

# Interstellar Correlations

An aerial photograph of a coastal city, likely Miami, Florida. The image shows a dense urban area with numerous buildings and a prominent sandy beach in the foreground. The water is a vibrant turquoise color, transitioning to a deeper blue further out. The sky is clear and blue, with a few wispy clouds. The overall scene is bright and sunny.

Mark Walker  
(Manly Astrophysics)

“I’d put my hand in the fire, for Ron.”

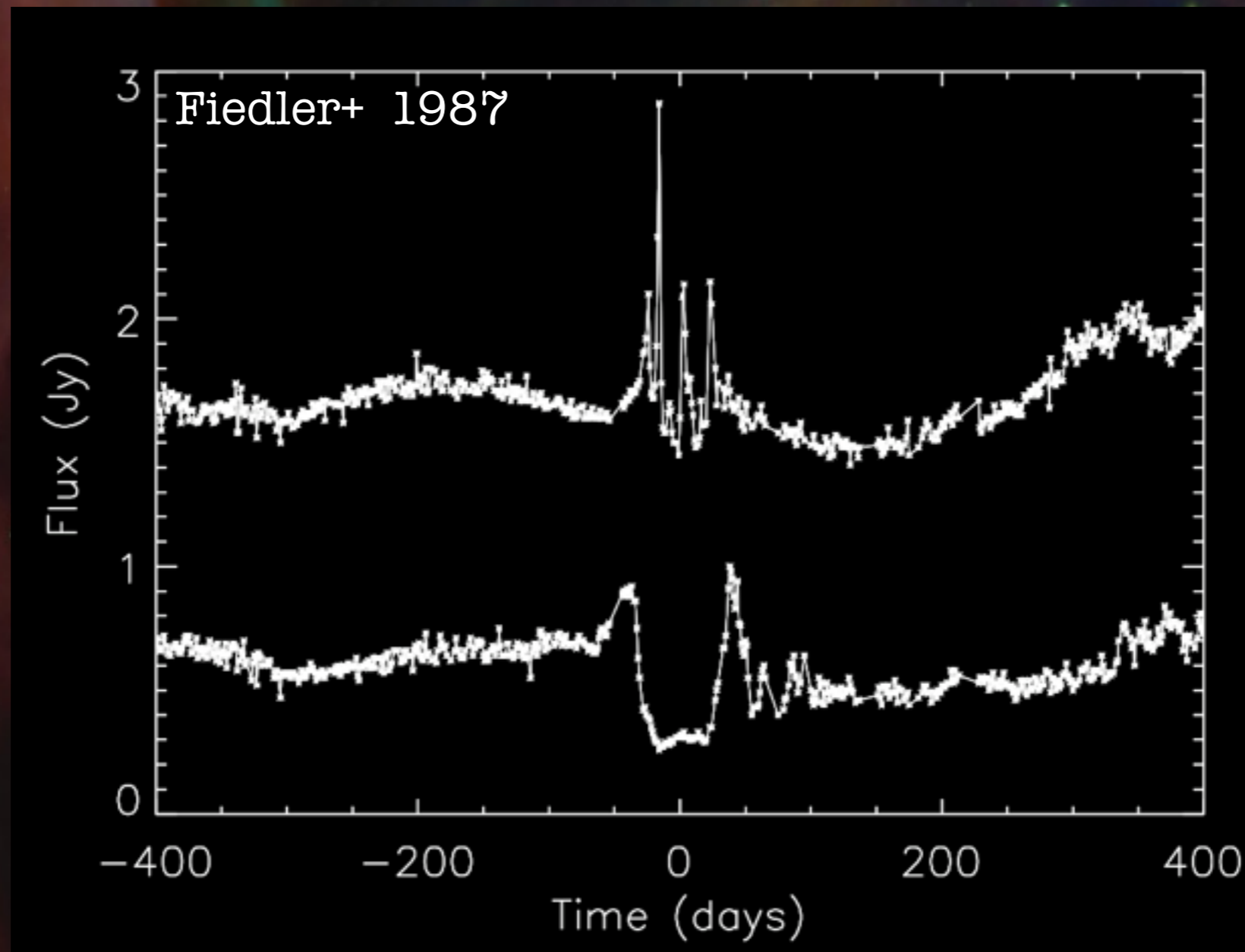
- Always interested in what others are doing
- Rich professional perspectives
  - Astrophysics. Technology. People.
- Encouraging. Helpful.
- Great at navigating in discovery space
  - Delays judgement
  - Cautious of expert opinion
  - ...
  - Likes crazy ideas

