Abstract: Wide-field surveys by the Herschel Space Observatory have discovered extremely luminous, gravitationally lensed galaxies at $z > 1.5$ that offer a unique window on star-formation in extreme environments. The SMA is playing a pioneering role in providing spatially resolved 870µm imaging that is critical to develop lens models and study both the lensing and lensed galaxies in unprecedented detail. We develop a new analysis tool for spatially resolved 870µm environments. The SMA is playing a pioneering role in providing lensed Dusty Star-forming Galaxies Found by Herschel

1. SMA 870µm Images of Herschel DSFGs and uvMCMCFit Best-fit Model

2. Lenses in the SMA Sample. Left: Einstein radius as a function of i-band AB magnitude. The Herschel sample is fainter and shows a wider range in Einstein radius values than any of the previous samples of lenses. Right: Mass enclosed within the Einstein radius as a function of lens redshift. Herschel has identified lenses that are lower in mass or higher in redshift than any of the optically-based searches (SLACS, BELLs, and SL2S). The range in parameter space occupied by the Herschel data points is comparable to that of CASTLES, CLASS, and SQLS, but Herschel promises to provide a sample size that is over an order of magnitude larger (Gonzalez-Nuevo et al. 2012)

3. Magnification factor from the SMA lens models as a function of 500µm flux density: The predicted values from Wardlow et al. (2013) are shown by the dotted blue line. The dashed purple line traces the same model, but with parameters tuned to jointly match the observed number counts and magnification factors shown in this diagram. The solid green lines show the effects of different maximum magnifications and are taken from Lapi et al. (2012).

4. Intrinsic source properties of Herschel DSFGs in the SMA sample. Left: Half-light radius as a function of FIR luminosity for lensed DSFGs discovered by Herschel (red circles) and South Pole Telescope (cyan stars, Hezaveh et al. 2013), as well as galaxies from a compilation in (Rujopakarn et al. 2011) at $z > 0.5$ (filled grey diamonds) and at $z = 0$ (open squares). The blue shaded region represents the median and 1σ range found for unlensed DSFGs by (Tacconi et al. 2006). Right: Far-IR luminosity surface density as a function of FIR luminosity. The orange dashed line traces the theoretical limit of $\Sigma_{\text{FIR}}$ for an optically thick disk (Thompson et al. 2005). The SMA sample spans nearly one decade in $L_{\text{FIR}}$ and two decades in $\Sigma_{\text{FIR}}$. A handful of sources approach or exceed the highest values observed in local LIRGs and ULRGs ($\Sigma_{\text{FIR}} = 10^{13} L_\odot$ kpc$^{-2}$).