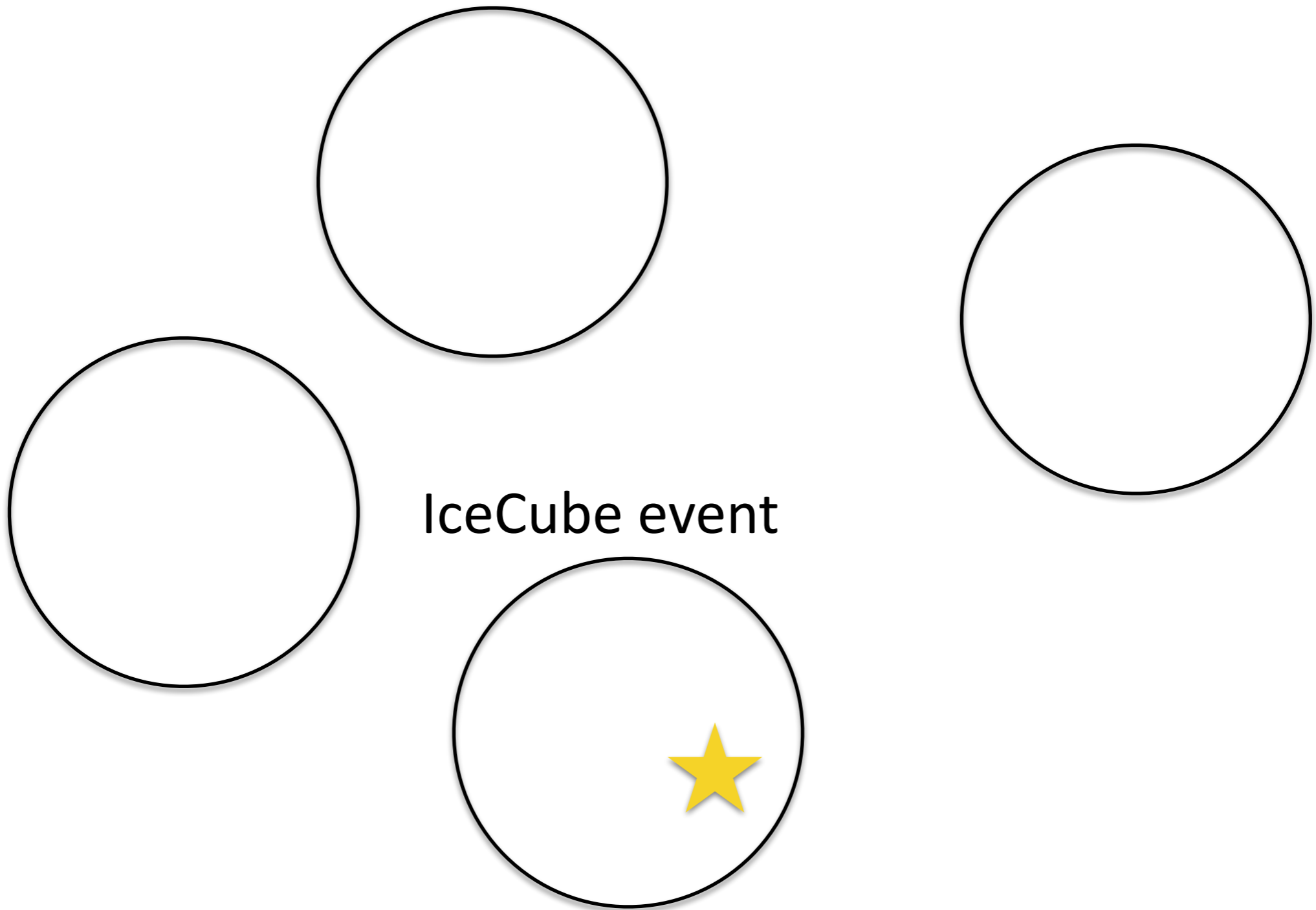
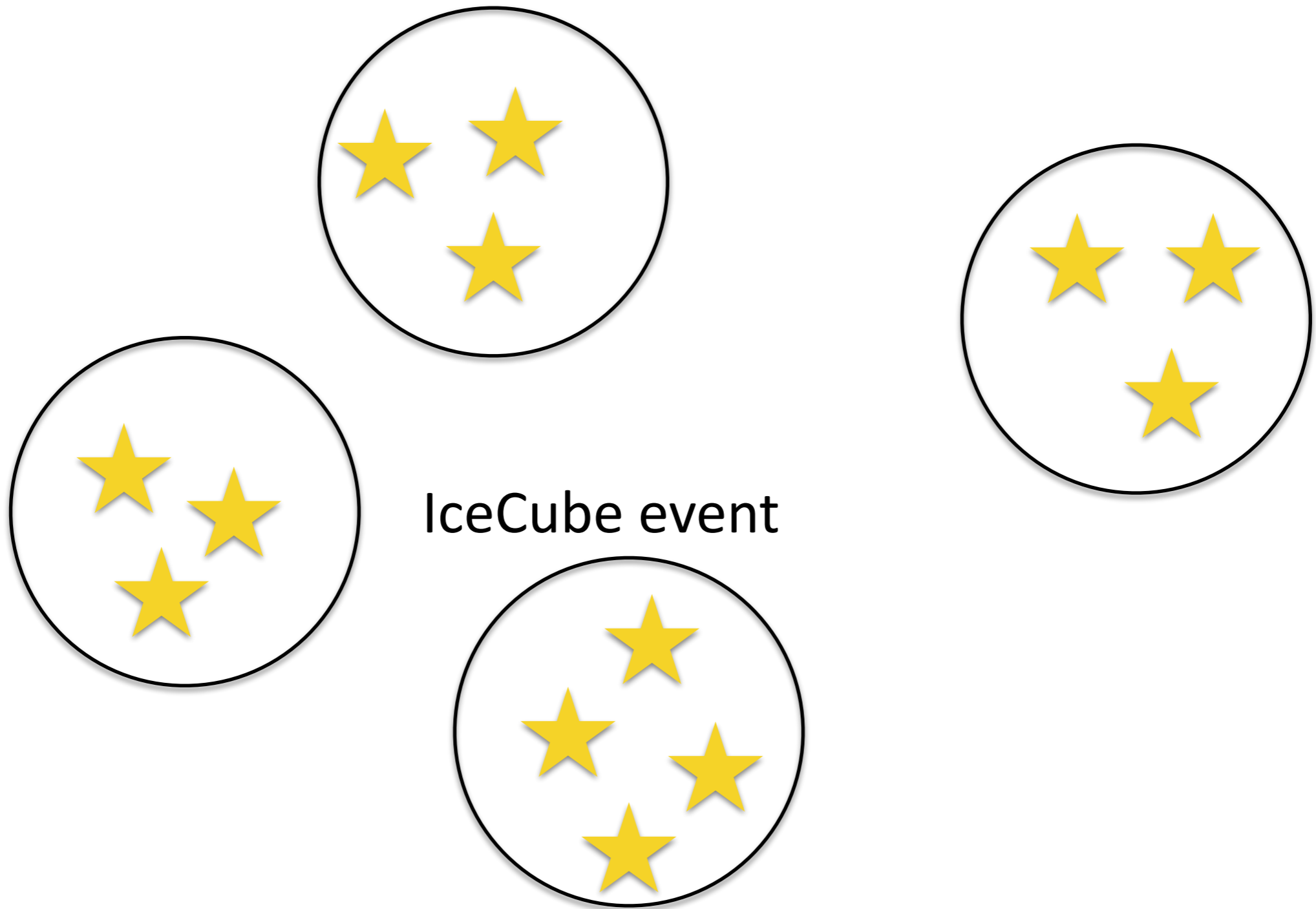