# A FEAST OF CRAZY IDEAS

Dark  
Matter

AU-sized  $H_2$   
gas clouds

Extreme  
Scattering  
Events



# A FEAST OF CRAZY IDEAS

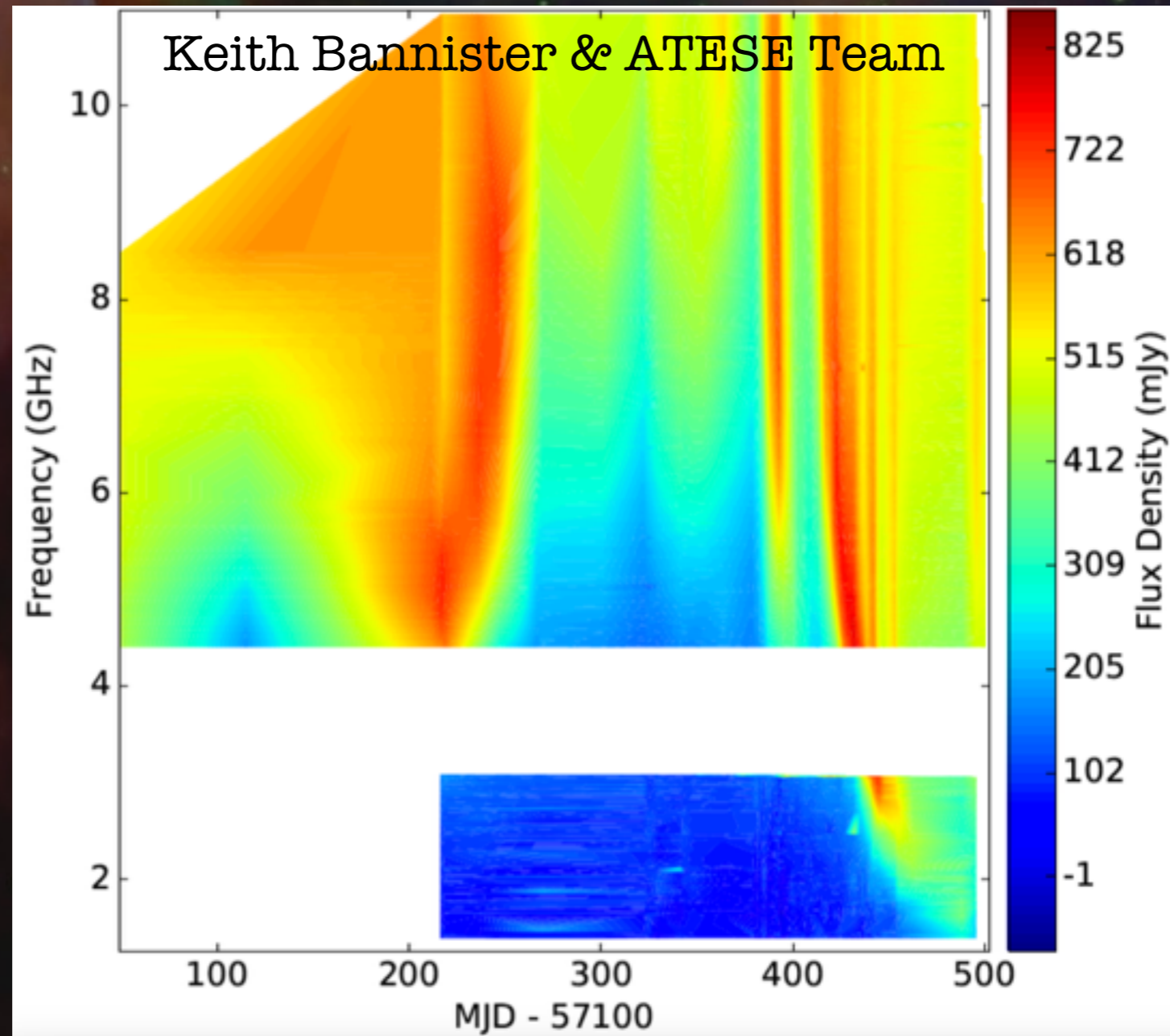
Dark  
Matter



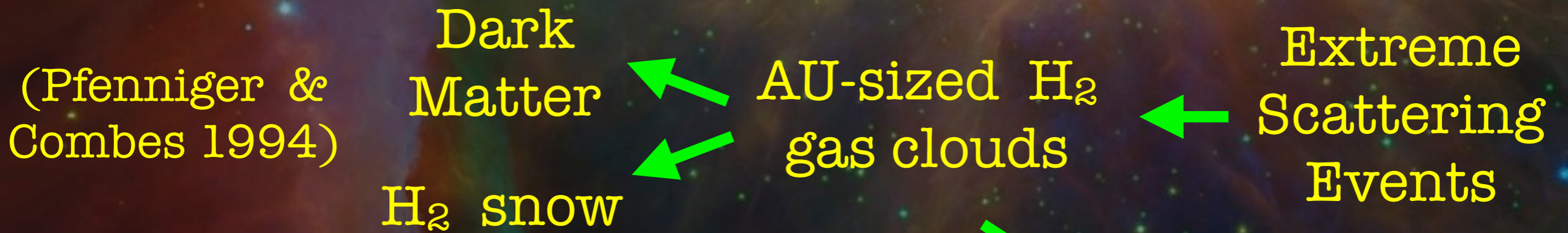
AU-sized  $H_2$   
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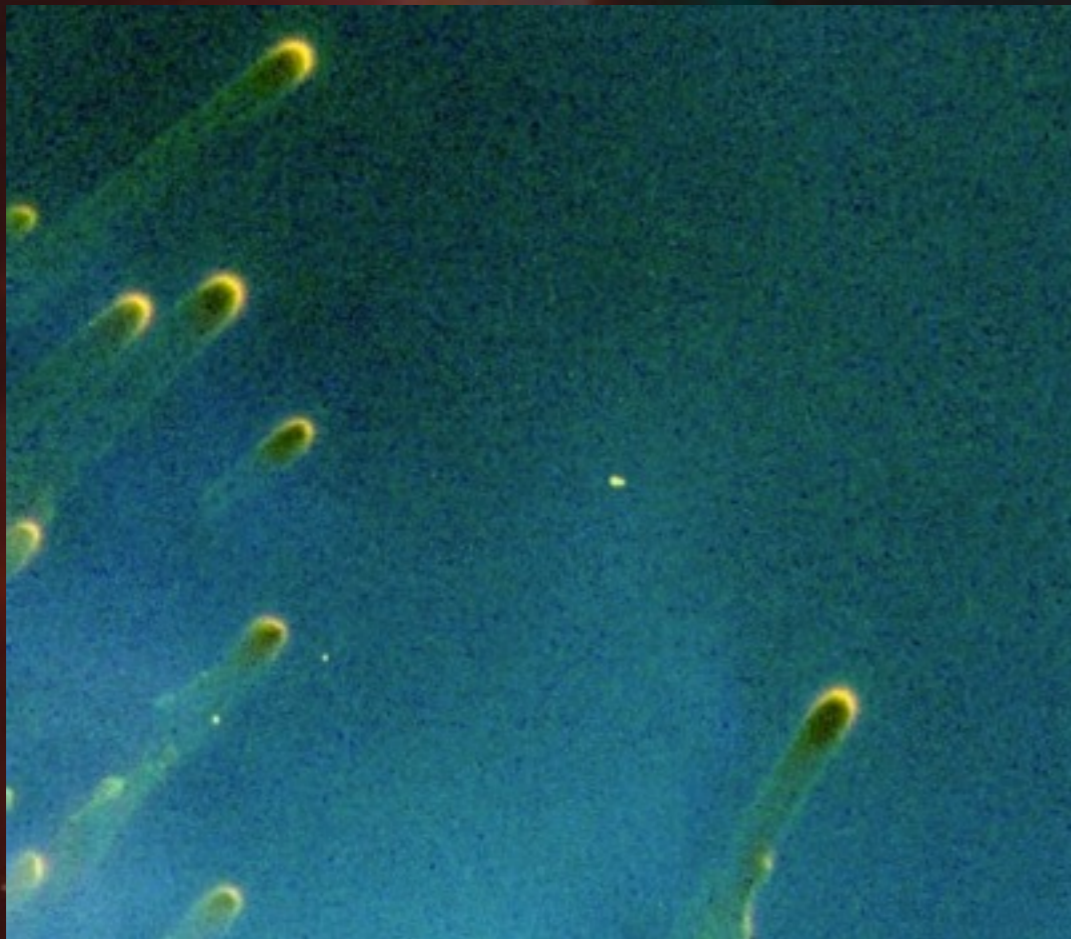
Extreme  
Scattering  
Events



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(O'Dell & Handron 1996)

