# Swift Supernovae – Desirable Characteristics

(These are ideal conditions, so an interesting SN might not need to meet all of these criteria, but these are things to keep in mind. This is not a complete list--we are still learning and optimizing our observations.)

**Nearby: [ z<0.01 (~50 Mpc, 3000 km/s)]** Nearby SNe are better detected by UVOT and more likely to be detected by XRT. Since SNe Ia are brighter and young SNe II are blue, we can go farther than this, but this is a pretty good limit to give good detections in all 6 filters in a typical 2,000 second exposure within a week of maximum.

**Young: [pre-max]** For both the X-ray detection and well sampling the uv/optical peak, the SNe need to be young. This can be determined through evidence of rising, a recent non-detection, or some sort of photometric or spectroscopic typing. The UV peaks a few days before the optical, so SNe have to be several days before maximum in the optical.

**Good location: [>8" from nucleus/stars]** To maximize the science output, targets should be well suited for observation by the UVOT. The brightness is mostly covered by the distance criterion, but in order to have good photometry, the SN should be located at least 8" from the core of the galaxy or any field stars. We might be able to get deep images after the SN has faded for image subtraction, but especially for SNe observed late in the mission, late time imaging may not be possible. There are other constraints as well such as no bright V<6ish stars within 20' and no V<9ish stars within 2' of the SN.

**Low extinction: [A_v<0.5]** Extinction (host or galactic) affects the UV (which is already a couple magnitudes fainter) even more than the optical. The limit here is kind of arbitrary, but A_v=1 extinction corresponds to A_uvw1=2.3 and A_uvw2=2.8. The UVM2 filter sits on the interstellar extinction bump, and is harder to detect even for small extinction. This is a very arbitrary criteria, especially since studying extinction is something very interesting we can study with UVOT. But the general idea is that high extinction needs to be limited to one source, ie if the galactic extinction is high then the SN needs to be well separated from the host where extinction would be lower.

**Low GRB impact: [GRB angle>60 preferably more, Sun angle>90 ]** To limit the impact on Swift's GRB studies (or rather so that our studies are less impacted) the SNe should be at least 60 degrees (in RA which determines what targets can be observed at a given point in the orbit) from a new burst. We can't predict if a new burst will come along and knock out observations, but if we are able to get time on a SN early and see the peak, then later observations can be more flexible without impacting the science. This is where a lot of unpredictability arises, as Swift has followed some bursts for nearly two months, while others are undetectable after just a few days. The sun angle restriction is intended to keep Swift BAT pointed away from the sun so that detected GRBs are preferentially located in the night sky where they can be followed up from the ground.