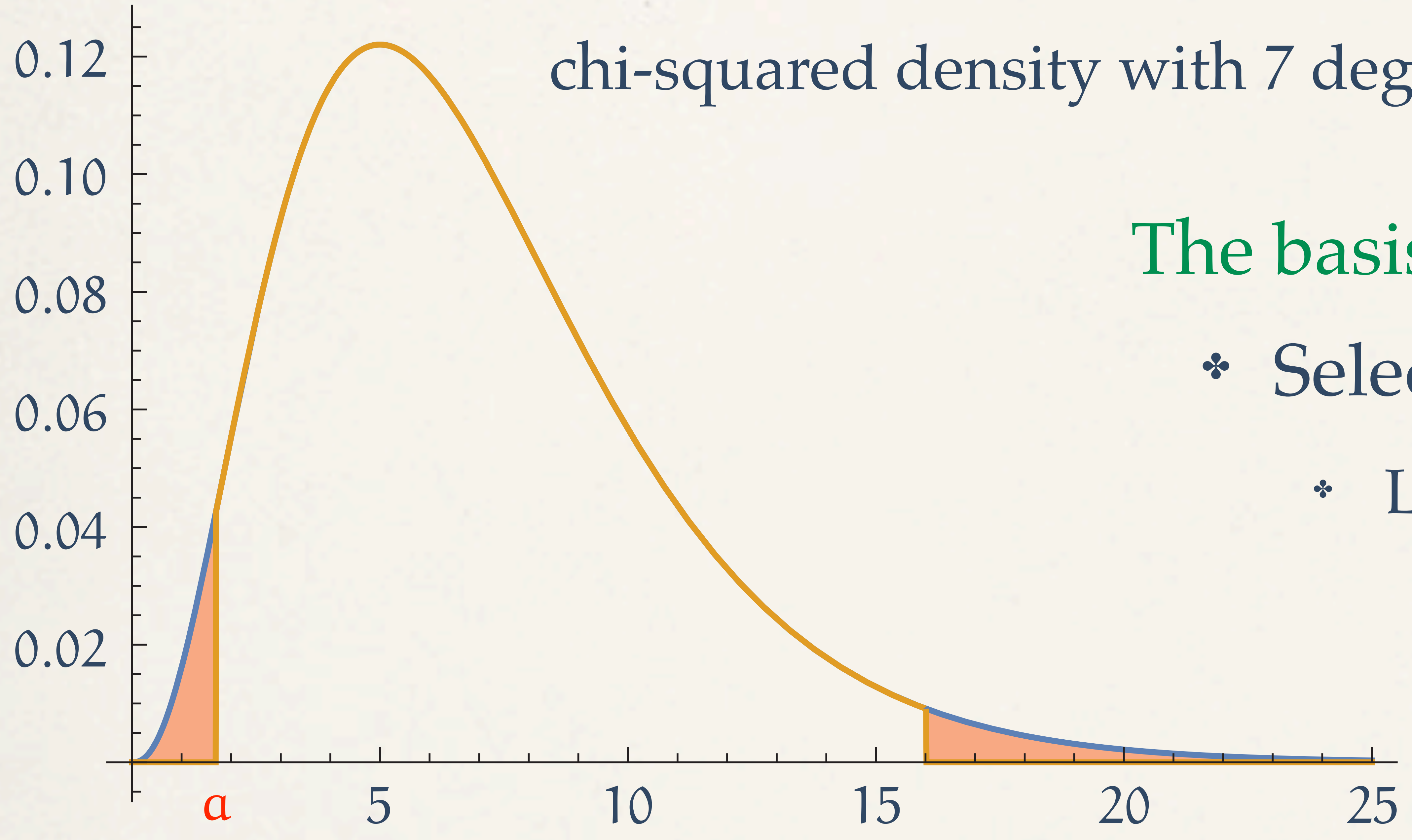


The basis of a statistical test:

- Select a 95% confidence interval: $\mathbf{P}\{a < \chi^2 < b\} = 0.95$.