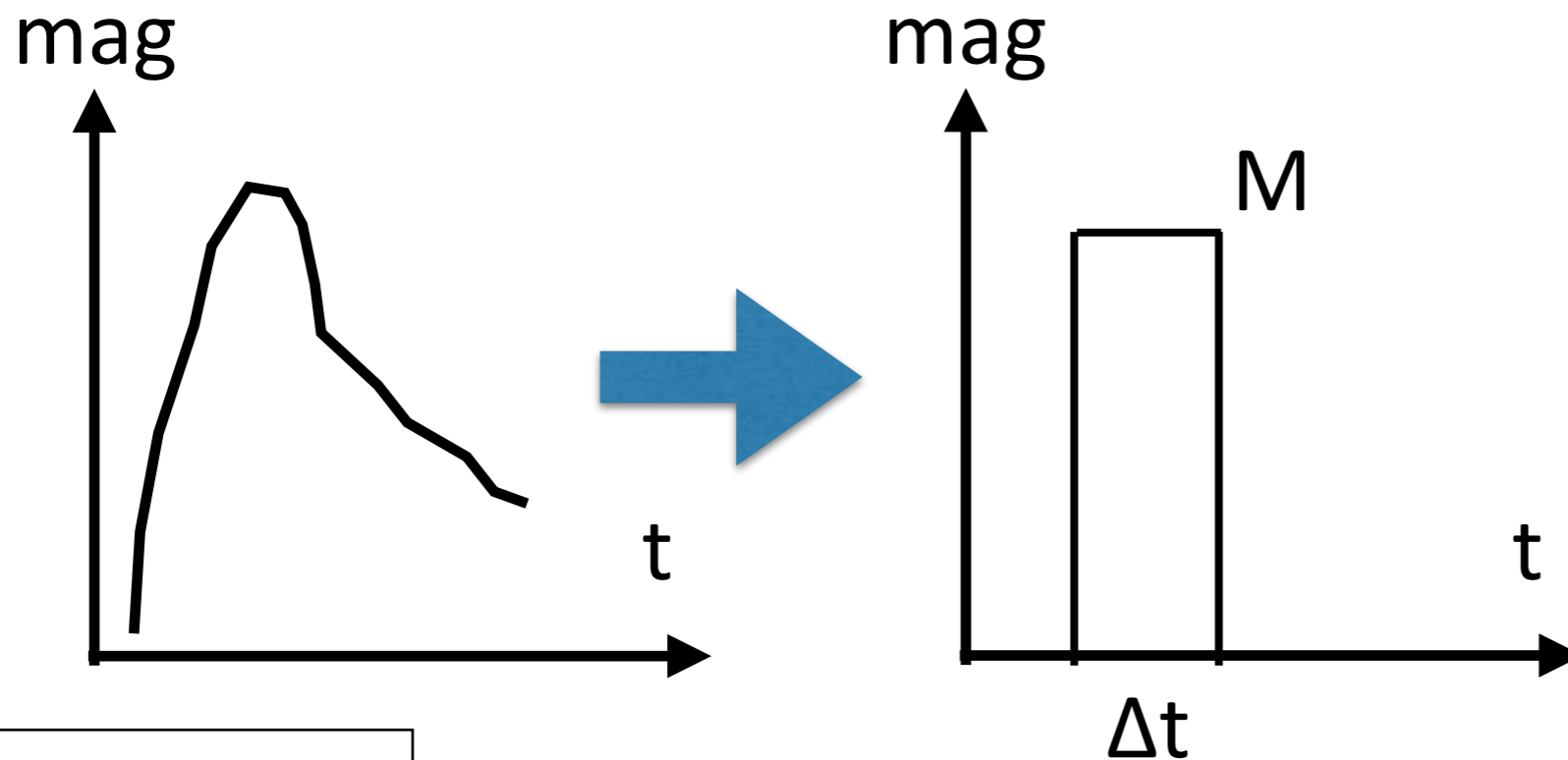
Q. How many transients in 1 deg^2 ?