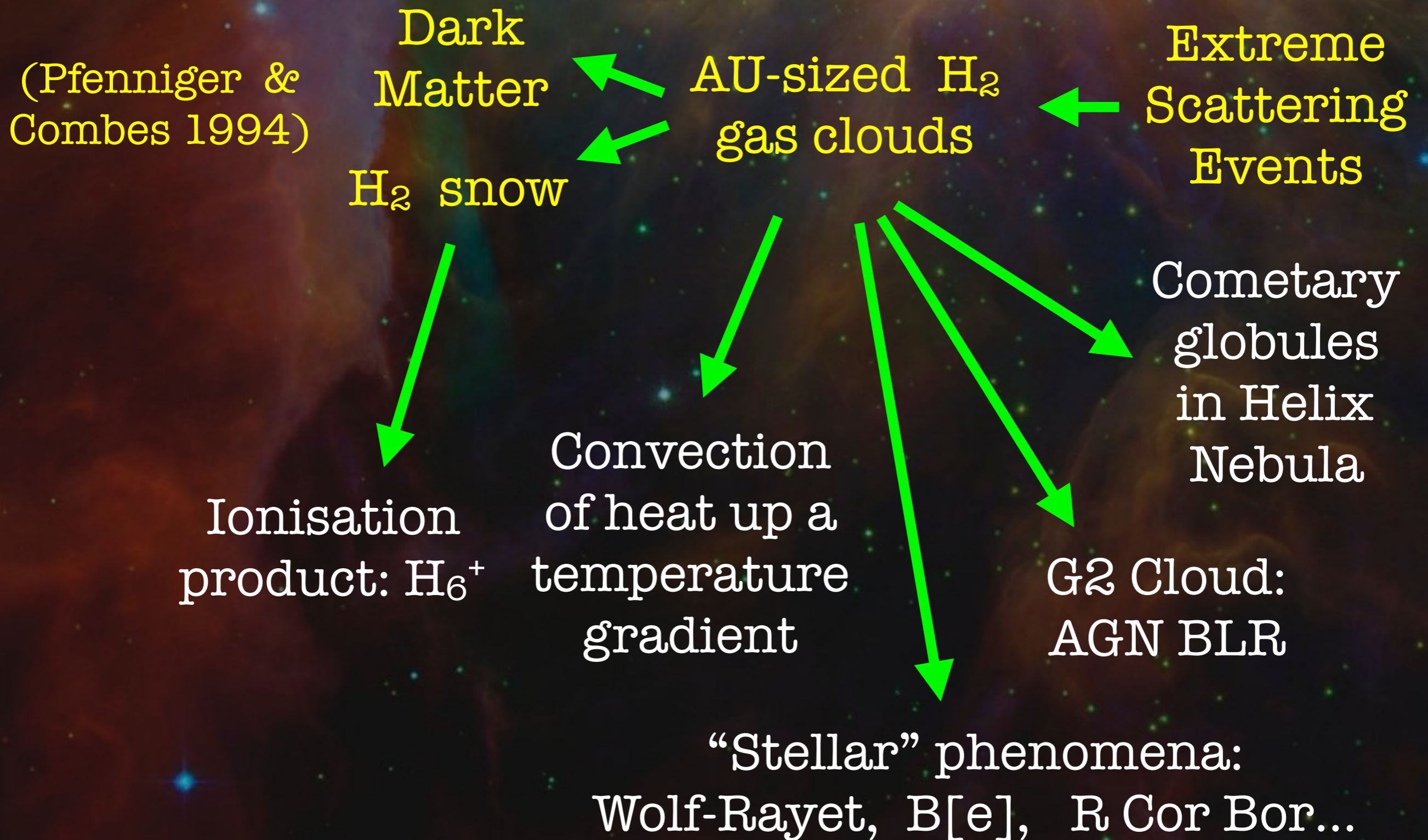


Cometary globules in Helix Nebula

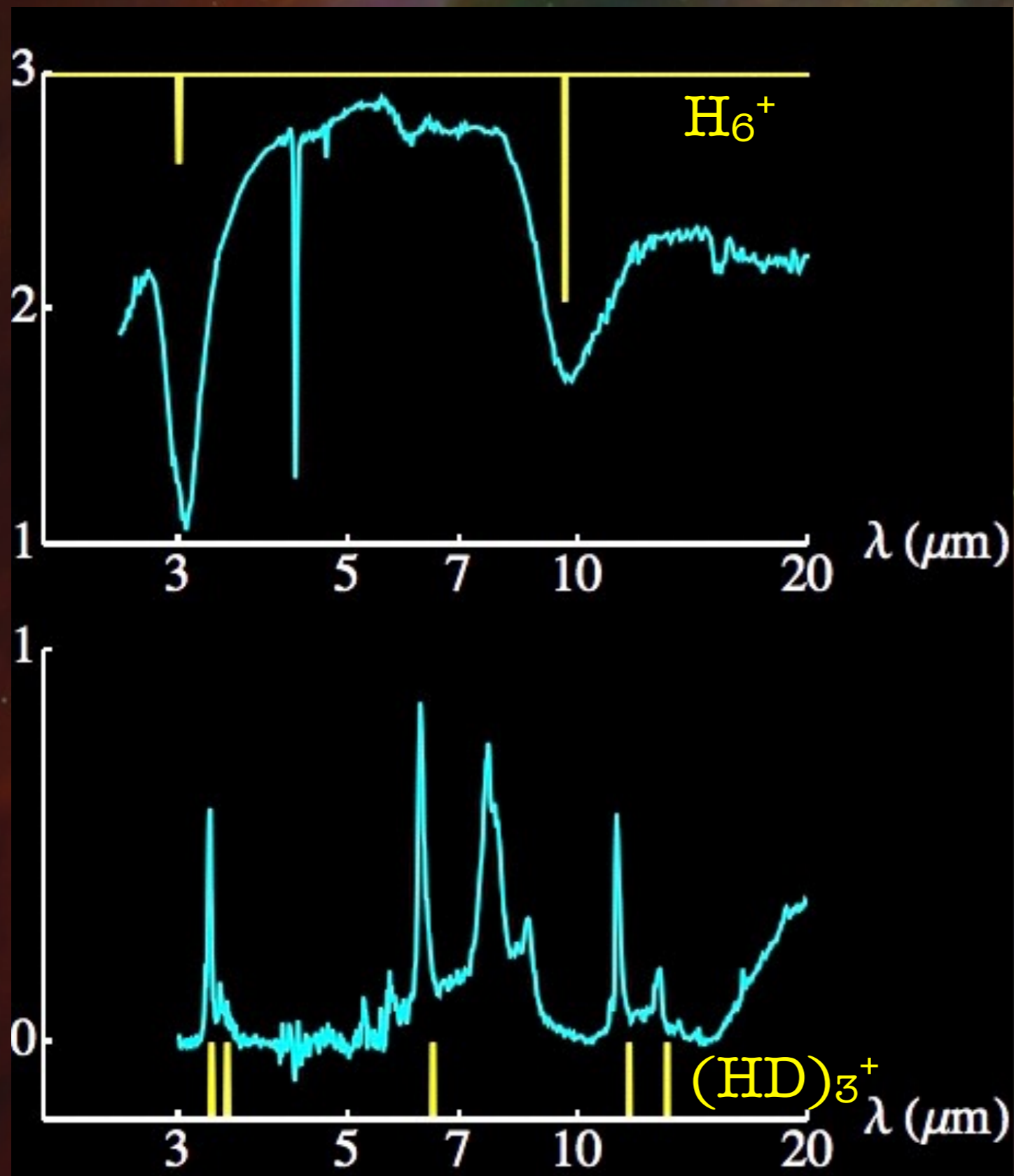
G2 Cloud:  
AGN BLR

“Stellar” phenomena:  
Wolf-Rayet, B[e], R Cor Bor...

