Outline for ARAA58 article with working title: “Protoplanetary Disk Structures”.

I am focusing the contents to try and build off the last major observational review on the subject (by Williams & Cieza in 2011), although there will necessarily be some (heavily updated) overlap. This means that most of the review will emphasize spatially resolved measurements (heavily, though not exclusively, weighted by results from ALMA).

0. Abstract and front matter (~1 page)

1. Introduction (2 pages)
    - My current draft keeps this brief, to avoid repetition. Each section will cover the relevant introductory material, so this emphasizes only the general “big picture”.

2. Basic Structural Properties (7 pages)
    - The goal here is to give a “sweeping” overview of what we would really like to know about disks, how we go about trying to measure such things, and what the key issues / limitations of such measurements are. Each topic here includes a motivation for the key questions and issues, a discussion of the observational tracers, a summary of the key measurements and conclusions to date, and a discussion of important limitations and caveats.
    - The topics include:
        A) the mass distribution of solids
        B) the mass distribution of gas
        C) thermal structure
        D) dynamical structure (primarily turbulence)

3. Insights from Demographics Studies (7 pages)
    - Even with all the challenges of precision measurements related to the fundamental structural properties outlined in Section 2, we can still learn a lot about disks and planet formation by studying empirical properties and how the scale with each other and various environmental and evolutionary proxies. Each topic addressed here considers some physical motivations for our observational expectations, key tracers, current results, and lingering issues.
    - The topics include:
        A) links between disk properties and host masses
        B) environmental effects (multiplicity, cluster properties)
        C) evolutionary signatures (for luminosities, sizes of dust, gas tracers)

4. The Evolution of Disk Solids (7 pages)
    - Much of the observational signatures described here are influenced, and perhaps entirely controlled, by the growth and migration of solids due to their interactions with the gas reservoir. Since this issue has been covered extensively in various recent reviews, so I am intending to keep this discussion as condensed as possible while still conveying the key points. Topics to cover:
        A) a basic physical overview (growth, sedimentation, drift)
        B) theoretical predictions for observable signatures

C) observational evidence, qualitative and quantitative
- frequency-dependent continuum, polarization, gas versus dust
D) the timescale / efficiency conundrum (a lead-in to next section)

5. Substructures (11 pages)
- This is the big new direction in the field, and it essentially ties everything else together naturally so I will spend more space here. Topics to cover:
A) basic physical concepts (pressure peaks, particle traps)
B) potential mechanisms (fluid instabilities, condensation fronts, planets)
C) “transition” disks (cavities, depletions, azimuthal asymmetries, gas)
D) “normal” disks (rings/gaps, spirals, arcs, variability)
E) links between all these, and lingering / open questions

6. Synopsis (1 page)
- This will try and highlight the big picture of the field, and link together all the sections more explicitly.

7. Prospects (1 page)
- This will try and synthesize the review in the contexts of where I suspect things will go over the near term (5 years) and the big questions we need to tackle in the coming decade.