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Optical 20 mag survey (1m telescope)

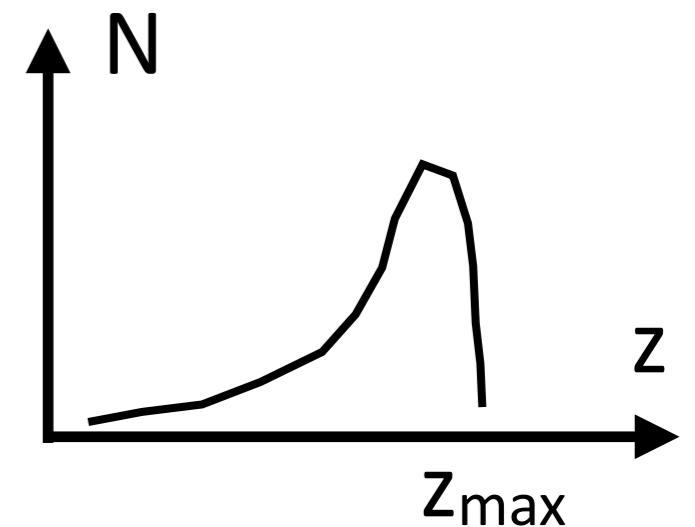


Type Ia SN

$\Delta t \sim 20$ days, $M_{\text{abs}} = -19$ mag (10^{43} erg s^{-1})

$\Rightarrow d_{\text{max}} \sim 800$ Mpc ($z_{\text{max}} \sim 0.18$)

$$N \sim R V \Delta t f_{\Omega} \sim (0.3 \times 10^{-4} \text{ Mpc}^{-3} \text{ yr}^{-1}) \times (4\pi/3) (800 \text{ Mpc})^3 \\ \times (0.05 \text{ yr}) \times (1 \text{ deg}^2/40,000) \\ \sim 0.1$$



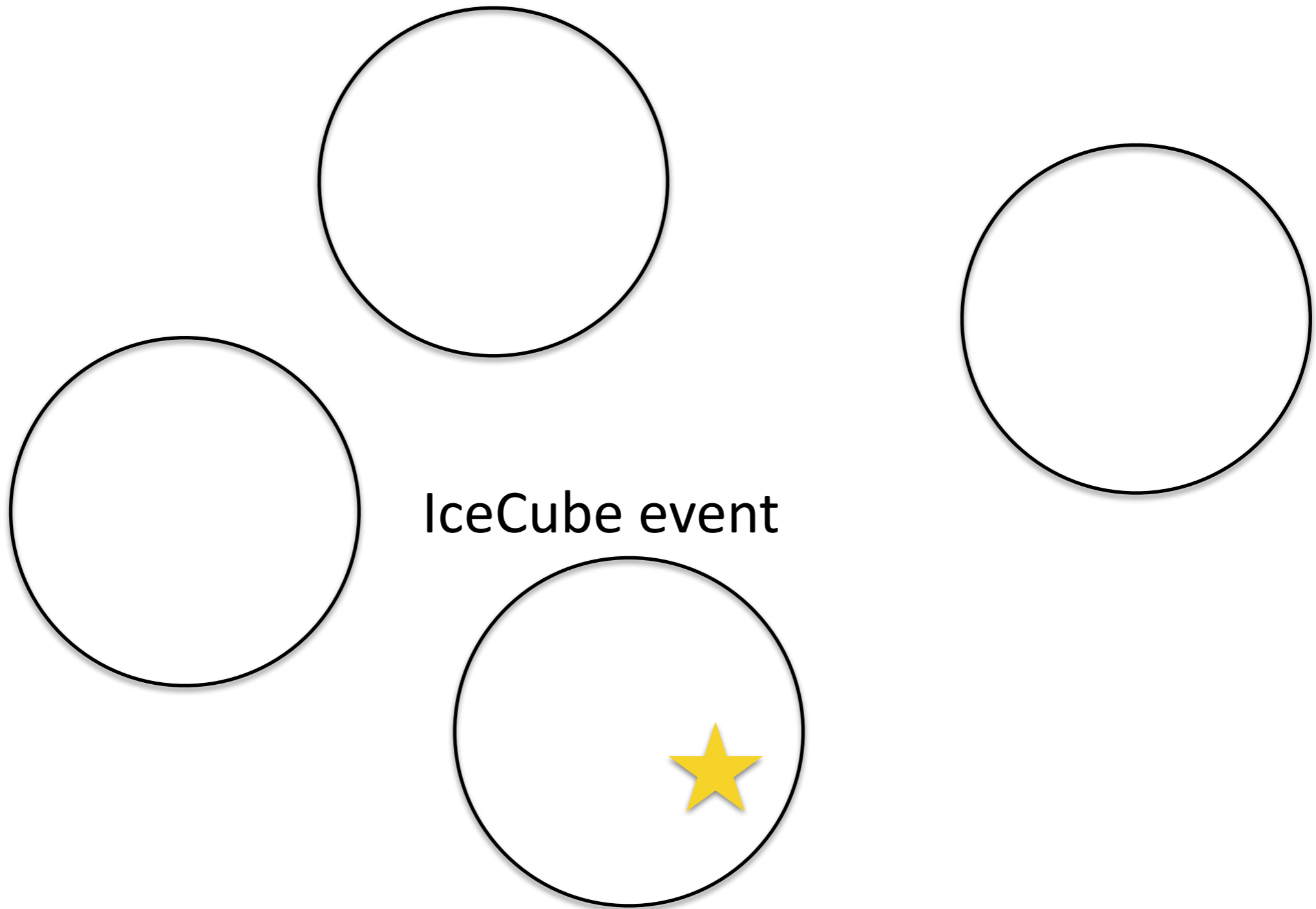
Optical 20 mag survey (1m telescope)

