Processing of PAHs and dust nanoparticles in H II regions

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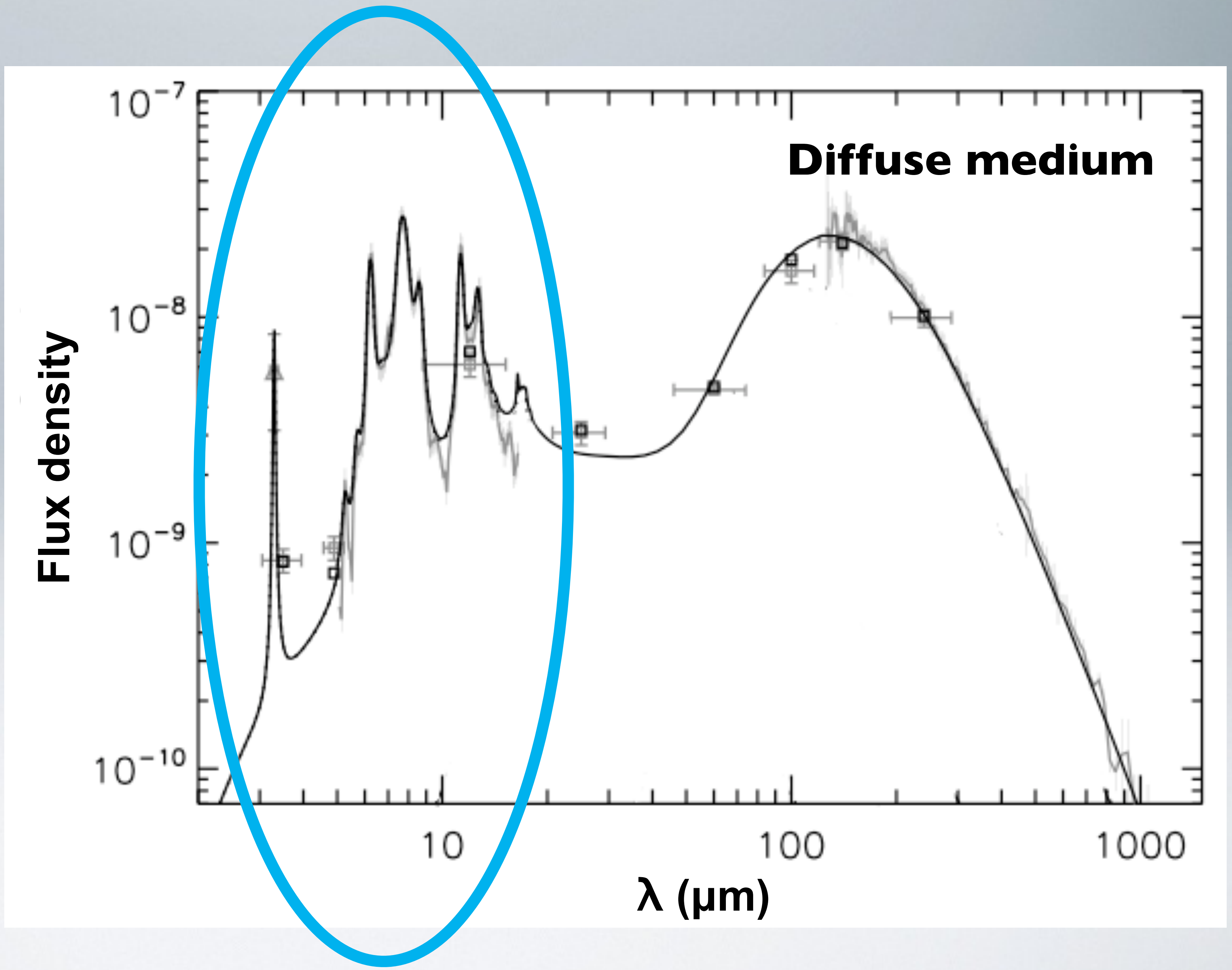
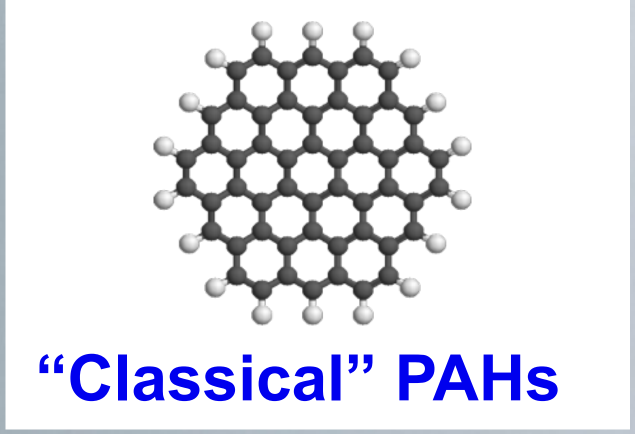
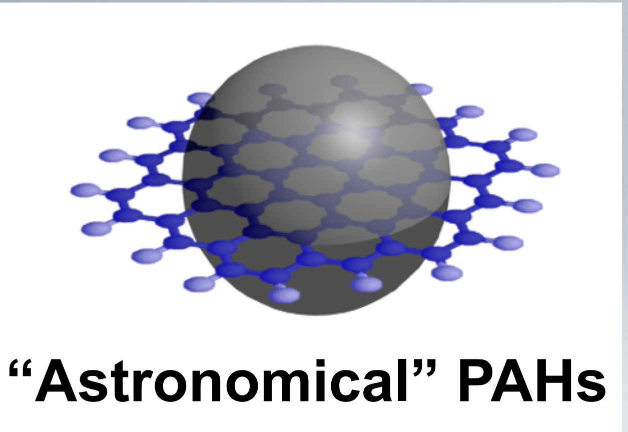
Aromatic Infrared Bands

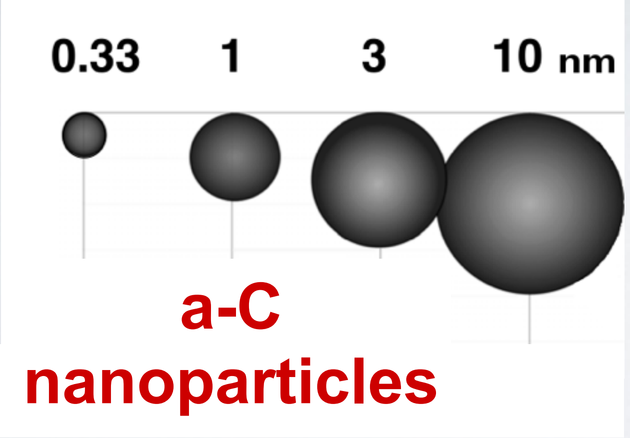


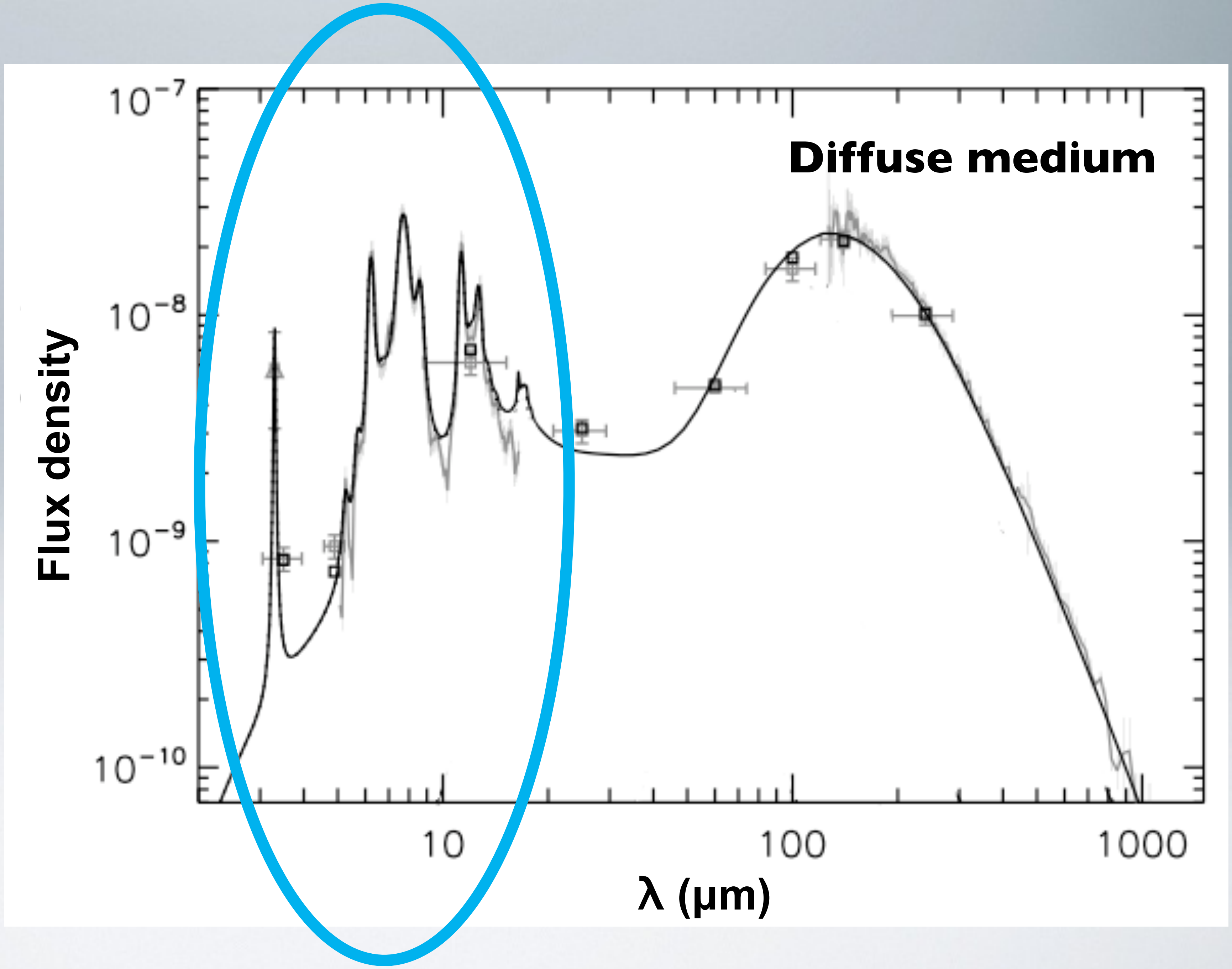
Aromatic Infrared Bands

Proposed carriers









Motivations

- Physical properties of AIB carriers: differences & similarities.
- Explanation for lack of AIBs in HII regions.
- AIB carriers and the global dust SED.
- Role of AIB carriers in dust evolution.