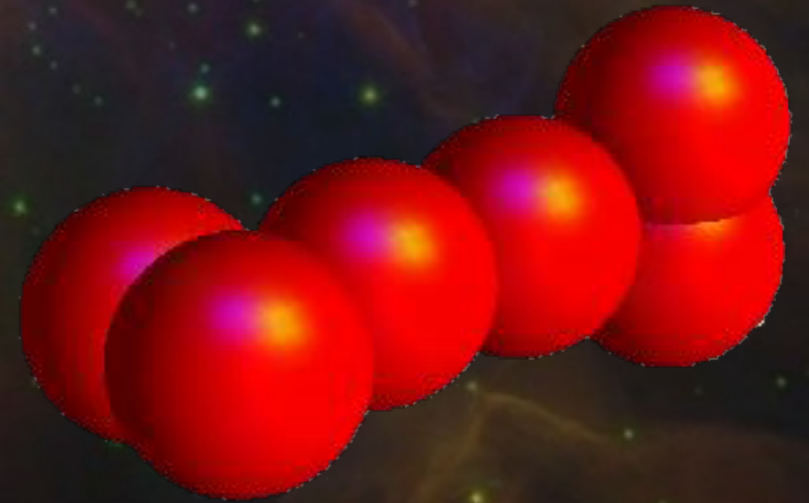
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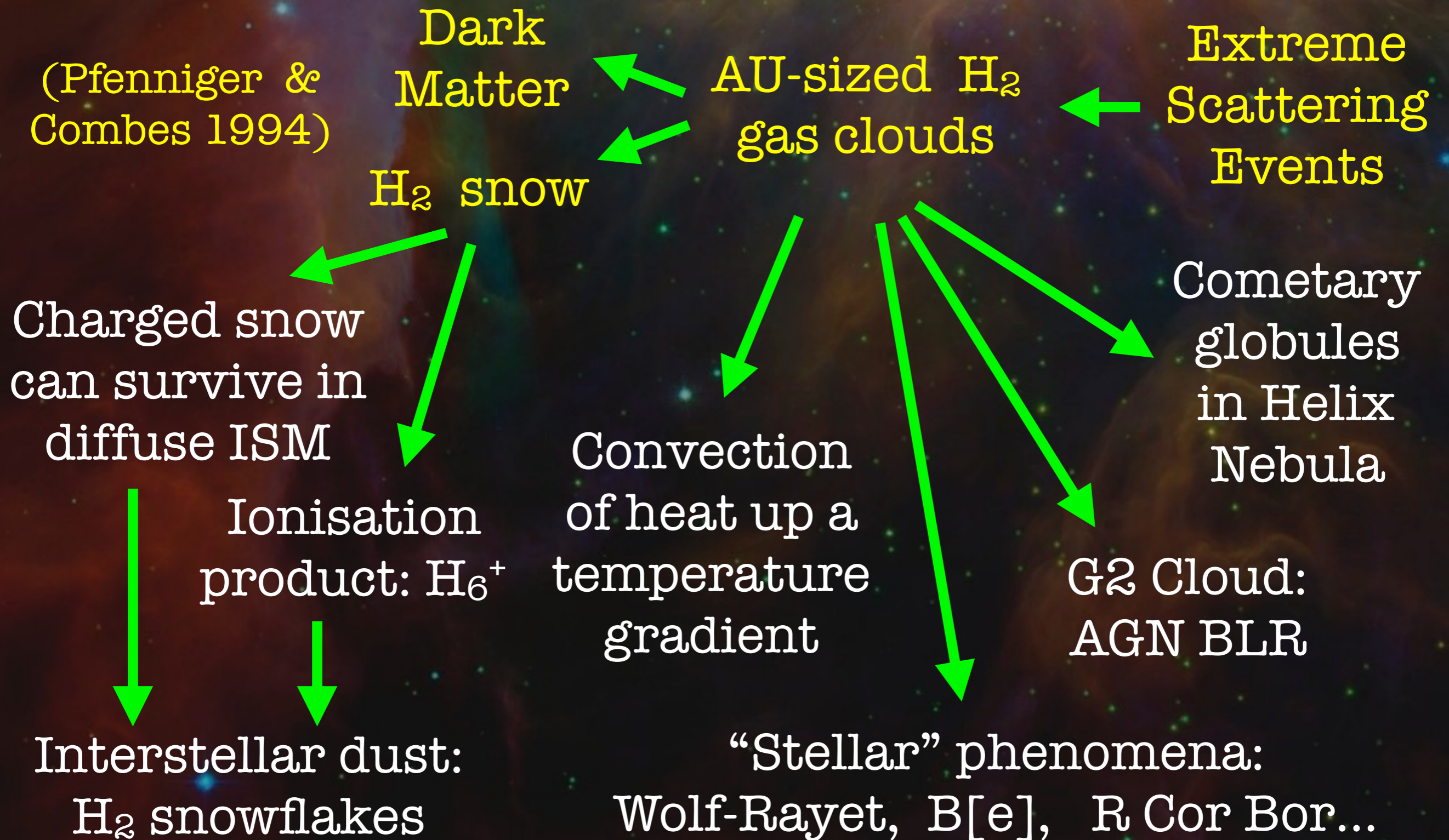
# Vibrational transitions of $\text{H}_6^+$