$$N \sim RV \Delta t f_{\Omega} \sim 5 \times 10^{-4} \left(\frac{R}{10^{-4} \text{ Mpc}^{-3} \text{ yr}^{-1}} \right) \left(\frac{d}{100 \text{ Mpc}} \right)^3 \left(\frac{\Delta t}{20 \text{ days}} \right) \left(\frac{\Omega}{1 \text{ deg}^2} \right)$$

| Type | Mabs | Δt | R (Mpc ⁻³ yr ⁻¹) | d _{max} (Mpc) | Z _{max} | N (deg ⁻²) |
|------------------------|------|------------|--|---------------------------|------------------|------------------------|
| Ia | -19 | 20 | 0.3 x 10 ⁻⁴ | 800 | 0.17 | 0.1 |
| Type II (H-rich) | -17 | 50 | 0.7 x 10 ⁻⁴ | 300 | 0.07 | 0.02 |
| Type Ibc (H-free) | -17 | 20 | 0.2 x 10 ⁻⁴ | 300 | 0.07 | 0.002 |
| Type IIn (CSM rich) | -19 | 50 | 0.1 x 10 ⁻⁴ | 800 | 0.17 | 0.05 |
| Hypernova | -18 | 20 | 0.01 x 10 ⁻⁴ | 400 | 0.09 | 0.0005 |

Optical 20 mag survey (1m telescope)

For core-collapse SNe: $z \sim 0.1$



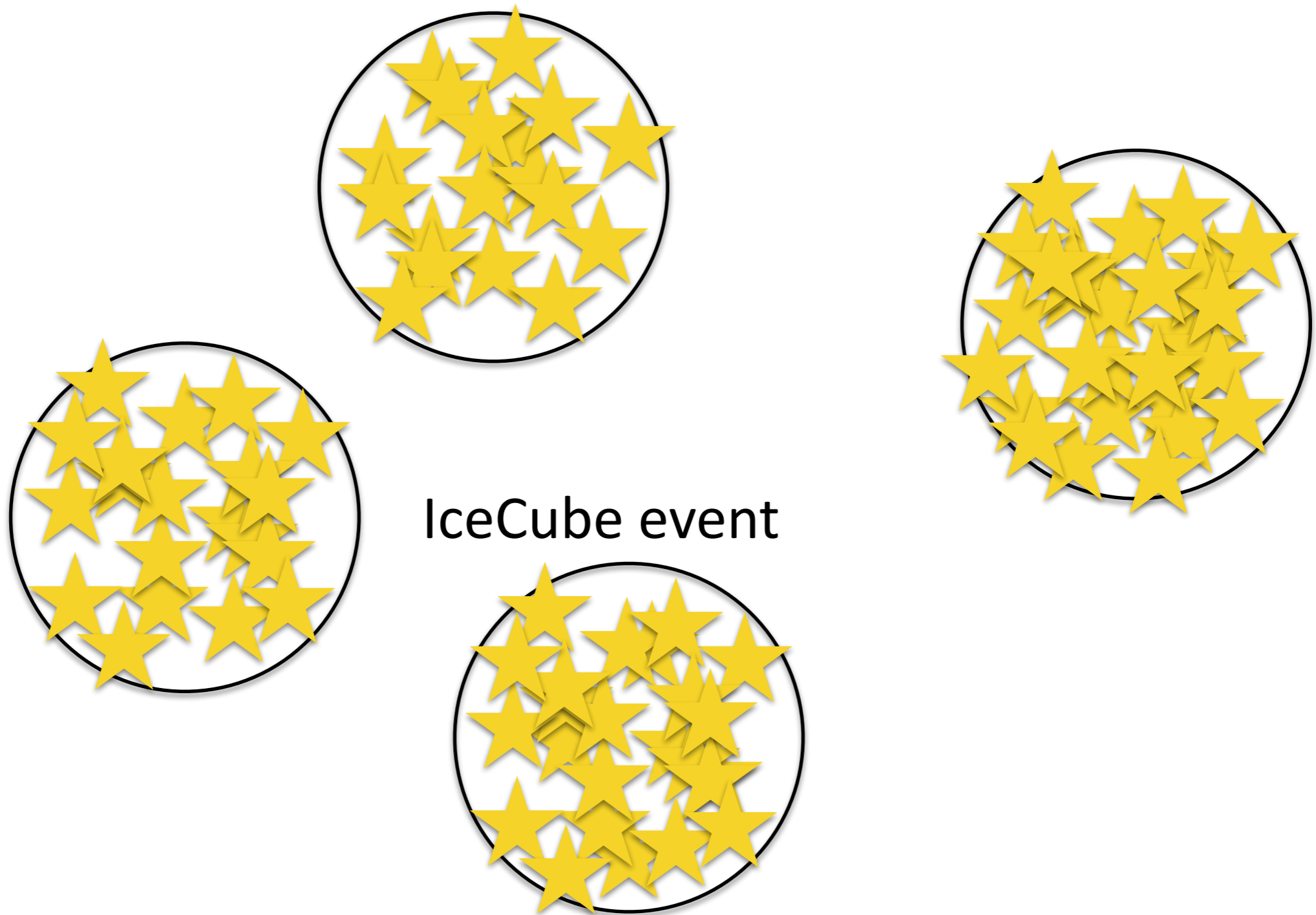
Optical 25 mag survey (8m telescope)