Photo-processing

ISRF

↓

ABSORPTION properties

↓

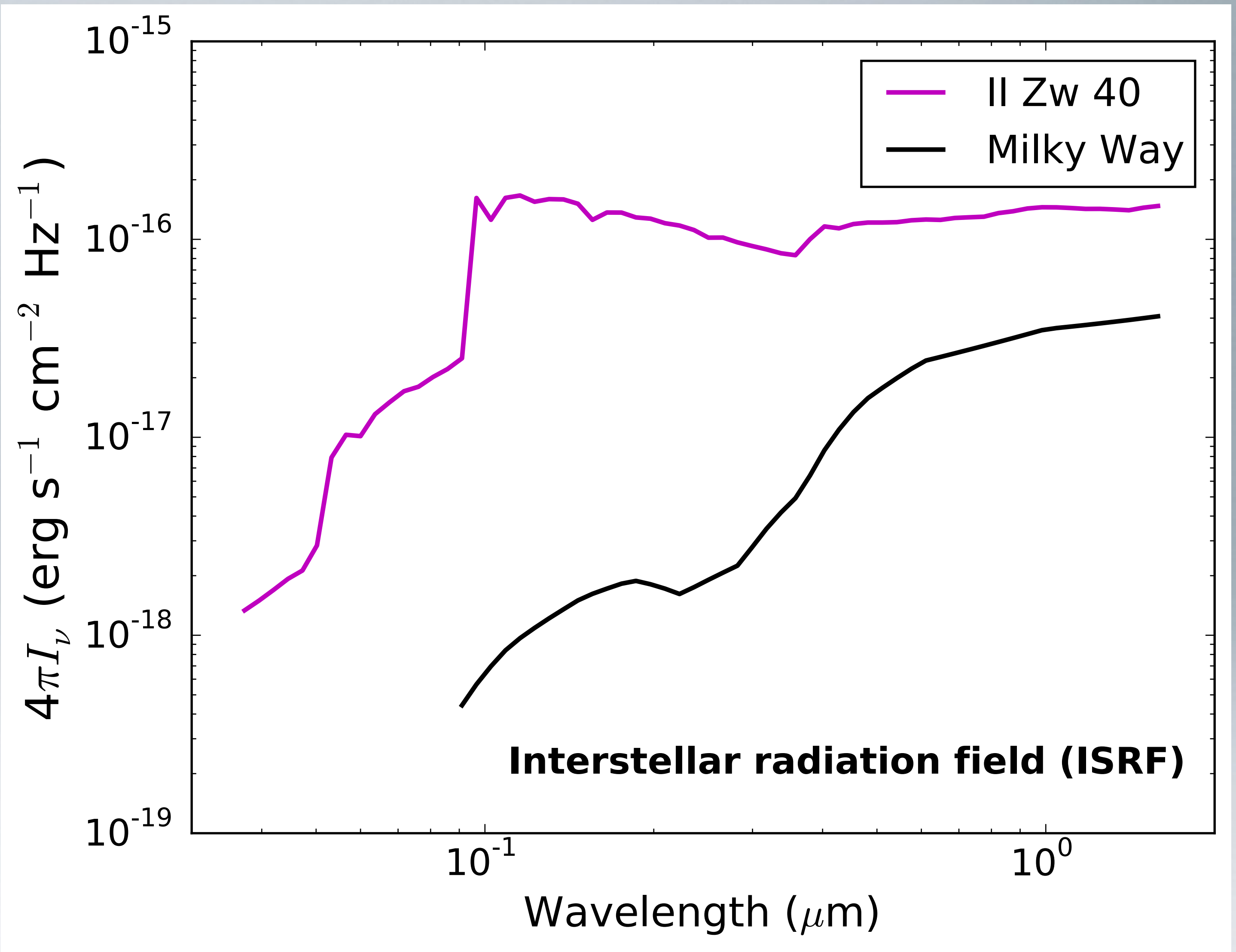
DISSOCIATION

↓

GRAIN SIZE modification

↓

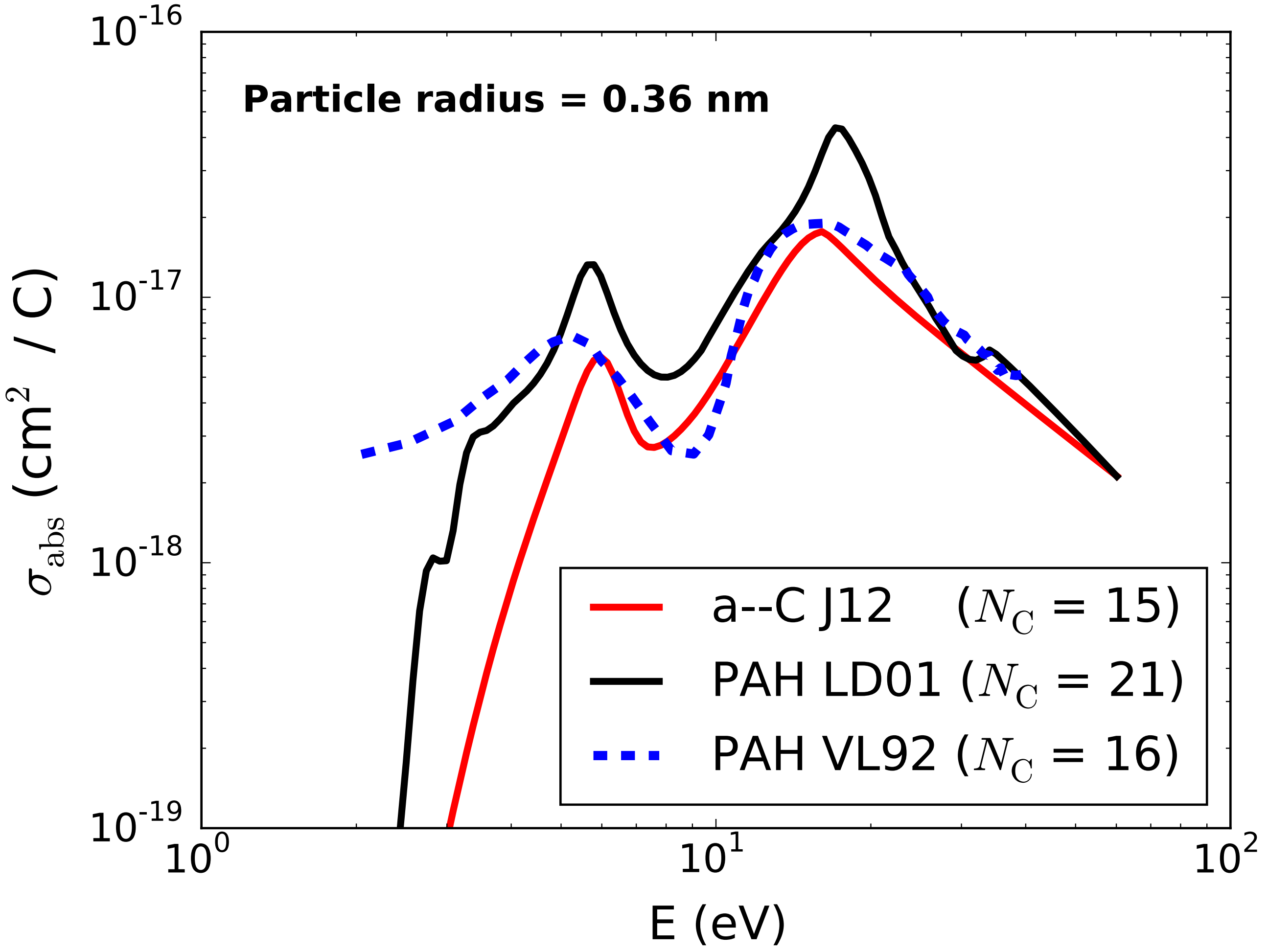
EMISSION properties

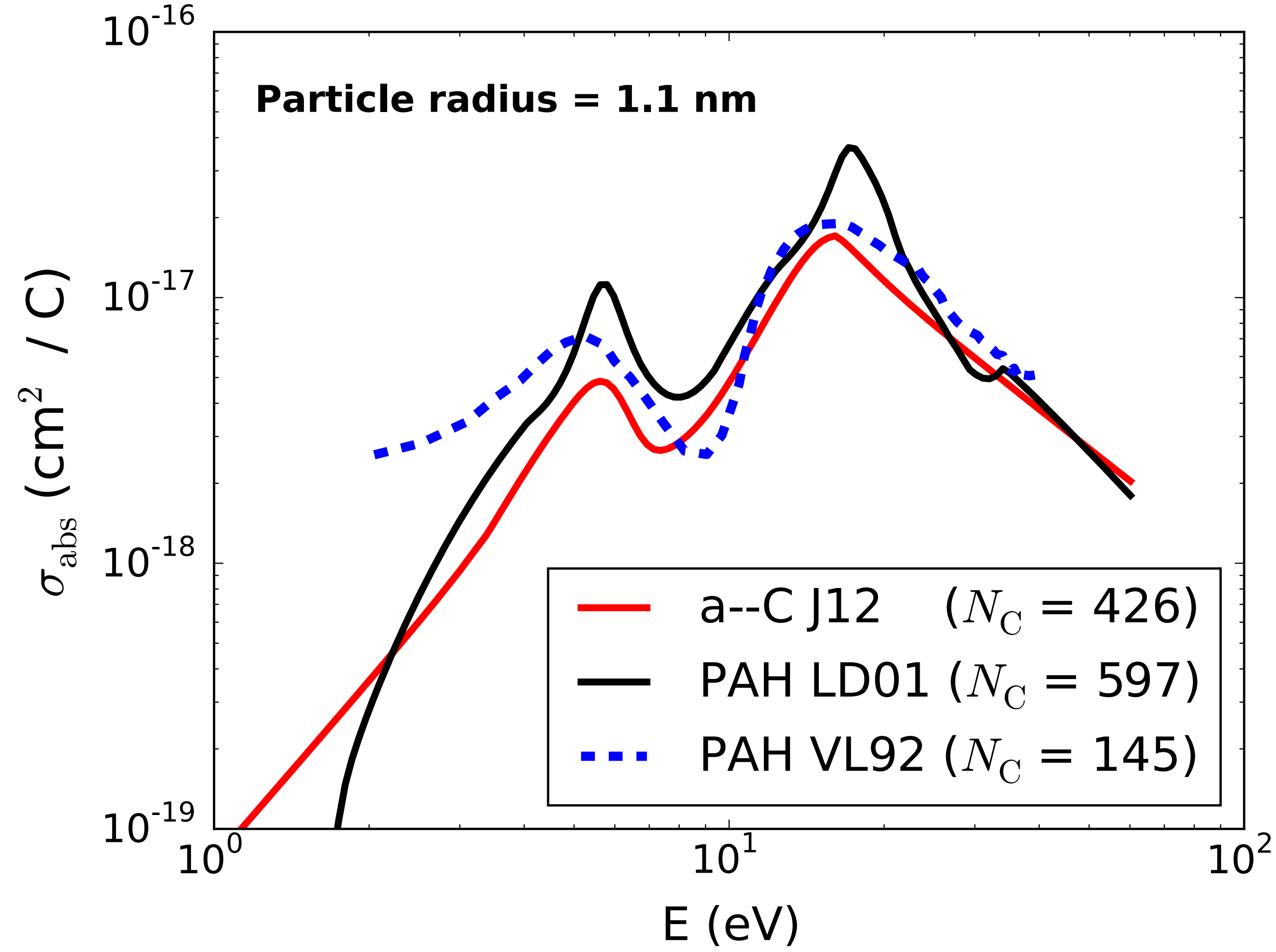


- Mathis, J. S., et al. 1983, A&A, 128, 212
- Galliano, F., et al. 2005, A&A, 434, 867

Photo-absorption cross section I

Optical - UV



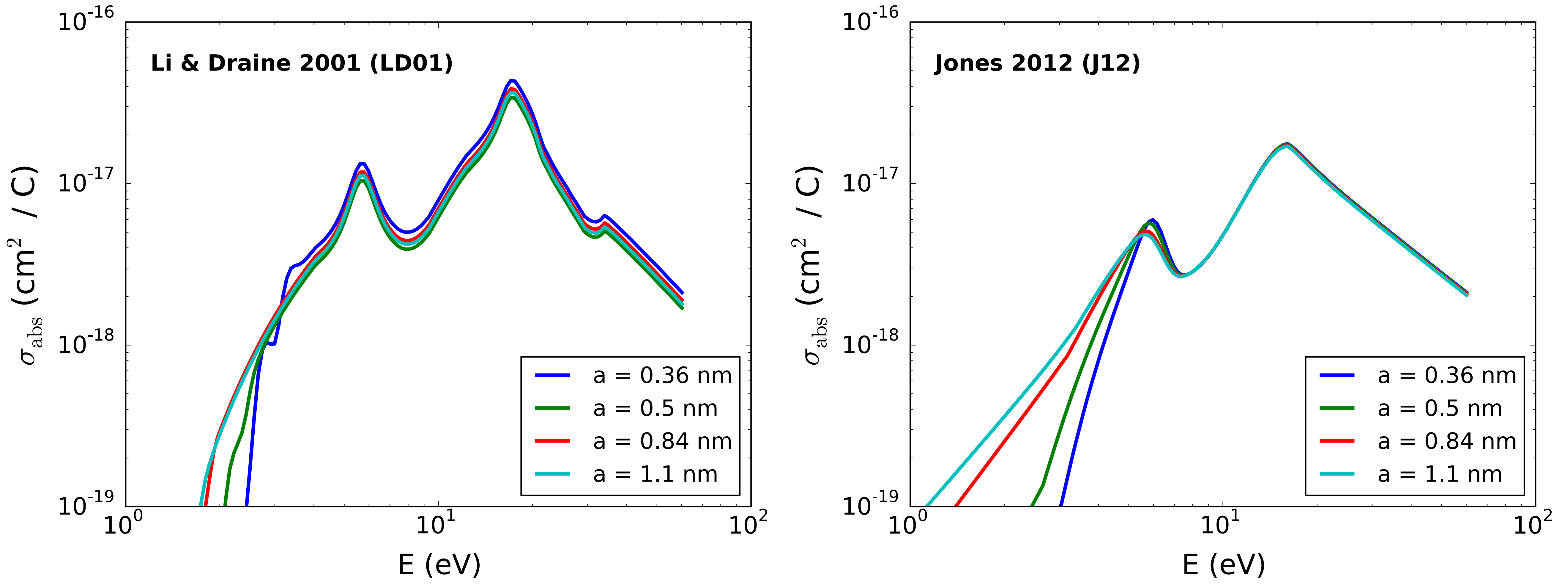