Lin, Gilbert & MW 2011  
Ab initio quantum theory.  
Five modes characterised

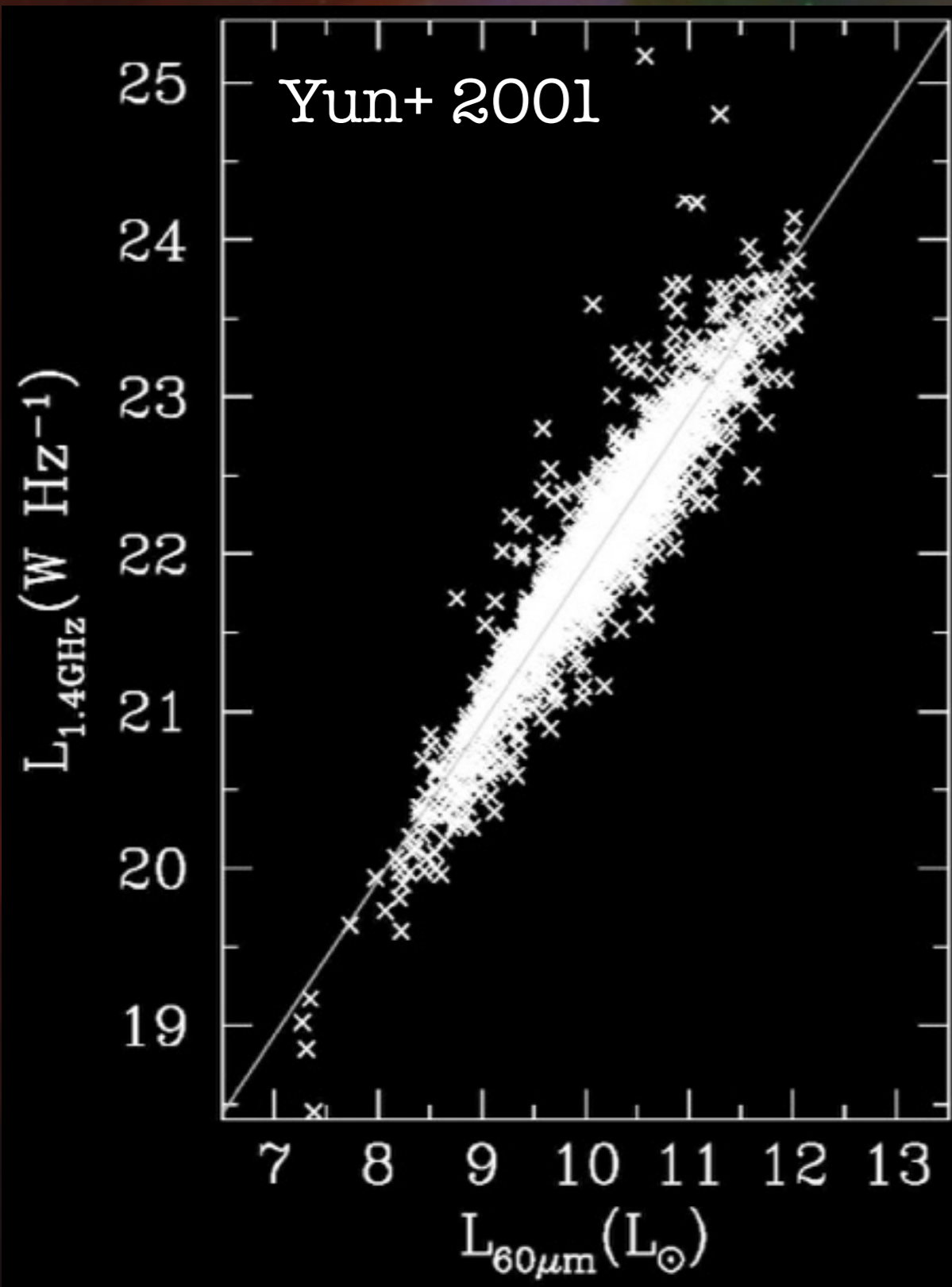