$$N \sim RV \Delta t f_{\Omega} \sim 5 \times 10^{-4} \left(\frac{R}{10^{-4} \text{ Mpc}^{-3} \text{ yr}^{-1}} \right) \left(\frac{d}{100 \text{ Mpc}} \right)^3 \left(\frac{\Delta t}{20 \text{ days}} \right) \left(\frac{\Omega}{1 \text{ deg}^2} \right)$$

| Type | Mabs | Δt | R (Mpc ⁻³ yr ⁻¹) | d _{max} (Mpc) | Z _{max} | N (deg ⁻²) |
|------------------------|------|------------|--|---------------------------|------------------|------------------------|
| Ia | -19 | 20 | 0.3 x 10 ⁻⁴ | 7000 | 1 | 50 |
| Type II (H-rich) | -17 | 50 | 0.7 x 10 ⁻⁴ | 2000 | 0.4 | 10 |
| Type Ibc (H-free) | -17 | 20 | 0.2 x 10 ⁻⁴ | 2000 | 0.4 | 1 |
| Type IIn (CSM rich) | -19 | 50 | 0.1 x 10 ⁻⁴ | 7000 | 1 | 20 |
| Hypernova | -18 | 20 | 0.01 x 10 ⁻⁴ | 4000 | 0.7 | 0.3 |

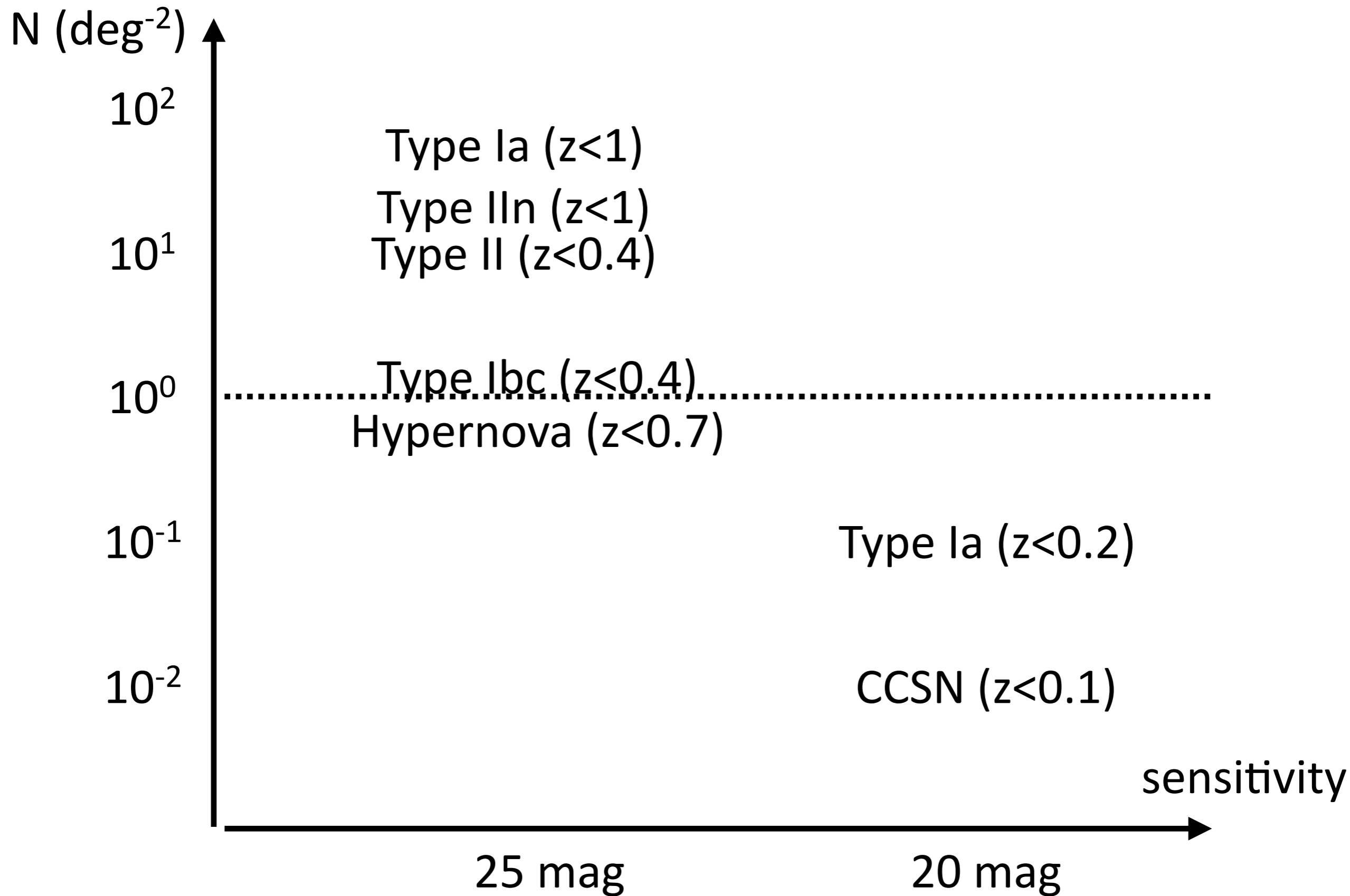
Optical 25 mag survey (8m telescope)