- Verstraete, L. & Léger, A. 1992, A&A, 266, 513
- Li, A. & Draine, B. T. 2001, ApJ, 554, 778
- Jones, A. P. 2012, A&A, 542, A98

***Micelotta**, Jones & Juvela 2016, in prep.*

Photo-absorption cross section II

Optical - UV



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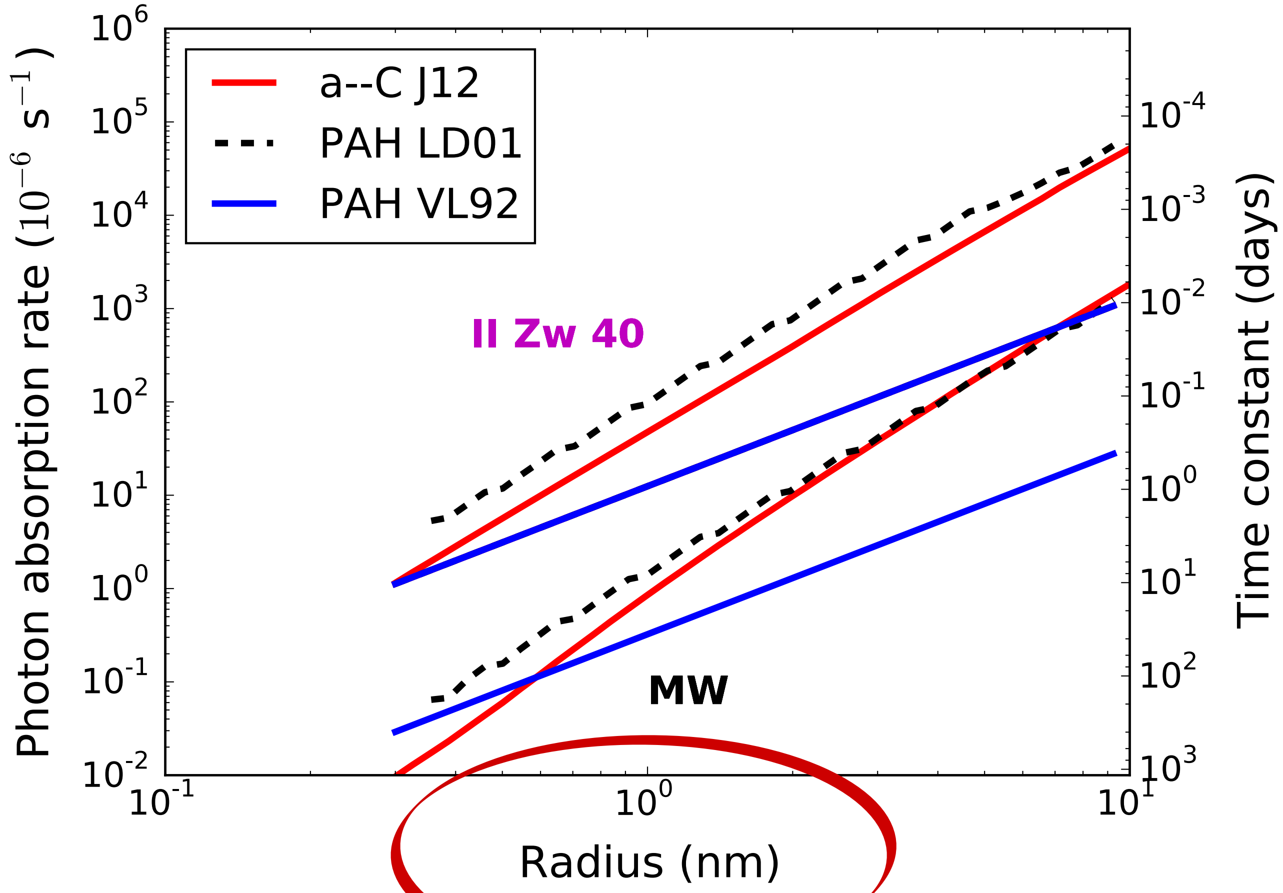
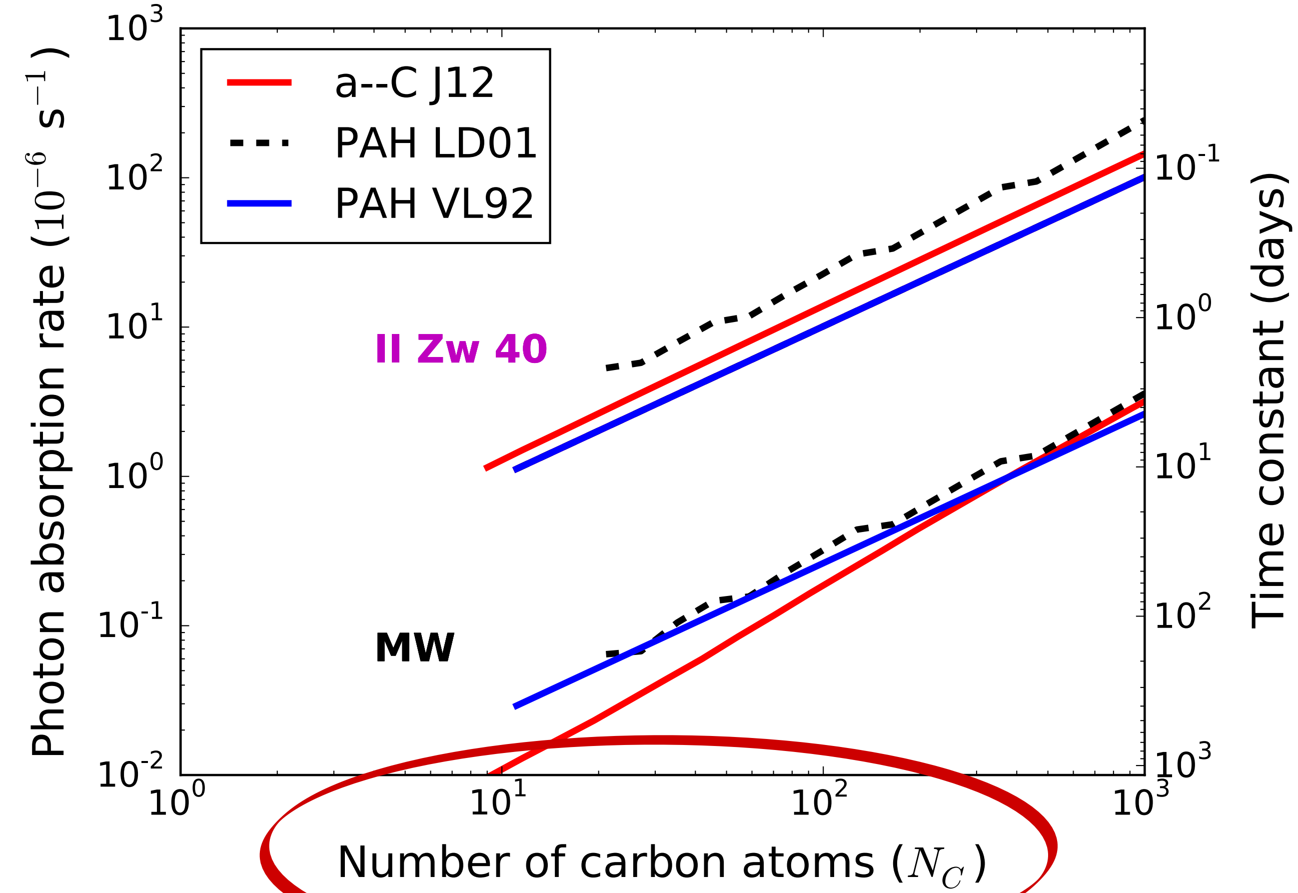
- Jones, A. P. 2012, A&A, 542, A98

