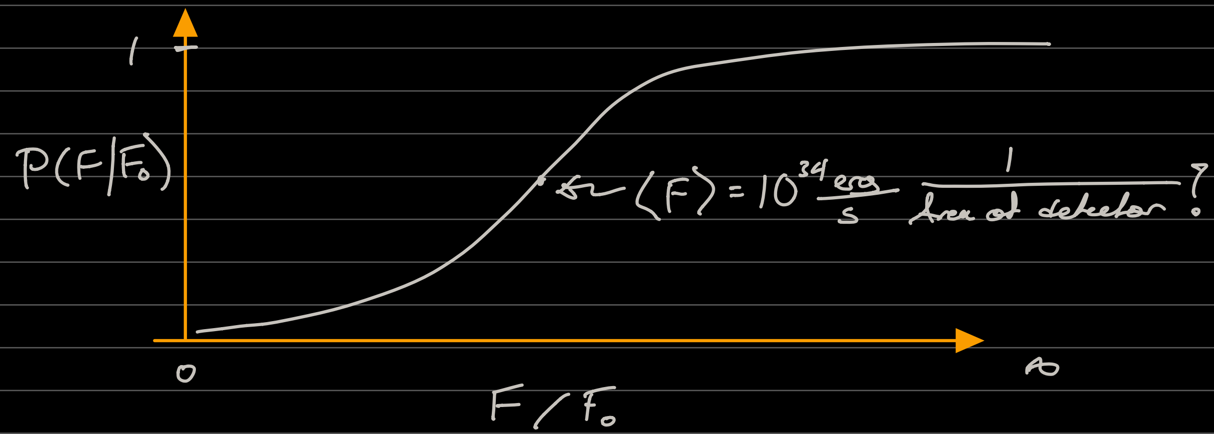
Question:

I have a full-sky map for LAT average ? flux. What is the probability distribution $\mathbb{P}(F|F_0)$ that an object with flux F (ergs/cm^2/s) will be observed against a background flux of F_0?



Say the probability of detection is the probability that the number of photons from F is $\geq \beta$ that from F_0.

$$P(k \text{ events in time } t) = \frac{(rt)^k e^{-rt}}{k!} = f(k) \quad , \quad r = \frac{F}{\hbar\omega}$$

$$P_\omega = \sum_k P(\geq \beta k) P_0(k) = \int_0^\infty P(\geq \beta k) P_0(k)\, dk$$

$$= \int_0^\infty \left(\int_{\beta k}^\infty f(k')\, dk' \right) f_0(k)\, dk$$

$u \qquad\qquad dv$

$$du = -\beta f(k) dk \ , \quad v = \int_0^k f_0(k) dk' =$$

$$P_\omega = -\int_0^\infty \int_0^k f_0(k') dk' (-\beta f(k)) dk = -\beta \int_0^\infty \left(\int_0^k f_0(k') dk' \right) f(k)\, dk$$

$$= -\beta \int_0^\infty \left(1 - \int_k^\infty f_0(k') dk' \right) f(k) dk$$

$$= -\beta \int_0^\infty f(k) dk + \beta \int_0^\infty \left(\int_k^\infty f_0(k') dk' \right) f(k) dk$$

$$P_\omega = -\beta + \beta \int_0^\infty \left(\int_k^\infty f_0(k') dk' \right) f(k) dk \qquad f_0 \mapsto f = r \to r_0$$

$$\mathbb{P}(F|F_0) = \int_{0.1\,\text{GeV}}^{100\,\text{GeV}} P_{\omega'}(F/F_0)\, P(\omega = \omega')\, d\omega'$$

← Power law from some paper I saw earlier.