For core-collapse SNe: $z \sim 0.5$



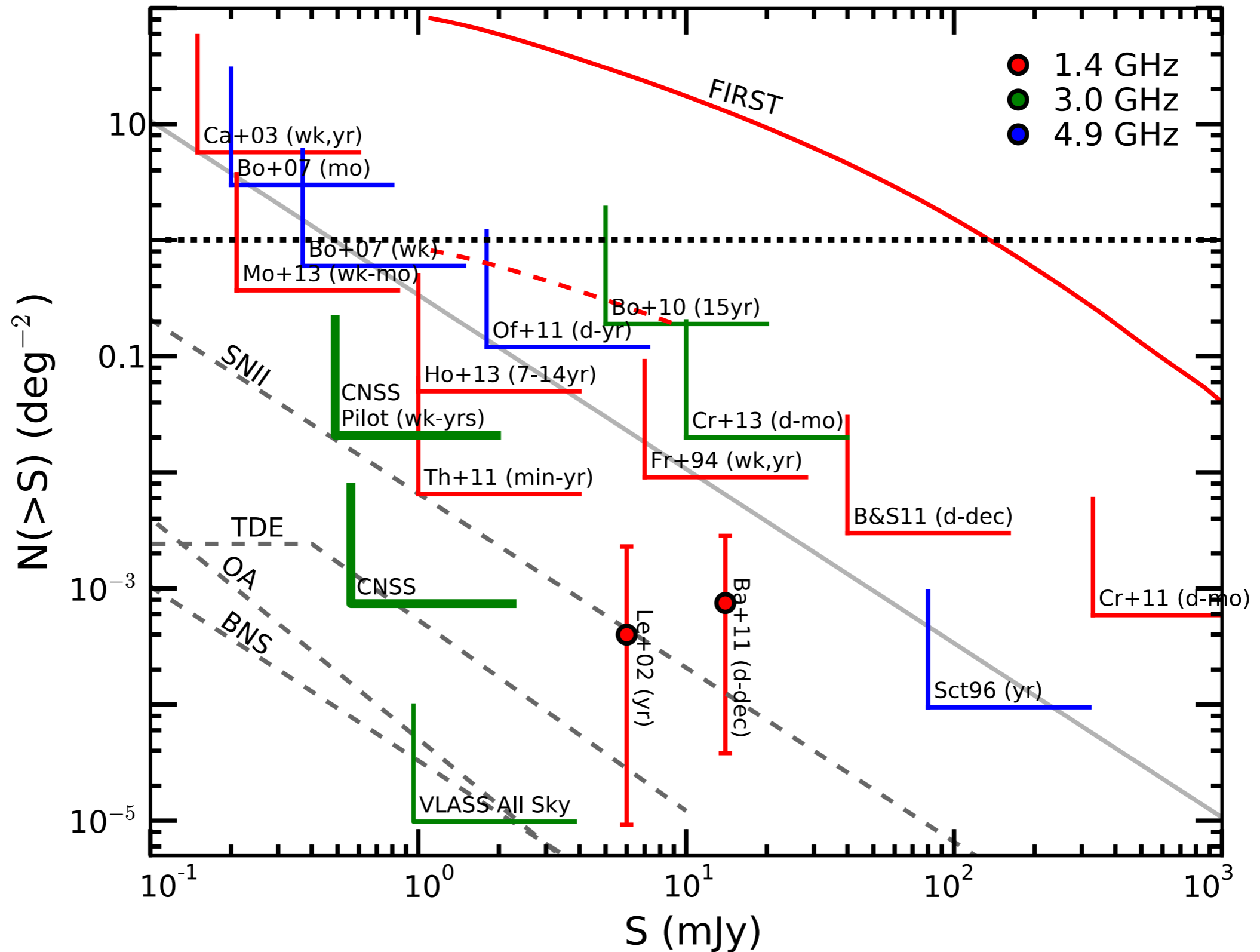
SN Typing is not easy only by images (needs color, spectrum)

Optical (transient)