Photon absorption rate

Optical - UV





vs.

Dissociation probability

- **Statistical** fragmentation instead of IR emission
- All particles treated as **PAHs**
- Use of **formalism** developed for **PAHs** to treat dissociation induced by **electron collisions** in shocks/hot gas (Micelotta et al. 2010a,b)

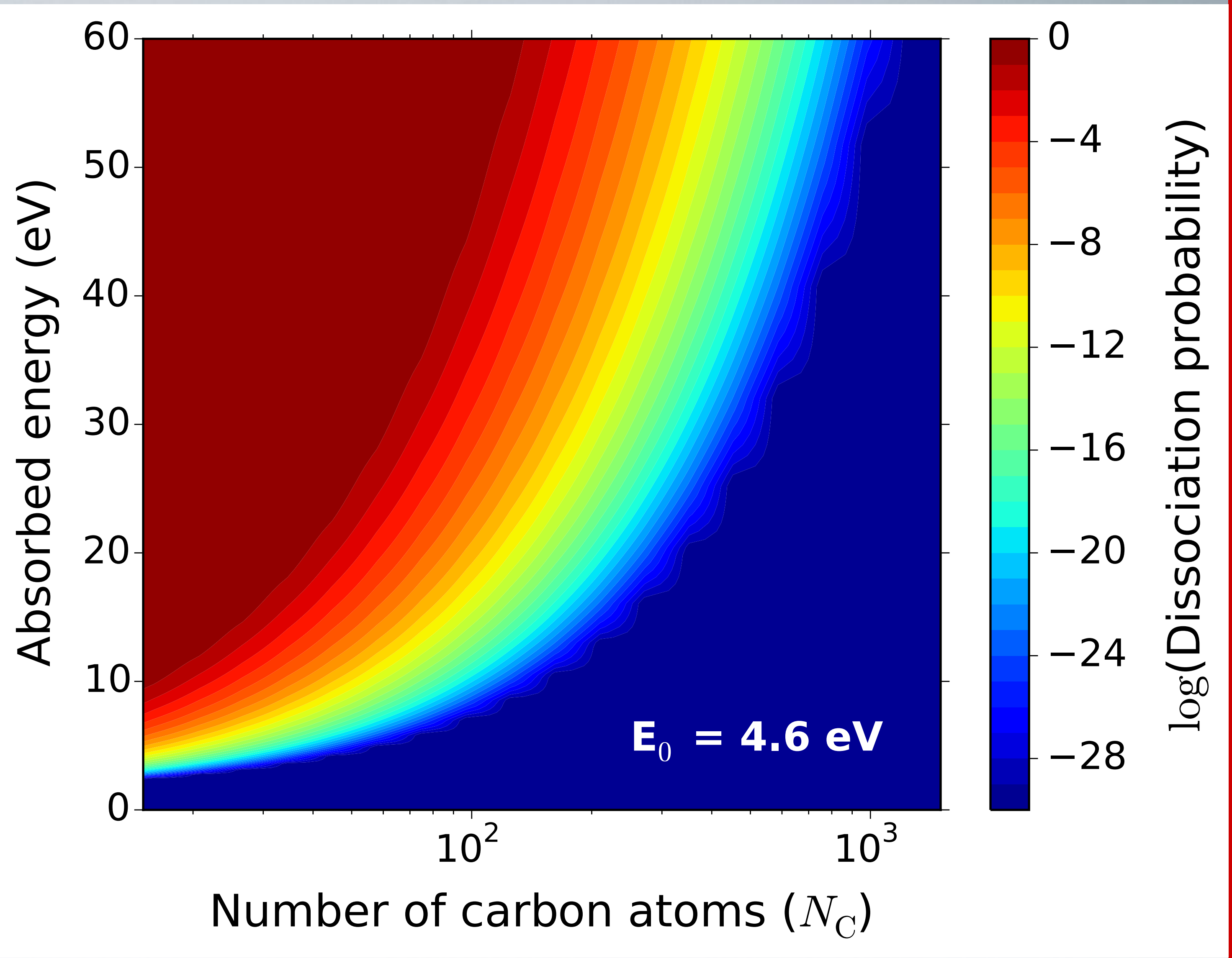
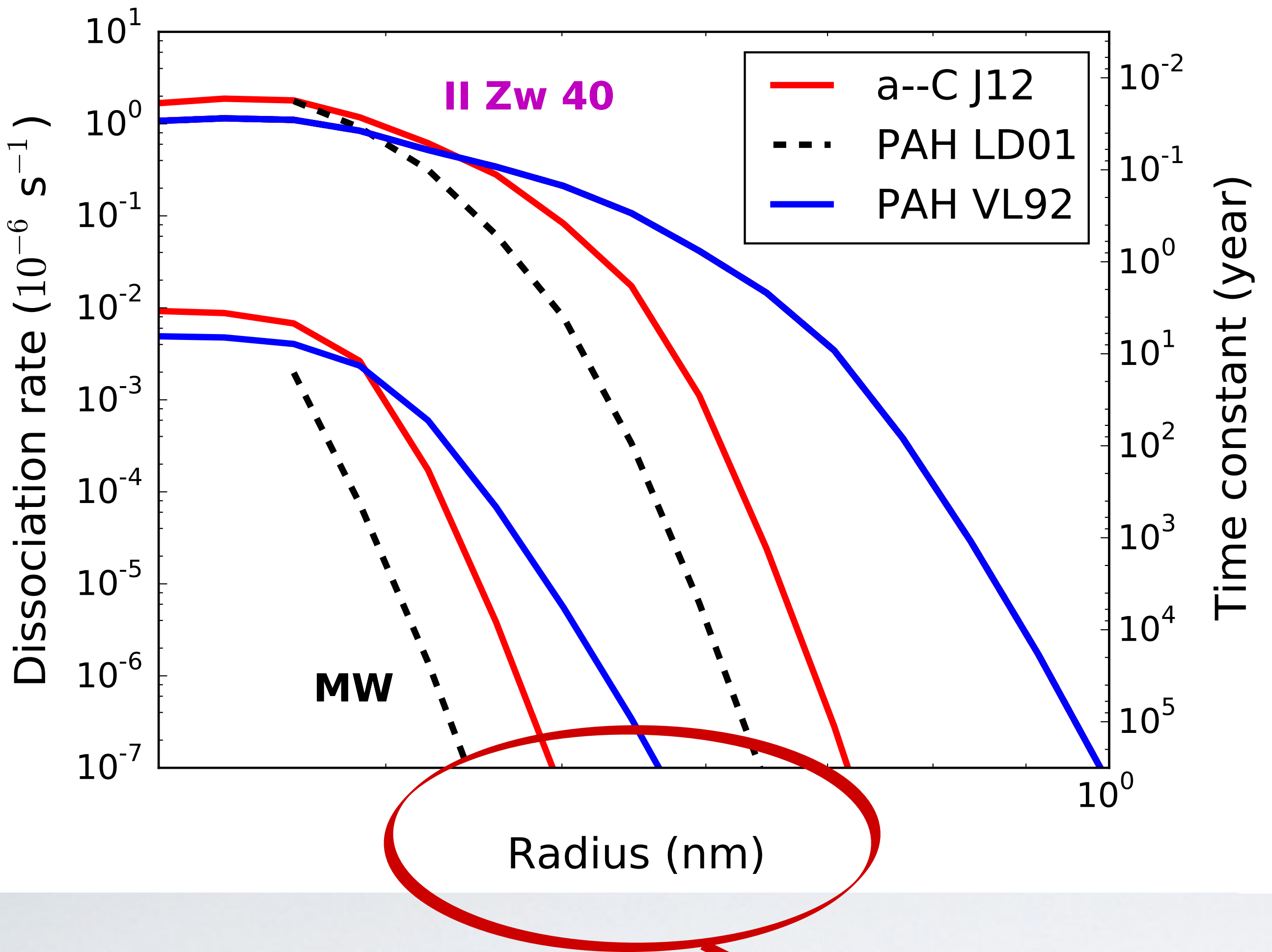
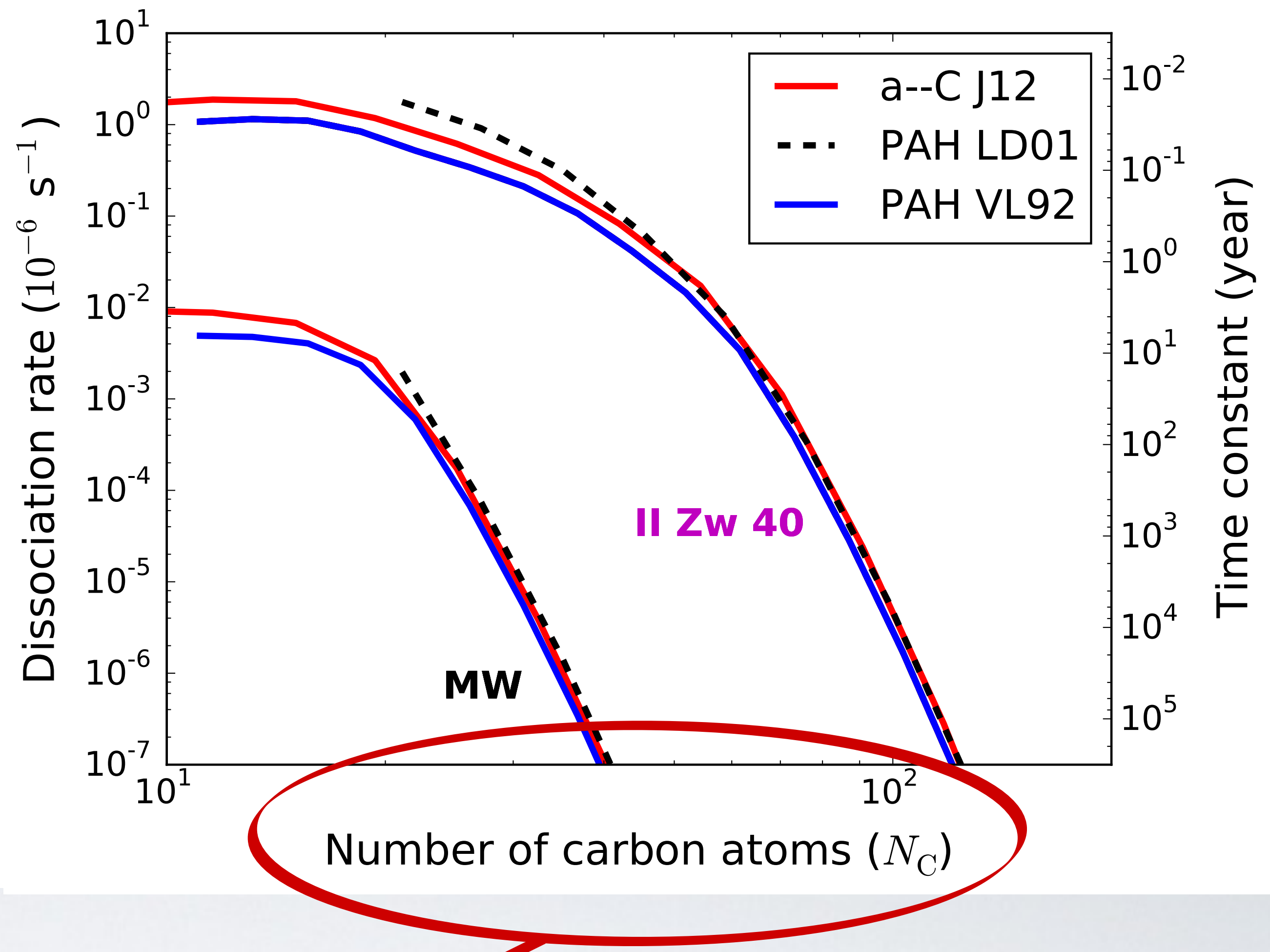