Karl Pearson's chi-squared test statistic:

$$\chi^2 = \frac{\left(S_n^{(1)} - np_1\right)^2}{np_1} + \frac{\left(S_n^{(2)} - np_2\right)^2}{np_2} + \cdots + \frac{\left(S_n^{(8)} - np_8\right)^2}{np_8}$$

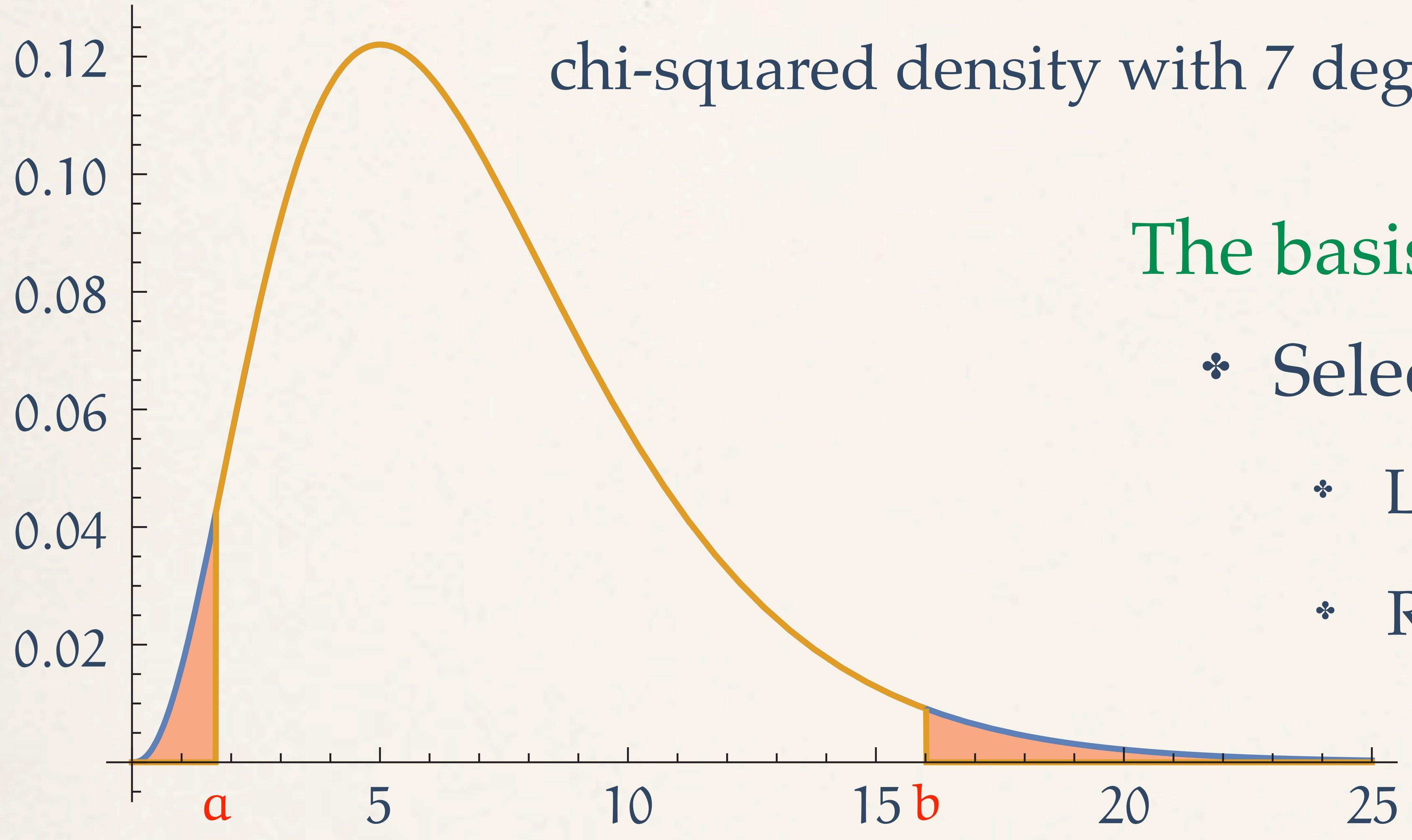


The basis of a statistical test:

- Select a 95% confidence interval: $\mathbf{P}\{a < \chi^2 < b\} = 0.95$.
  - Left quantile $a = 1.69$: $\mathbf{P}\{\chi^2 \le a\} = 0.025$.

Karl Pearson's chi-squared test statistic:

$$\chi^2 = \frac{\left(S_n^{(1)} - np_1\right)^2}{np_1} + \frac{\left(S_n^{(2)} - np_2\right)^2}{np_2} + \cdots + \frac{\left(S_n^{(8)} - np_8\right)^2}{np_8}$$

