Disk breaks of barred galaxies at 3.6 μm with the Spitzer Survey of Stellar Structure in Galaxies (S4G)

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We have performed two-dimensional multicomponent decomposition of 144 nearby barred galaxies using 3.6 μm images from the *Spitzer* Survey of Stellar Structure in Galaxies. The fitting algorithm, BUDDA: BUlge/Disk Decomposition Analysis, includes up to four components (bulge, disk, bar and a point source) and, most importantly, includes disk breaks in the model fit to account for down-bending (Type II) or up-bending (Type III) disk profiles. Our sample of barred galaxies covers stellar masses from 10^9 to $10^{11} M_\odot$ and Hubble types from SB0 to SBdm. We find that ignoring the disk break and using a single disk scale length in the model fit for Type II disk galaxies can lead to differences of 40% in the disk scale length, 10% in bulge-to-total luminosity ratio (B/T), and 25% in bar-to-total luminosity ratios. We find that for galaxies with B/T $\geq$ 0.1, the break radius to bar radius, $r_{\rm br}/R_{\rm bar}$, varies between 1 and 3, but as a function of B/T the ratio remains roughly constant. This suggests that in bulge-dominated galaxies the disk break is likely related to the outer Lindblad Resonance (OLR) of the bar, and thus the OLR also moves outwards at the same rate as the bar grows. For galaxies with small bulges, B/T $<$ 0.1, $r_{\rm br}/R_{\rm bar}$ spans a wide range from 1 to 6. This suggests that the mechanism that produces the break in these galaxies may be different from that in galaxies with more massive bulges. Consistent with previous studies, we conclude that disk breaks in galaxies with small bulges may originate from bar resonances that may be also coupled with the spiral arms, or be related to star formation thresholds.