Photo-dissociation rate

Following Vis-UV absorption

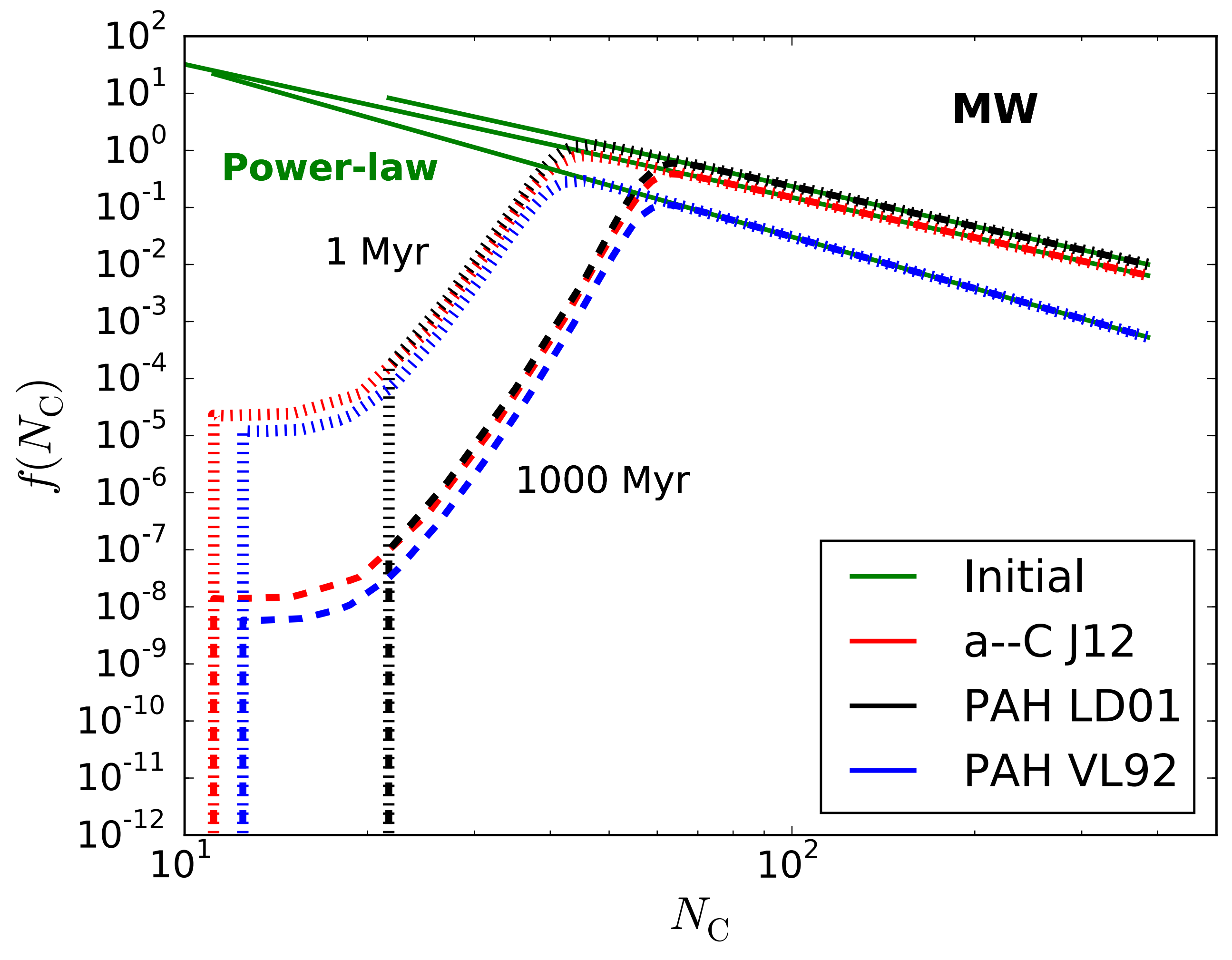


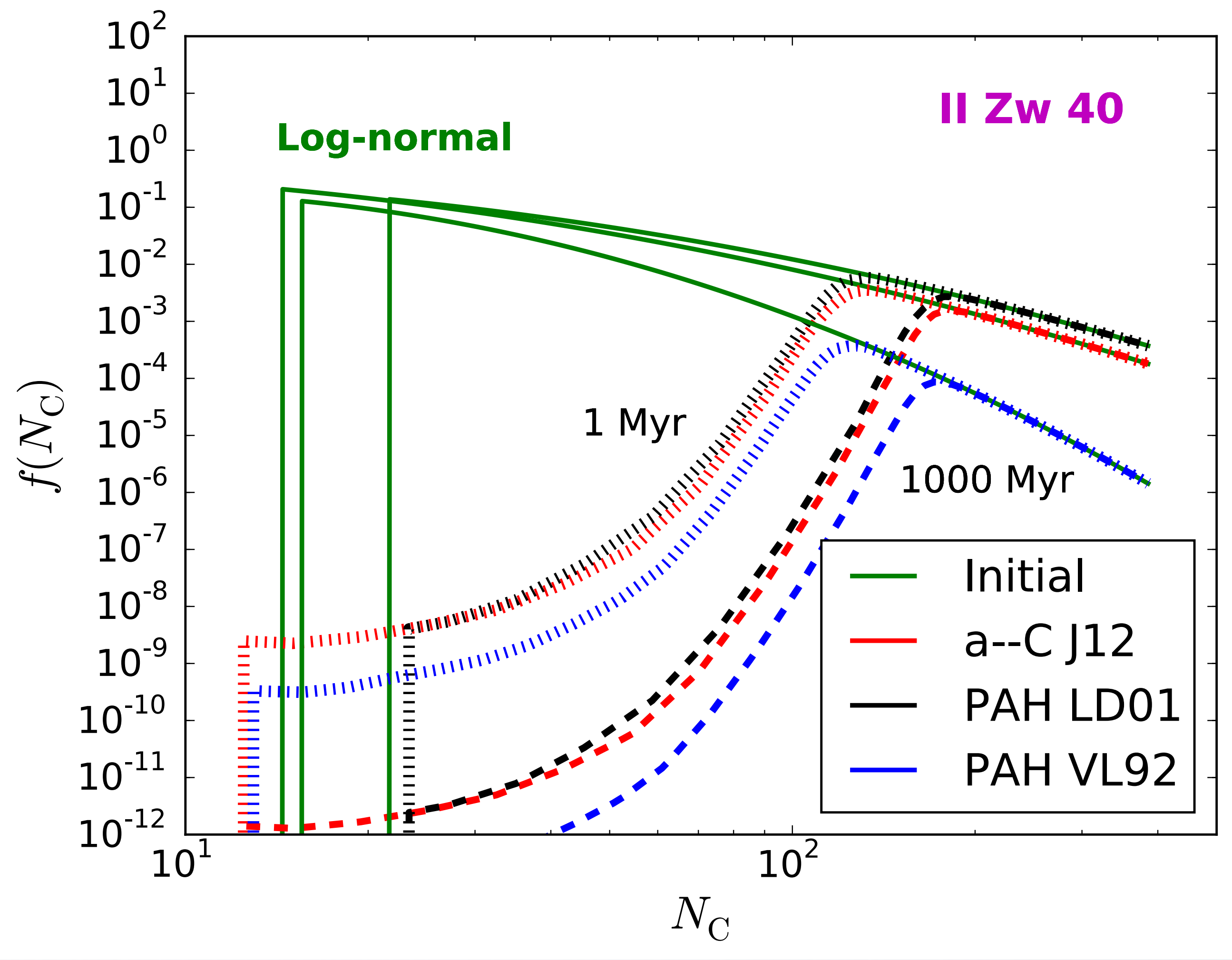


vs.

Modified size distributions I

The effect of photo-dissociation





Power-law for all:
the "native" distribution of
nanoparticles - J12

Log-normal for all:
the "native" distribution of