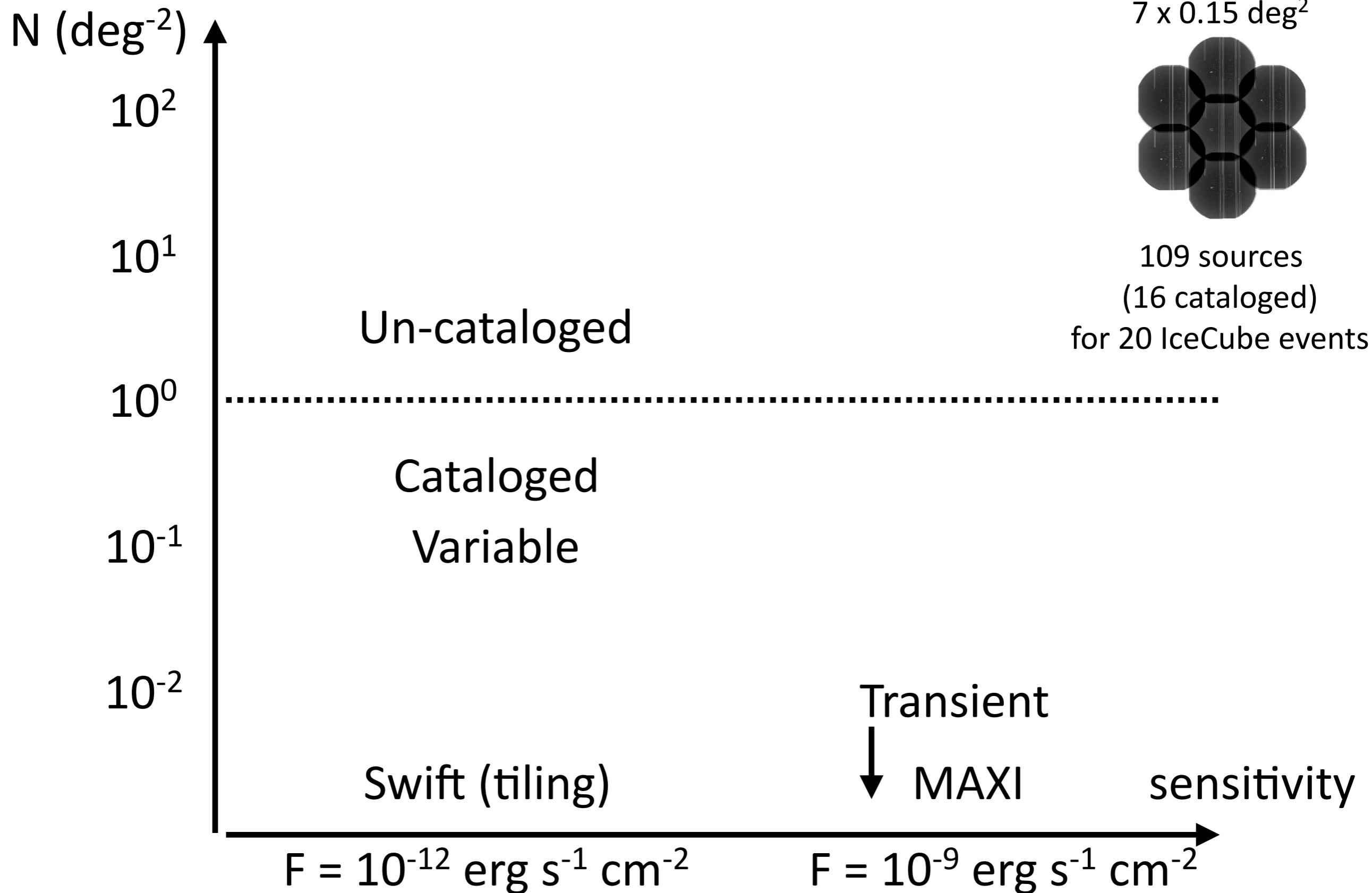
Radio (transient)

~ 5 flat spectrum source
(persistent)



X-ray (persistent + transient)

Sakamoto-san's talk
Serino-san's talk



High-E gamma-ray (persistent)

Tanaka-san's talk

3FGL: ~3000 sources

N (deg⁻²)