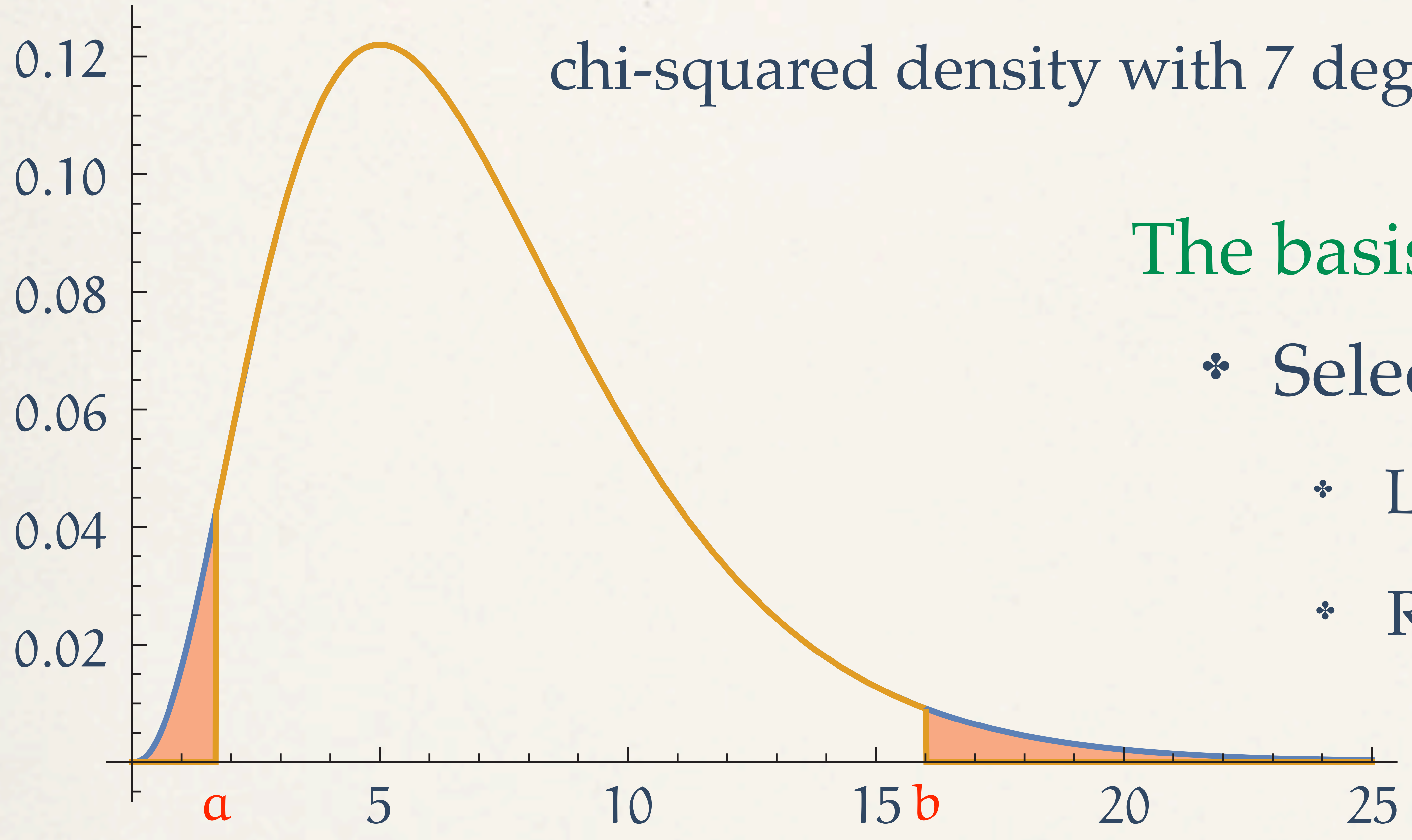


The basis of a statistical test:

- Select a 95% confidence interval: $\mathbf{P}\{a < \chi^2 < b\} = 0.95$.
  - Left quantile $a = 1.69$: $\mathbf{P}\{\chi^2 \leq a\} = 0.025$.
  - Right quantile $b = 17.01$: $\mathbf{P}\{\chi^2 \geq b\} = 0.025$.

Karl Pearson's chi-squared test statistic:

$$\chi^2 = \frac{\left(S_n^{(1)} - np_1\right)^2}{np_1} + \frac{\left(S_n^{(2)} - np_2\right)^2}{np_2} + \cdots + \frac{\left(S_n^{(8)} - np_8\right)^2}{np_8}$$