astronomical PAHs - LD01

Modified size distributions II

The effect of photo-dissociation & initial grain size distribution

EACH KIND of particle with its **"NATIVE"** initial distribution

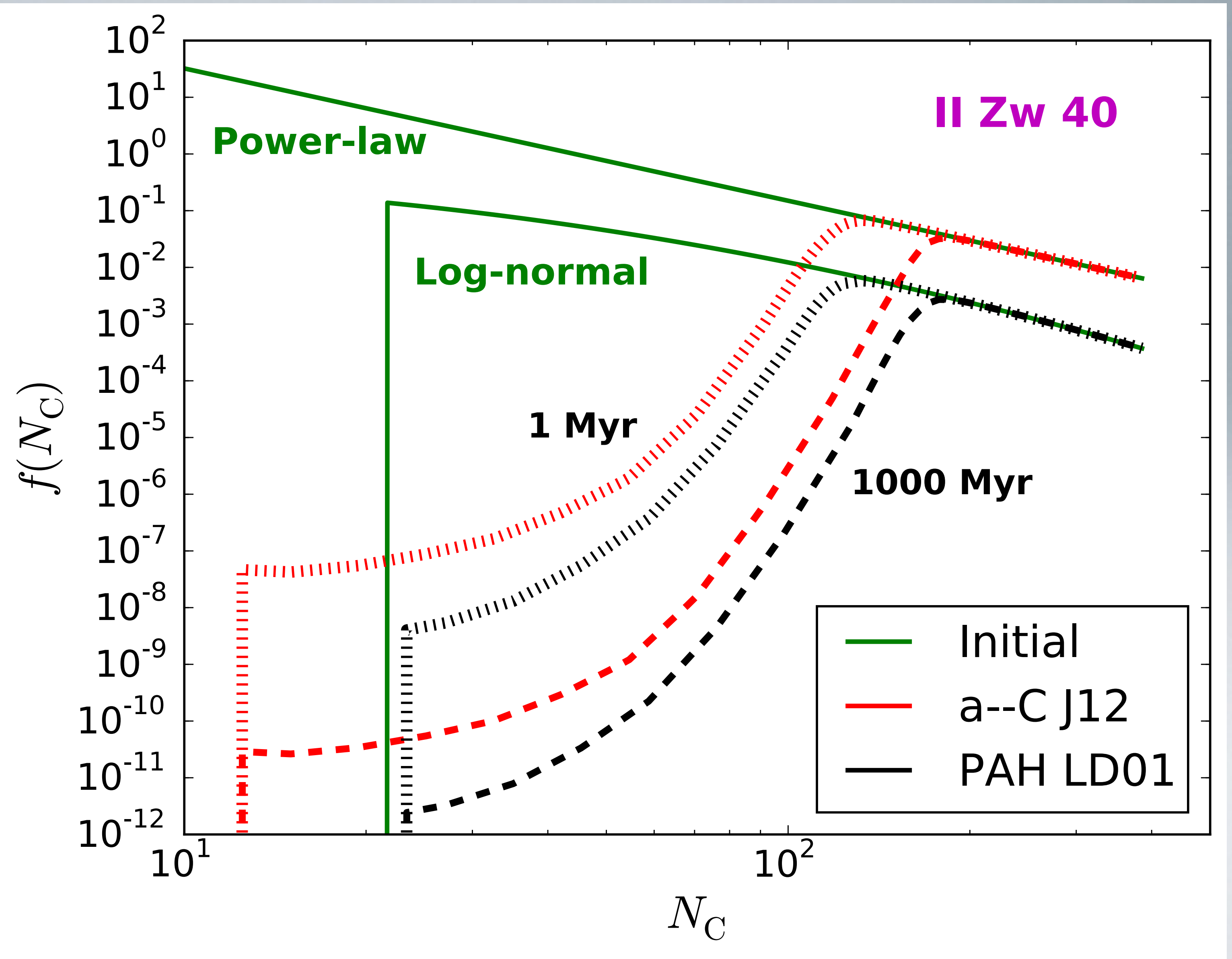
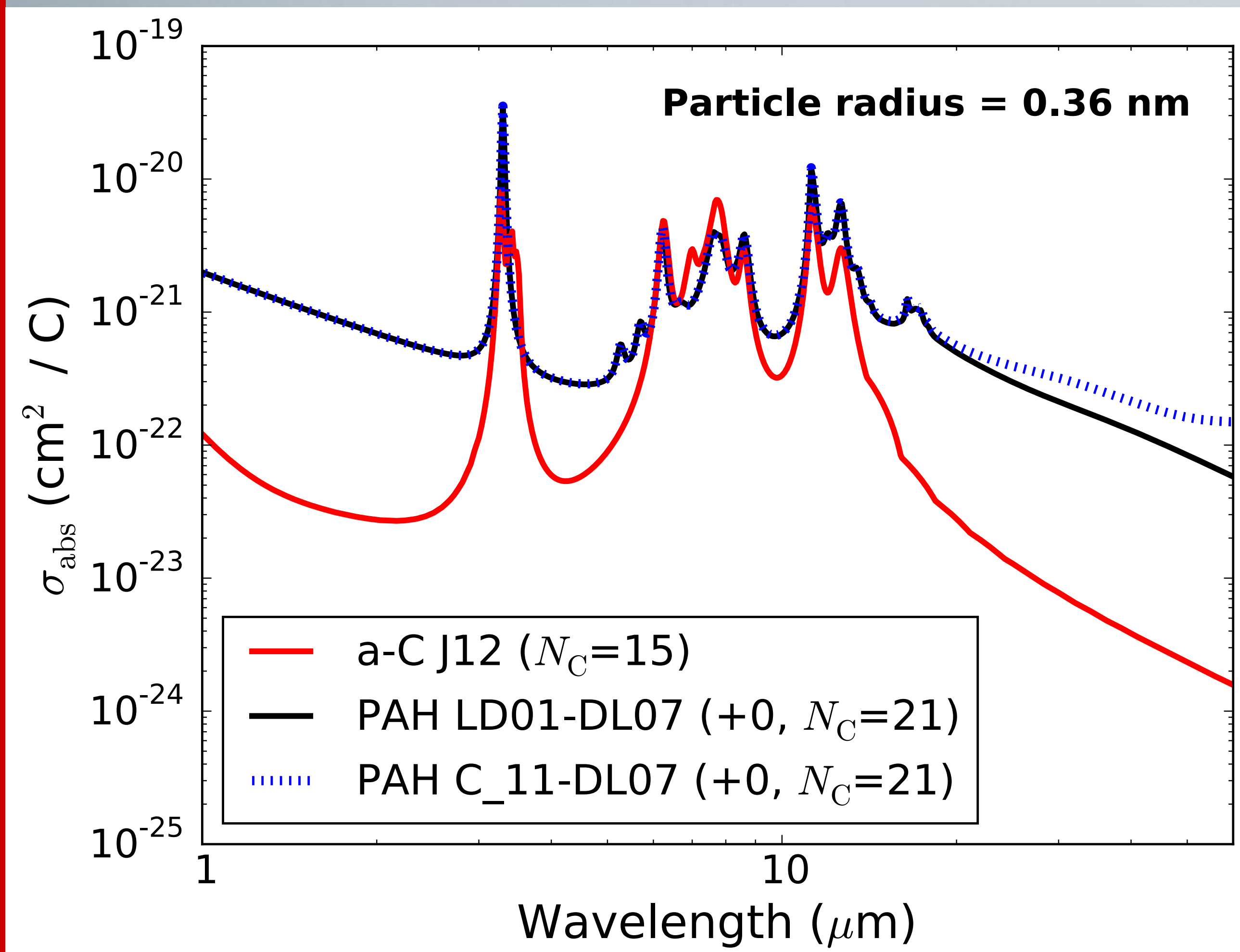
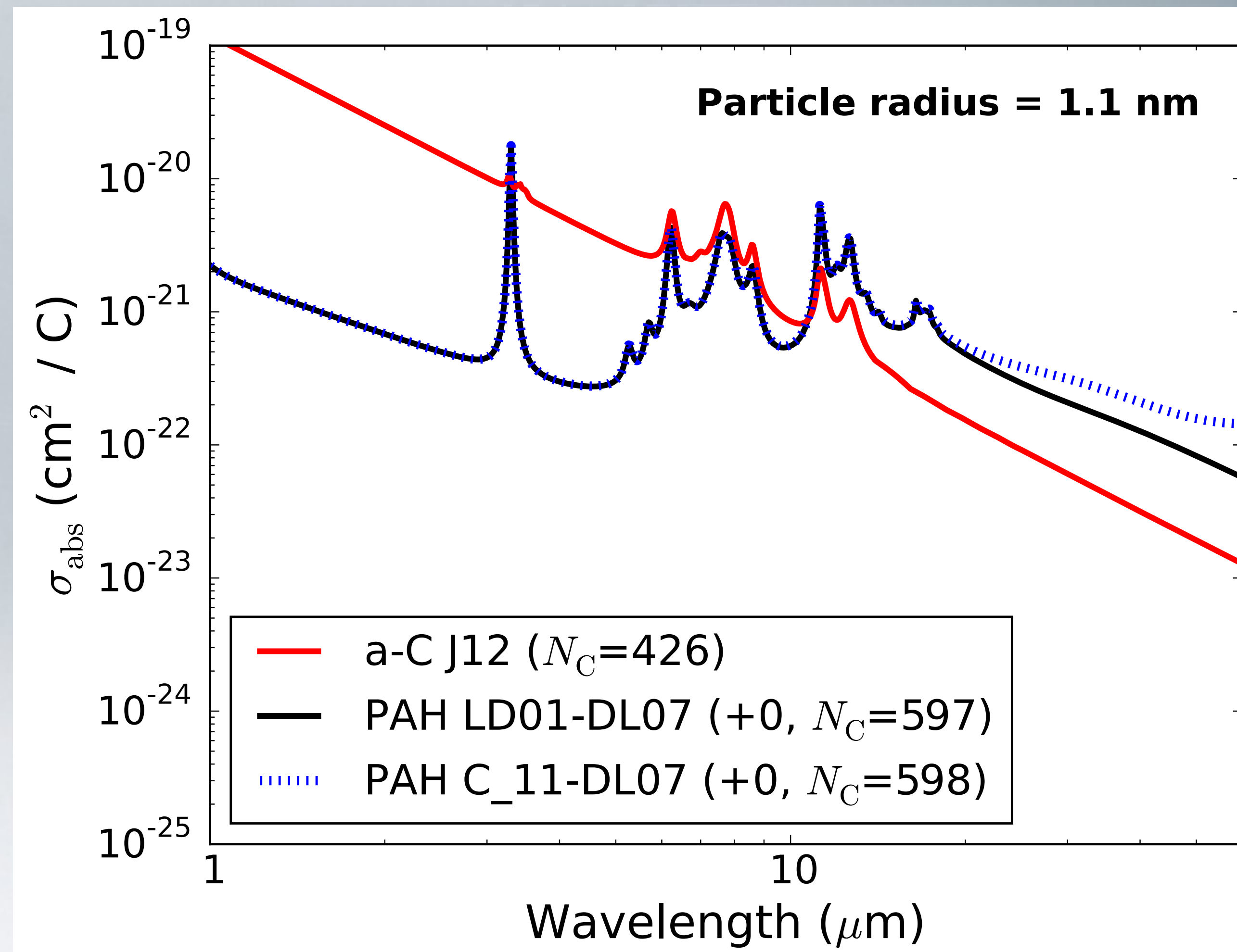