# A FEAST OF CRAZY IDEAS

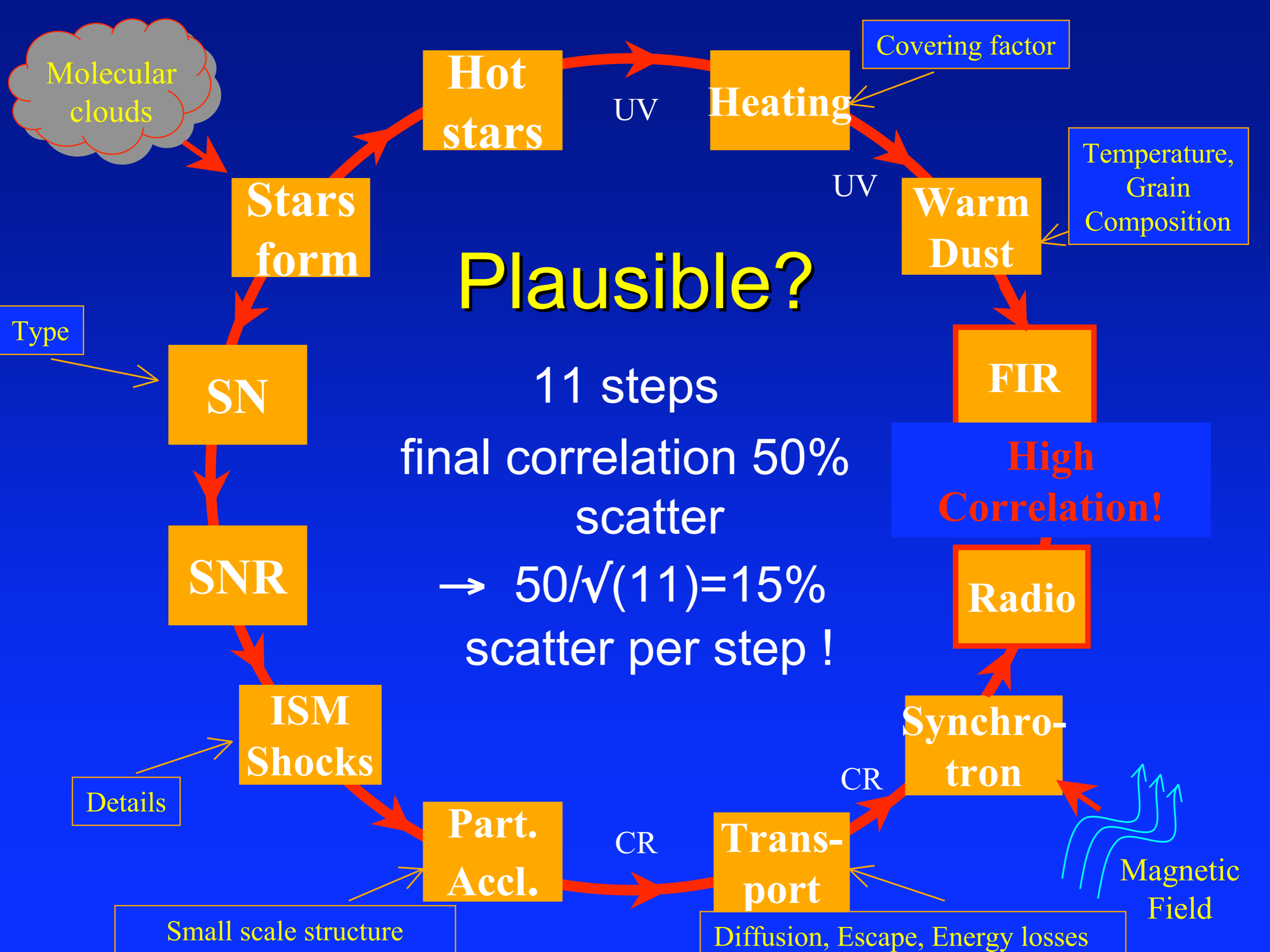




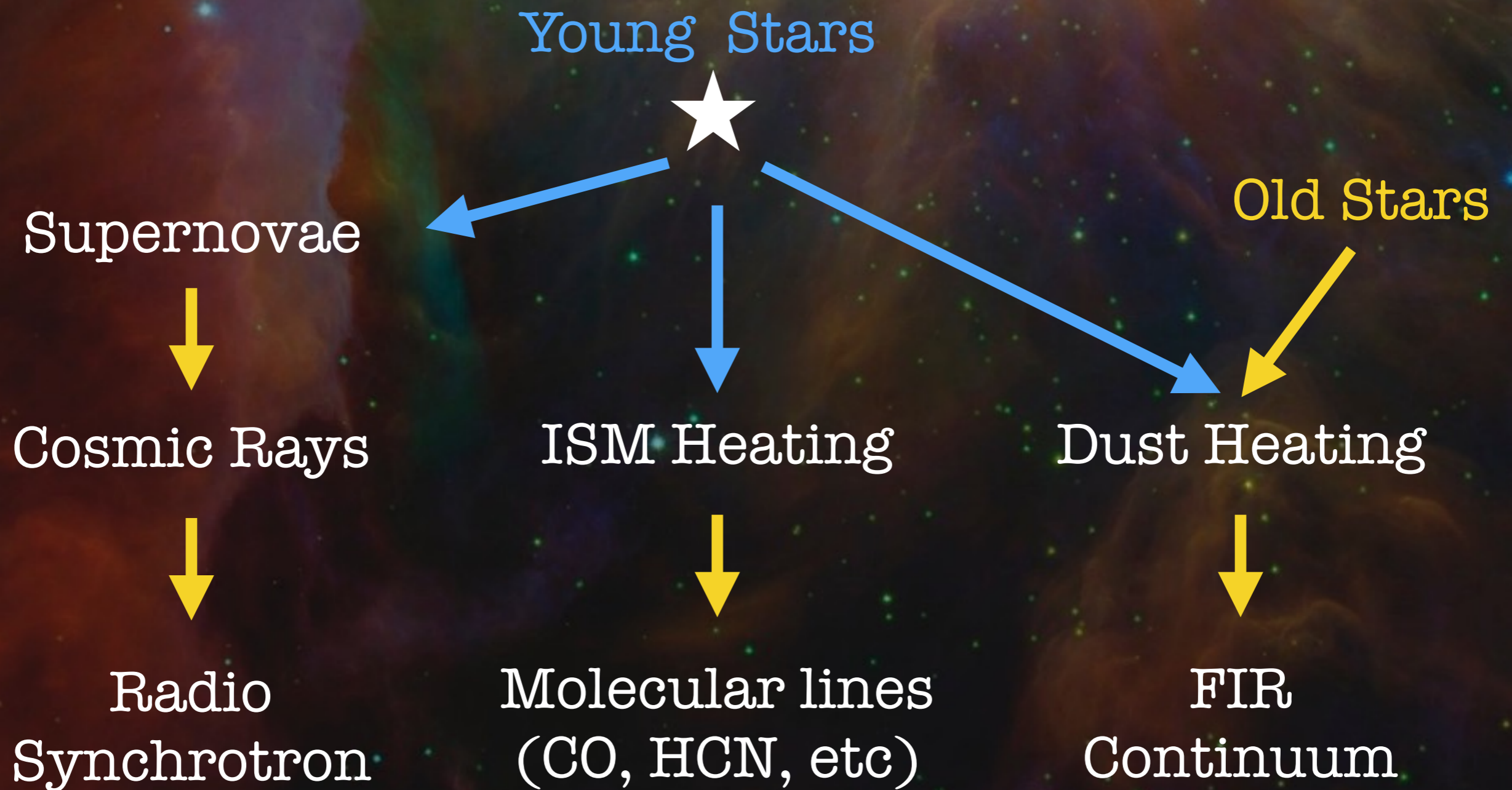
# FIR - Radio correlation(s) of galaxies



