Chapter 8: (Working) Title: Success and Potential Failures in Innovation Landscape - Lessons from Astrophysics

- In short, what is our Chapter about?
  - Aims to present the process of and benefits from complex technological innovation from large-scale collaborations using astronomy and astrophysics -- radio astronomy, infrared astronomy, gravitational waves -- and CERN as examples: "Big Science Chases Big Ideas"
  - Highlights the importance of grand scale collaboration (Multi messenger Astronomy and Gravitational Waves) for breakthrough research and significance of international networks such as software and network of technologies
  - Highlights and examines key technologies developed in support of scientific breakthroughs achieved in these domains

Chapter 8: Summary Status

- Our estimate of current level of completion: 75%
- The following additions/revisions will (hopefully) be completed by July 31st
  - There is lots of material in the chapter (now 24 pages), will need to be condensed.
  - The different sections are written in 'different voices'; needs to be edited to read as a single & coherent chapter
  - Figures need to be incorporated into the document; some references are missing
  - Conclusion needs to be added
- Figure permissions needed
  - B. Abbott et al, The Astrophysical Journal Letters, 848:L13, 2017 October 20 (https://doi.org/10.3847/2041-8213/aa920c) **Figure 2**
  - May be a few more…

Chapter 8: Key messages, insights (possible input for other chapters)

- "Big Science Chases Big Ideas"

- Technology development is driven by asking fundamental questions
  - '…outrageous capabilities are advanced with the simplest of statements "wouldn't it be nice if…" and the journey to that advancement is realised in the decades since.'

- Collaboration among many different 'flavors' of scientists & engineers is necessary and flourishes in large astronomy/astrophysics collaborations
  - "The overall complexity of the interferometric detectors and the data analysis methods requires a complex and diverse ecosystem …. to design, build, commission and operate the detectors, carry out the analysis, and interpret the data."