Photo-absorption cross section III

Infrared

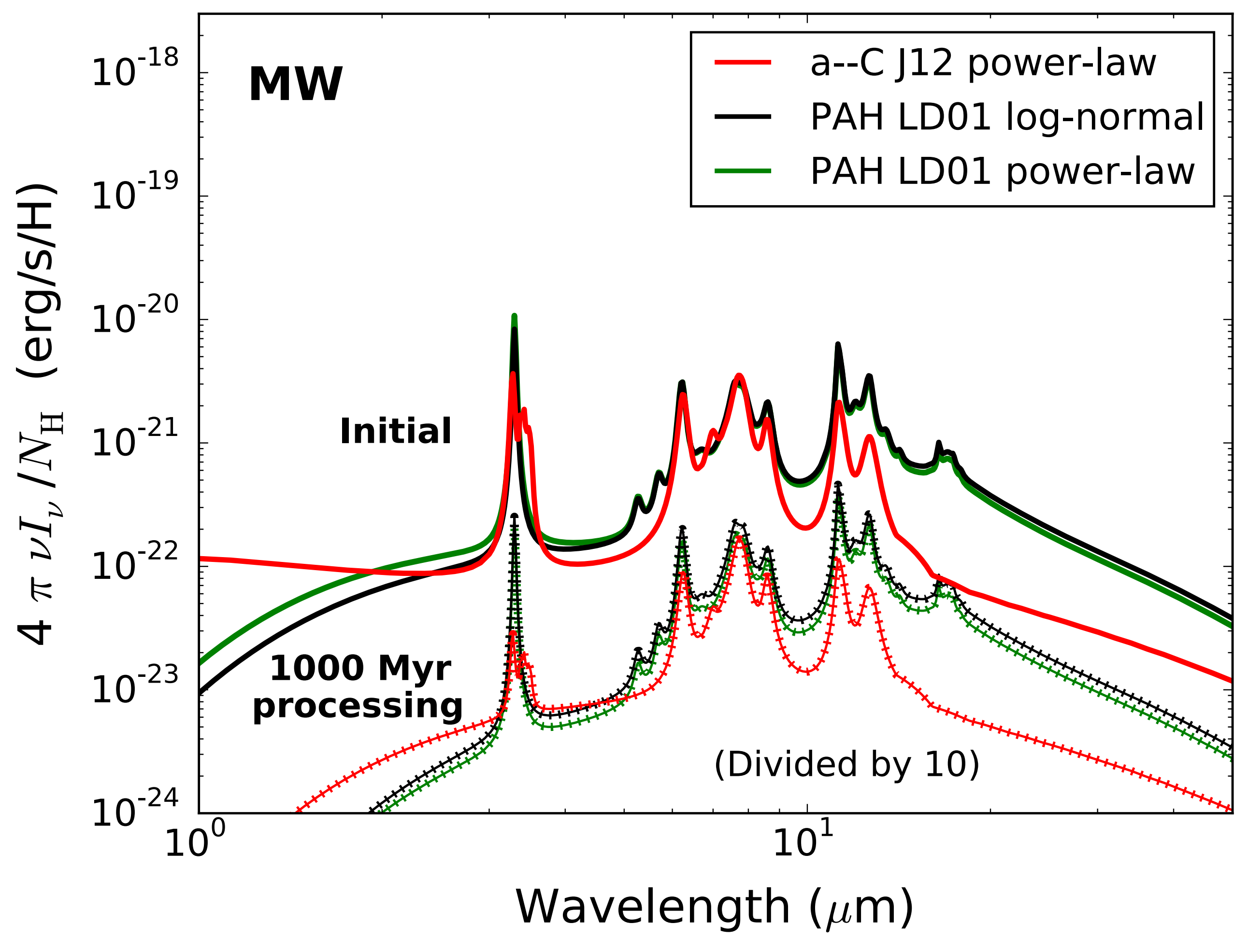


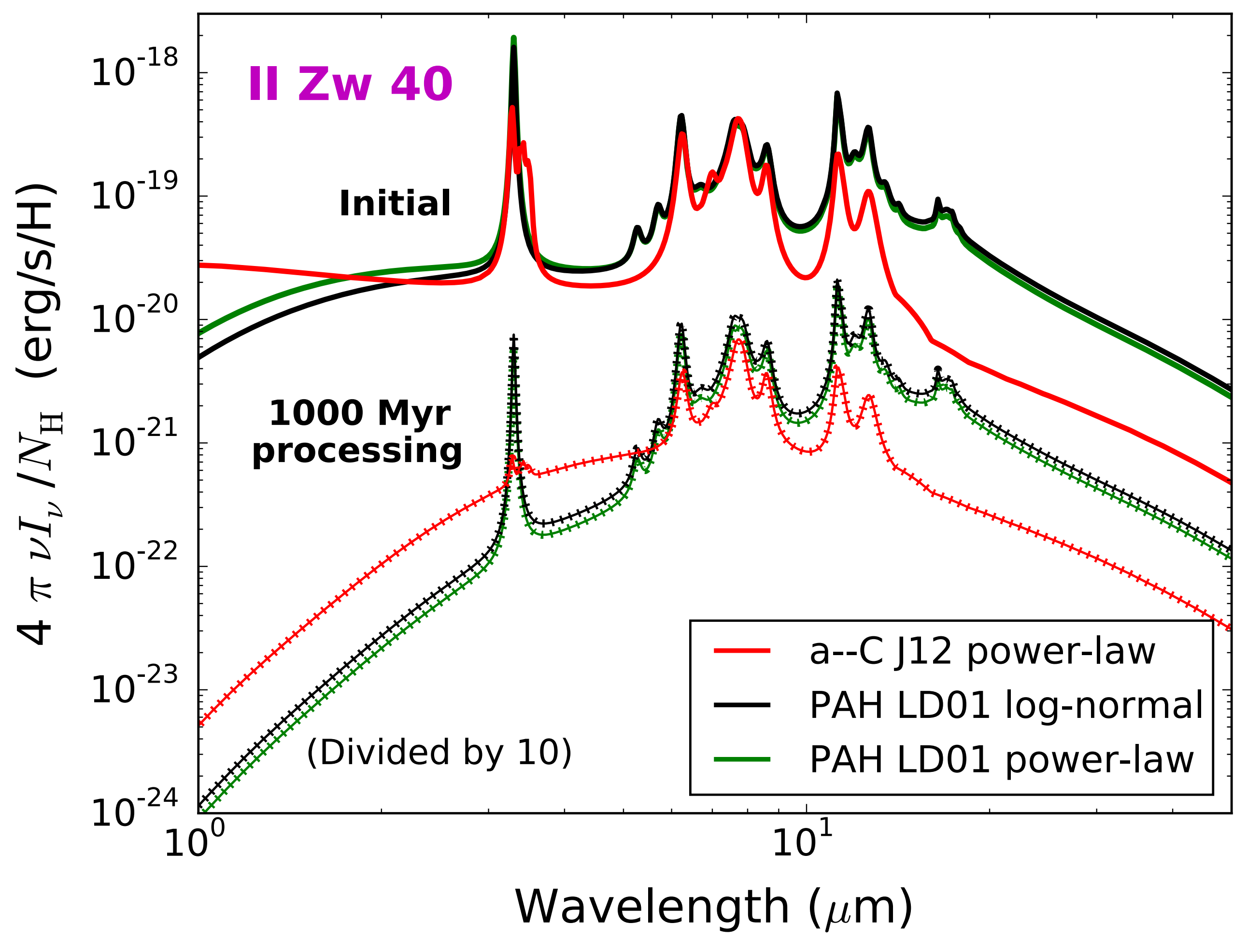


- Verstraete, L. & Léger, A. 1992, A&A, 266, 513 — Compiègne, M., et al. 2011, A&A, 525, A103
- Li, A. & Draine, B. T. 2001, ApJ, 554, 778 — Draine, B. T. & Li, A. 2007, ApJ, 657, 810
- Jones, A. P. 2012, A&A, 542, A98

Infrared emission

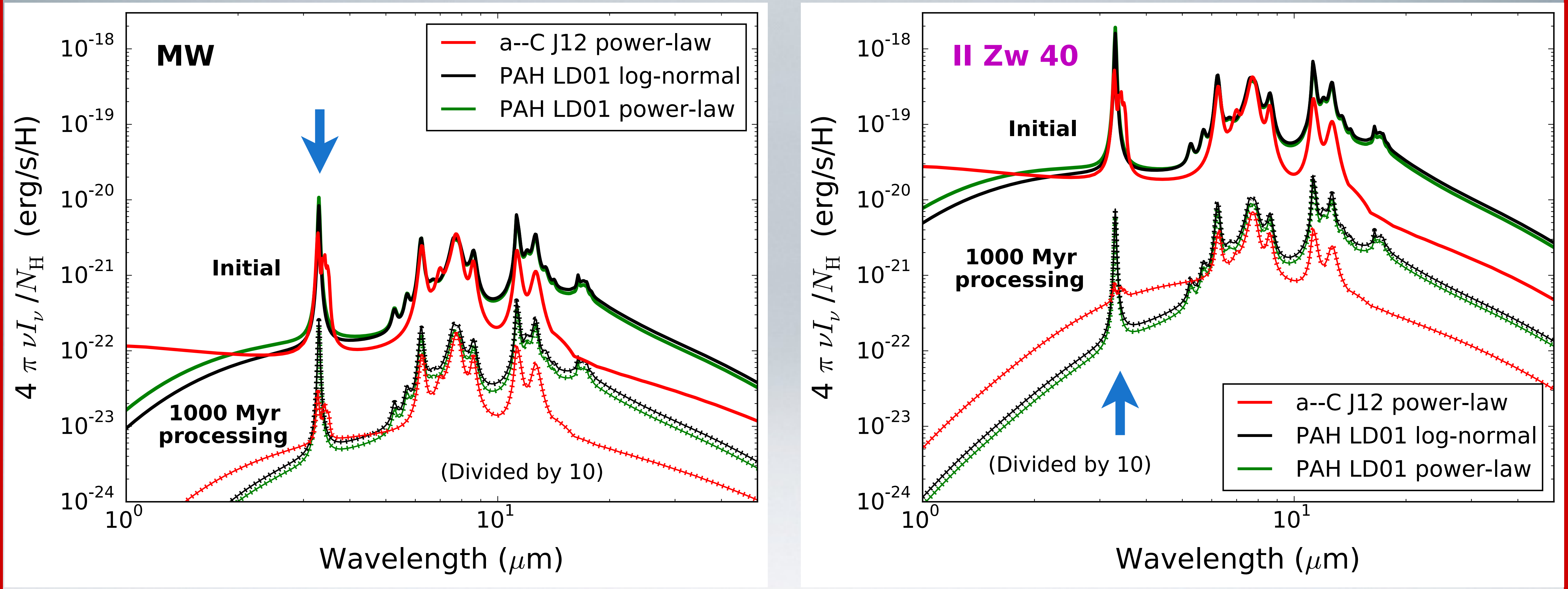