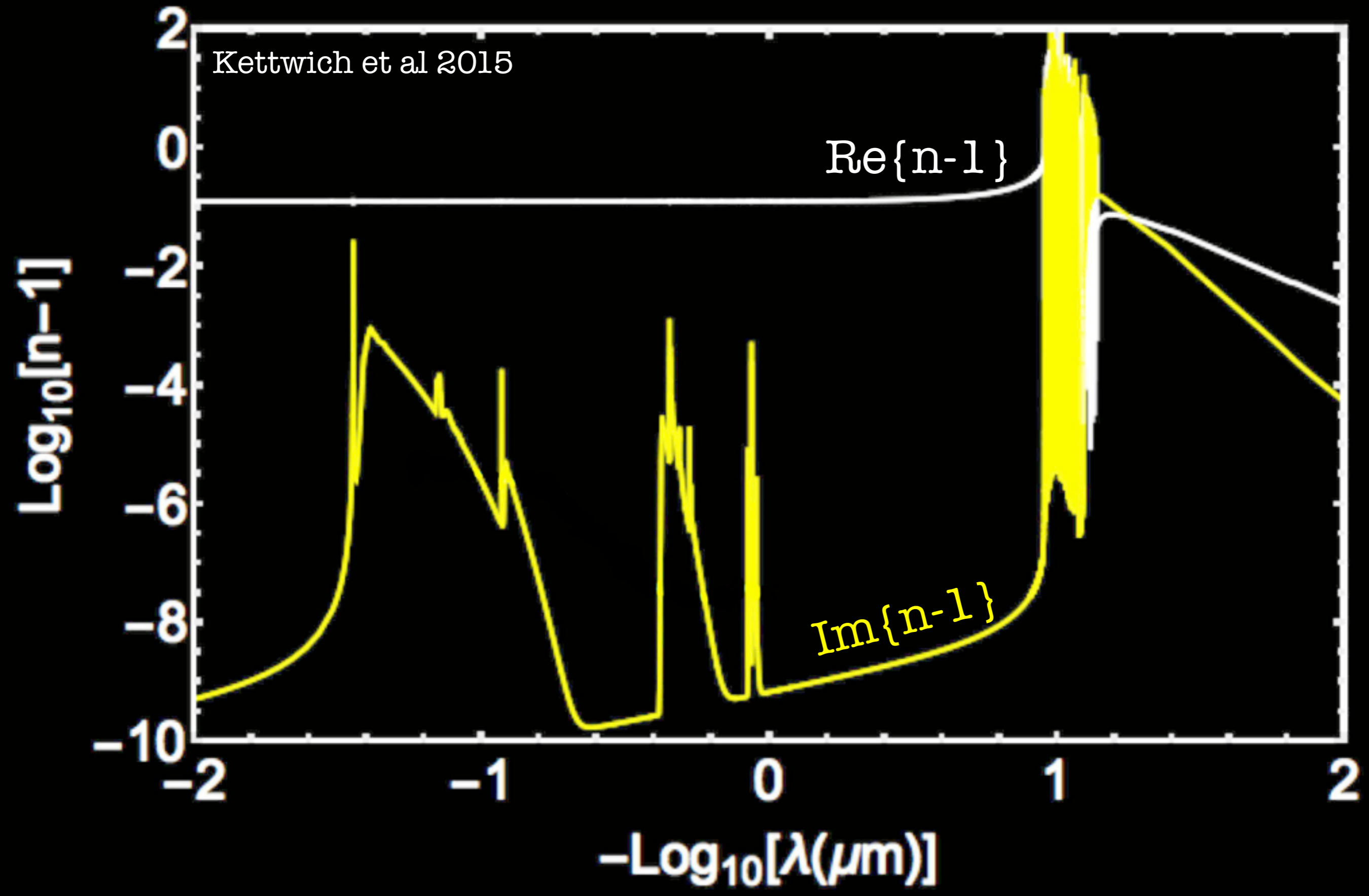
- Tight global correlation
- Linear
- No evolution with redshift
- Dwarfs. Giants. ULIRGs.
- Spatially resolved correlation
- Scales above  $\sim 100$  pc
- Both synchrotron & free-free
- Correlation with CO, HCN ...



# FIR & Radio: conventional picture



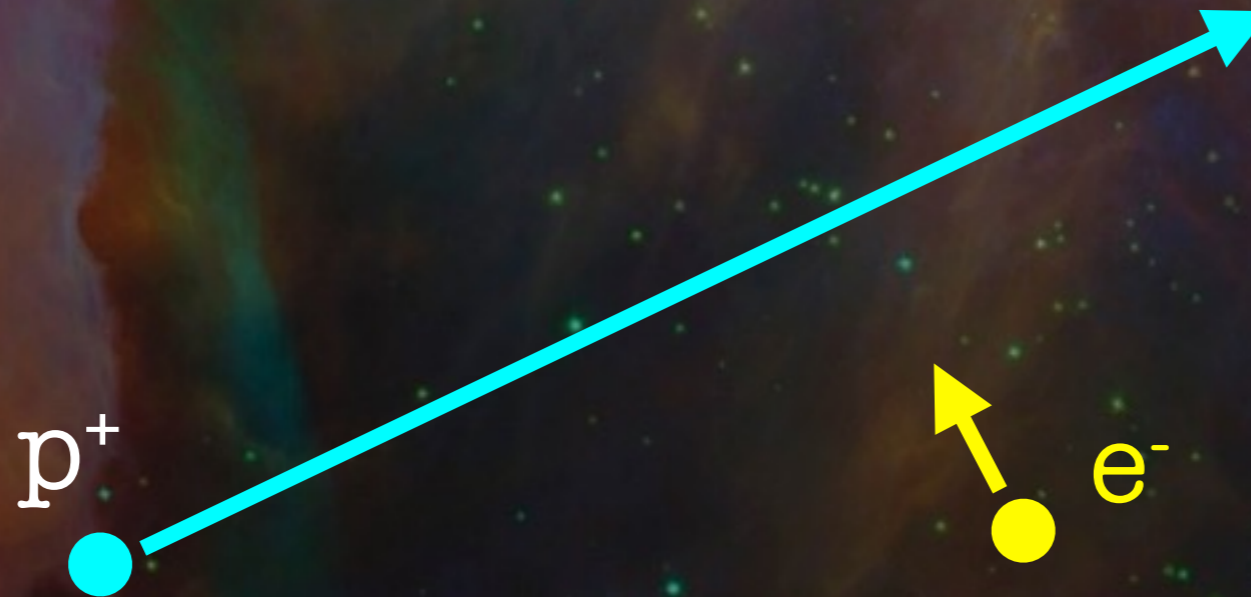
# Optical constants of solid H<sub>2</sub>