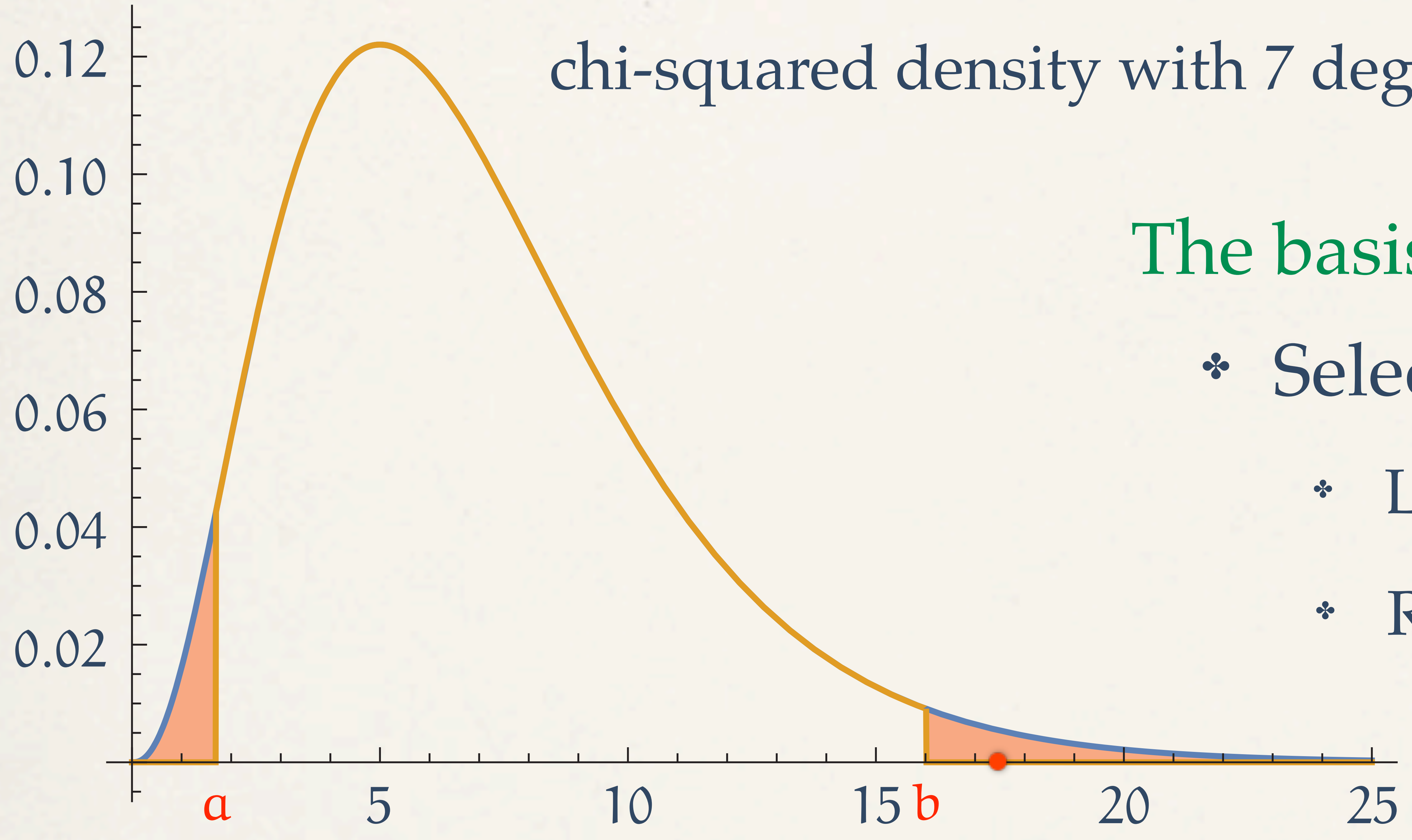


The basis of a statistical test:

- Select a 95% confidence interval: $\mathbf{P}\{a < \chi^2 < b\} = 0.95$.
  - Left quantile $a = 1.69$: $\mathbf{P}\{\chi^2 \le a\} = 0.025$.
  - Right quantile $b = 17.01$: $\mathbf{P}\{\chi^2 \ge b\} = 0.025$.
- Rejection criteria:

Karl Pearson's chi-squared test statistic:

$$\chi^2 = \frac{\left(S_n^{(1)} - np_1\right)^2}{np_1} + \frac{\left(S_n^{(2)} - np_2\right)^2}{np_2} + \cdots + \frac{\left(S_n^{(8)} - np_8\right)^2}{np_8}$$