10²

10¹

10⁰

10⁻¹

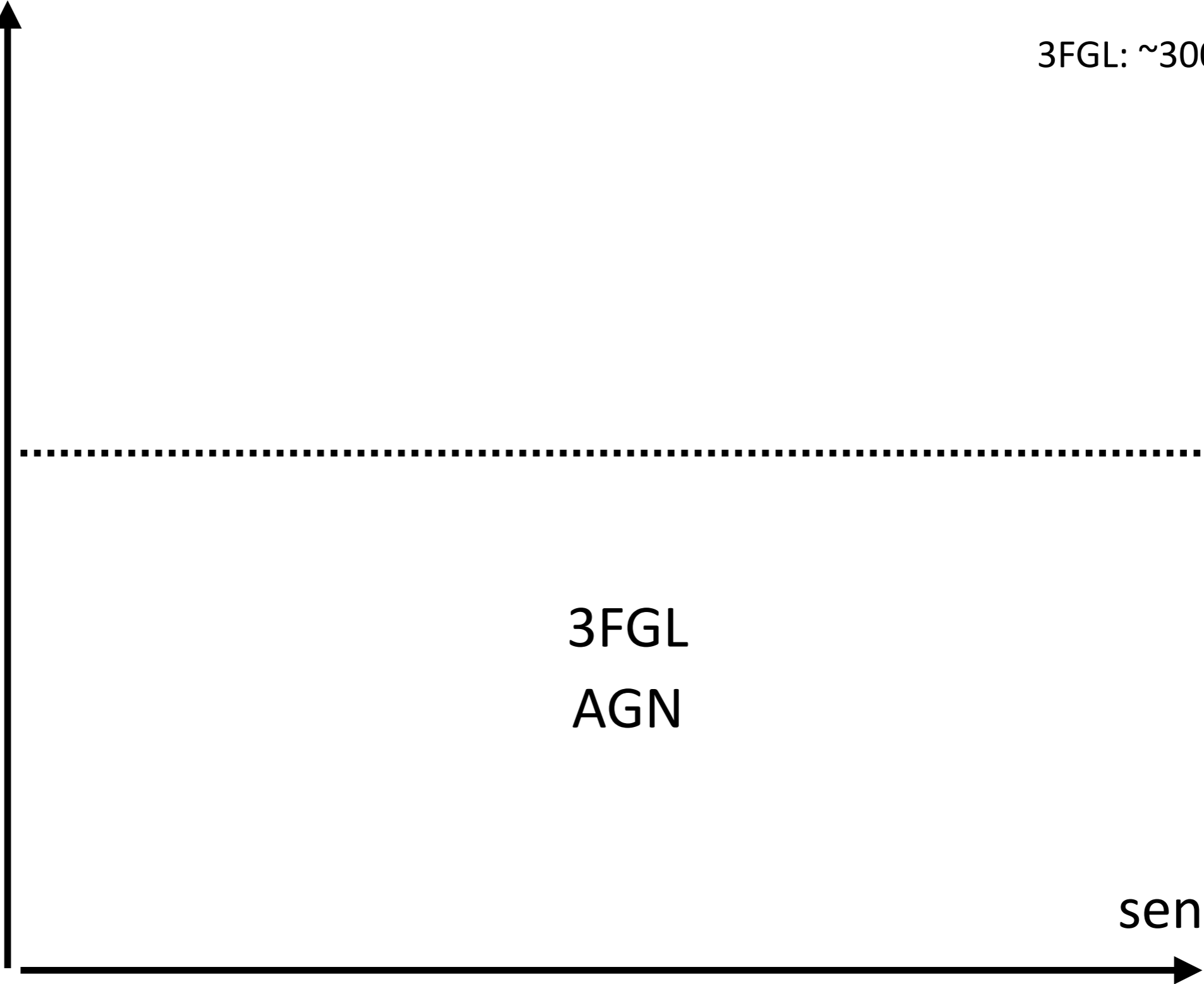
10⁻²

3FGL

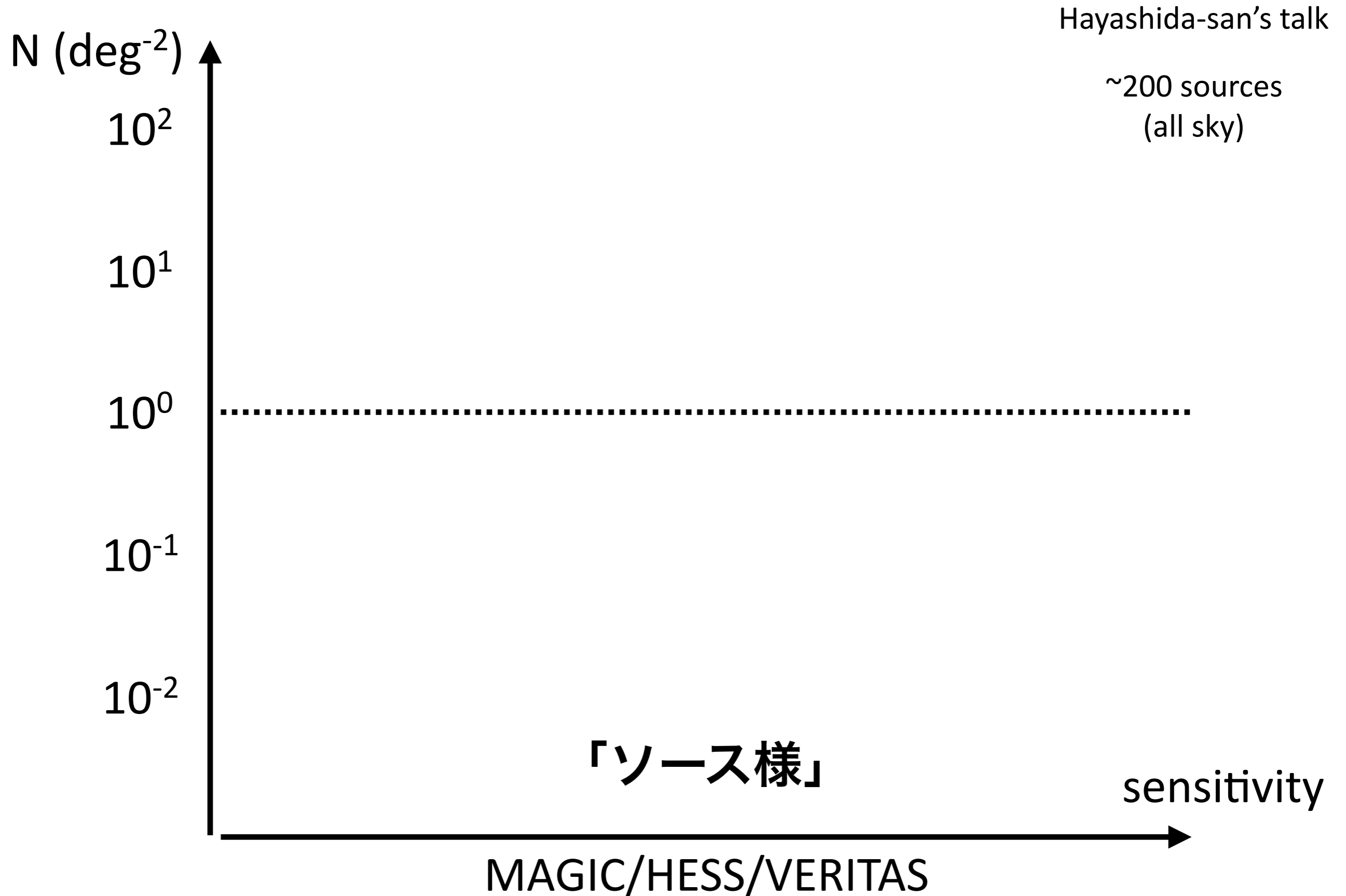
AGN

sensitivity

Fermi/LAT



Very high-E gamma-ray (persistent)



Discussion

- Contamination strongly depends on sensitivity
 - Source luminosity
 - Distance
- Radio/X-ray/Gamma-ray transient
 - $< 1 \text{ deg}^{-2}$ @ current sensitivity
- Optical transient
 - $\sim 0.1 \text{ deg}^{-2}$ @ 20 mag (core-collapse SN, $z < 0.1$)
 - $\sim 50 \text{ deg}^{-2}$ @ 25 mag (core-collapse SN, $z < 0.4$)
 - $\Rightarrow 0.1 \text{ deg}$ localization is desired