# Surface state electrons heated by (Warm) Ionised Medium

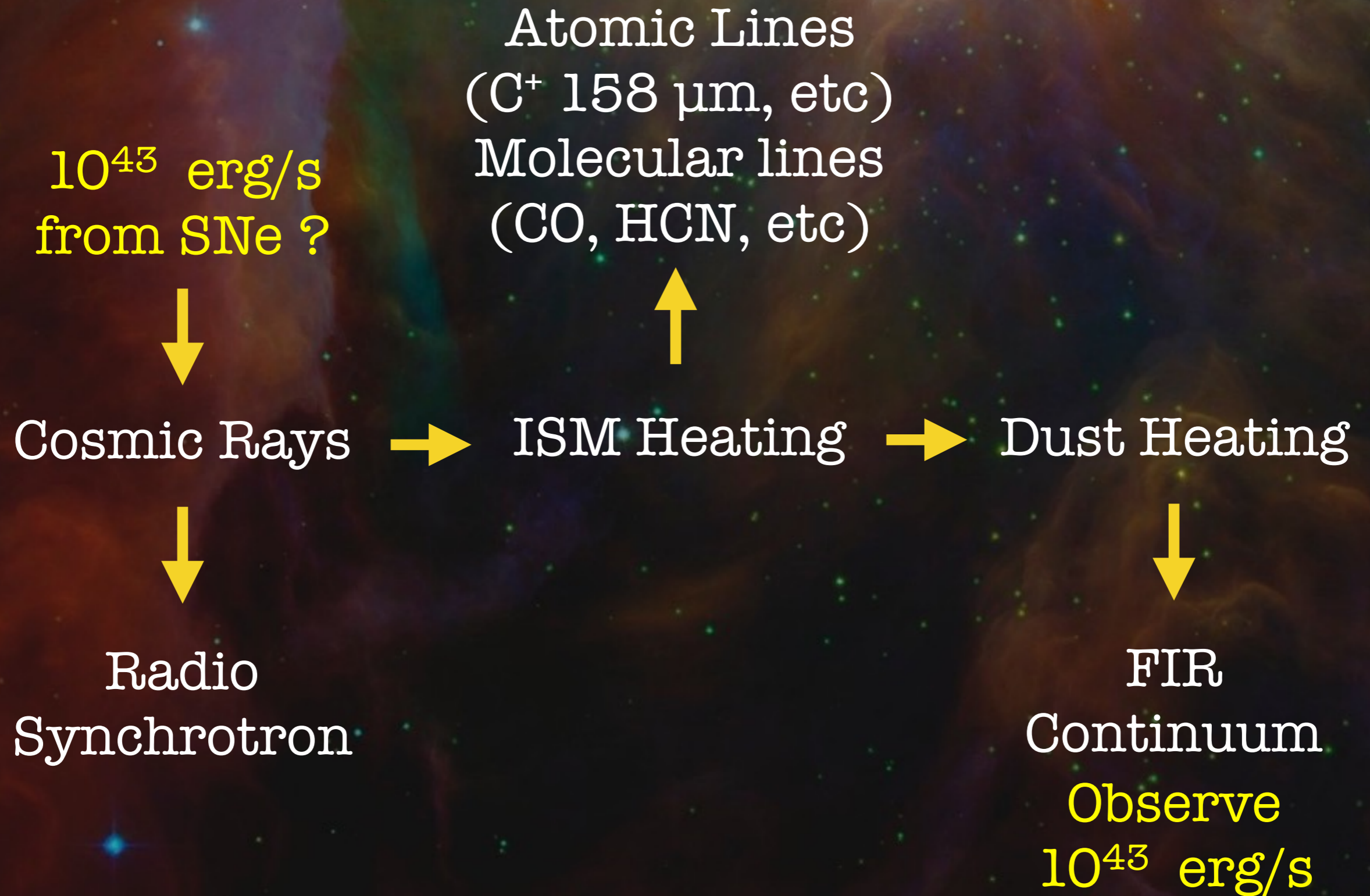


# WIM heated by cosmic-rays

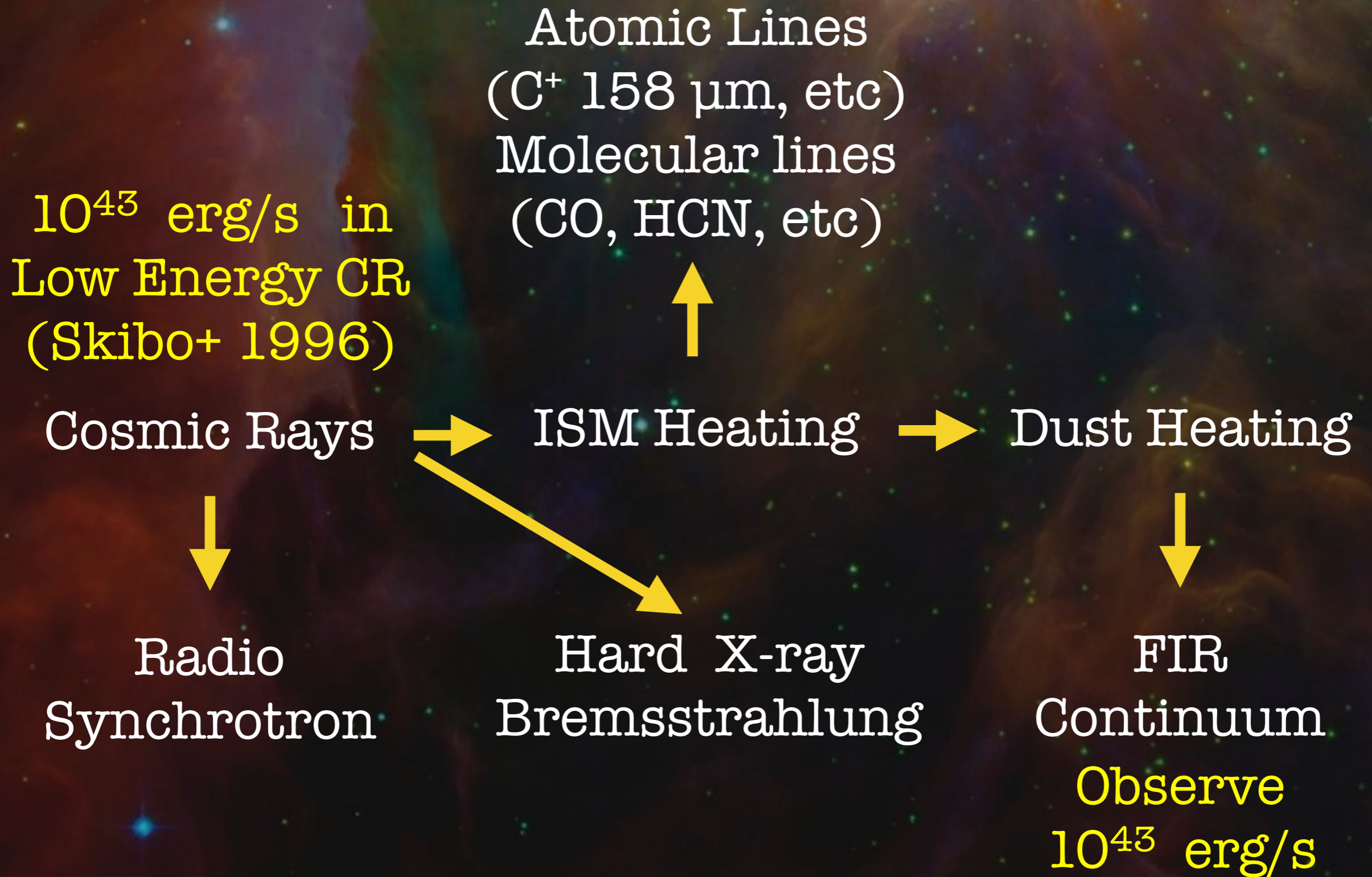


- Observations of  $H_3^+$  in diffuse  $H_2$  clouds suggest high cosmic-ray ionisation rates (McCall+ 2003)
- WIM is too hot to be (just) photo-ionised
- Mean-free-path  $\sim 100$  pc, vs 1 pc for UV photons

# FIR & Radio: snowflake picture



# FIR & Radio: snowflake picture





# Summary

- Radio source scintillation yields new perspectives:
  - Dark matter  $\leftrightarrow$  snow clouds
    - Snow clouds responsible for many phenomena
  - Interstellar dust  $\leftrightarrow$  H<sub>2</sub> snowflakes
  - Interstellar mid-IR bands from H<sub>6</sub><sup>+</sup>
- What?! Are you crazy?
- Yes, thanks to Ron's guidance.