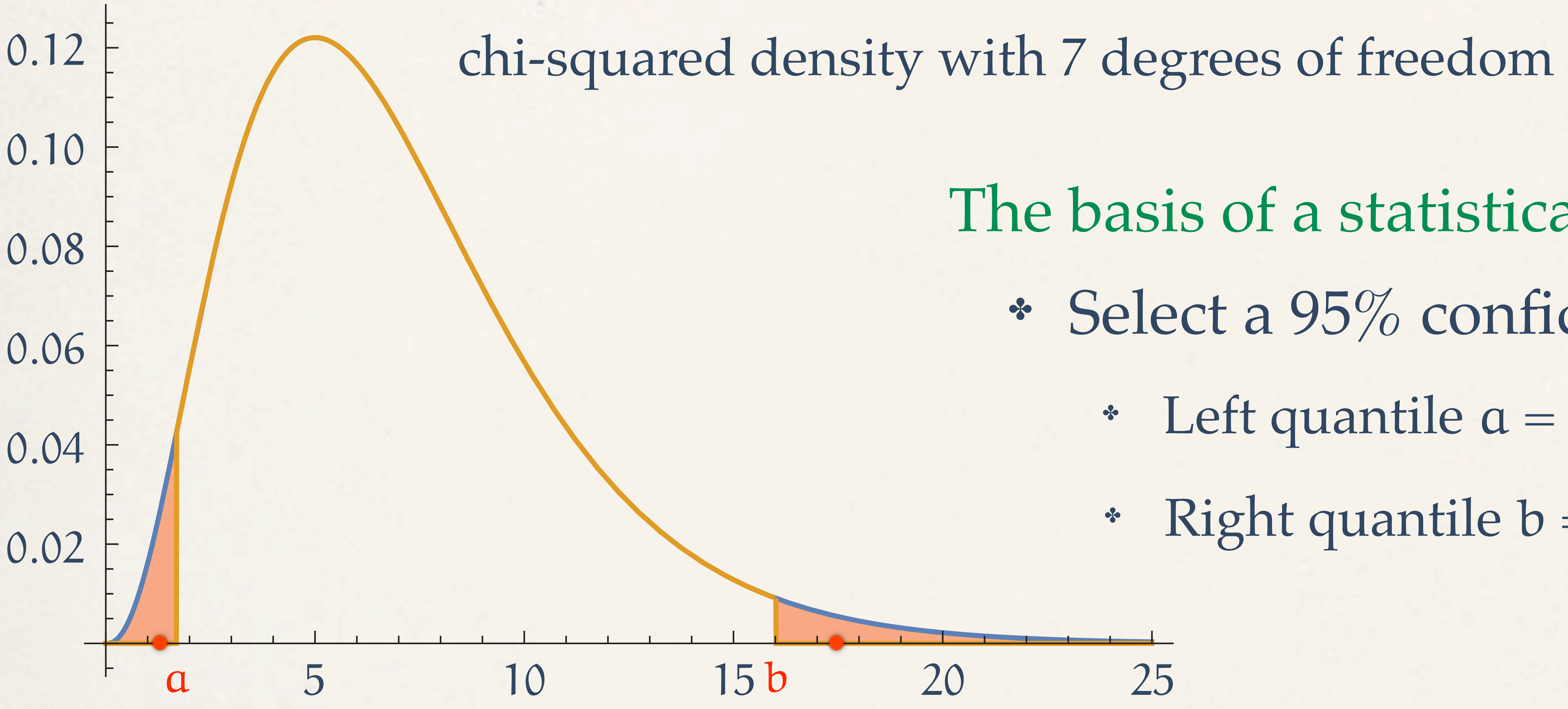
The basis of a statistical test:

- Select a 95% confidence interval: $\mathbf{P}\{a < \chi^2 < b\} = 0.95$.
  - Left quantile $a = 1.69$: $\mathbf{P}\{\chi^2 \le a\} = 0.025$.
  - Right quantile $b = 17.01$: $\mathbf{P}\{\chi^2 \ge b\} = 0.025$.

- Rejection criteria:
  - If $\chi^2 \ge 17.01$, reject on grounds of excessive irregularity.

Karl Pearson's chi-squared test statistic:

$$\chi^2 = \frac{\left(S_n^{(1)} - np_1\right)^2}{np_1} + \frac{\left(S_n^{(2)} - np_2\right)^2}{np_2} + \cdots + \frac{\left(S_n^{(8)} - np_8\right)^2}{np_8}$$



The basis of a statistical test:

- Select a 95% confidence interval: $\mathbf{P}\{a < \chi^2 < b\} = 0.95$.
  - Left quantile $a = 1.69$: $\mathbf{P}\{\chi^2 \leq a\} = 0.025$.
  - Right quantile $b = 17.01$: $\mathbf{P}\{\chi^2 \geq b\} = 0.025$.
- Rejection criteria:
  - If $\chi^2 \geq 17.01$, reject on grounds of excessive irregularity.
  - If $\chi^2 \leq 1.69$, reject on grounds of a too suspicious regularity!