From photo-processed species and size distributions





Infrared emission

From photo-processed species and size distributions



Note the SUPPRESSION of the 3.3 - 3.4 µm complex in NANOPARTICLES emission

Take-home messages

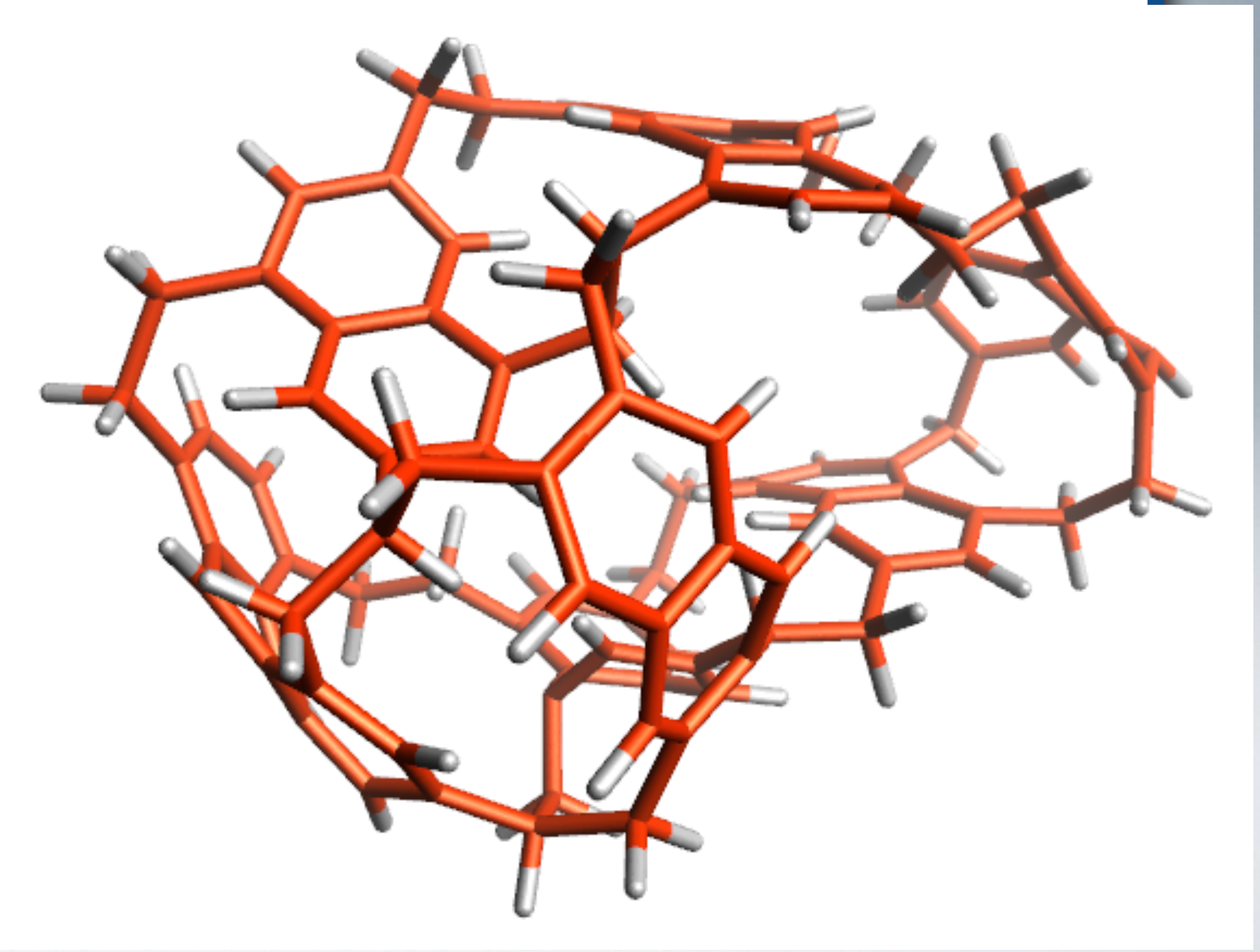
- **a-C** nanoparticles contain **AROMATIC DOMAINS** → determine their properties → **SIMILAR TO PAHs**.
- **a-C** grains **SIMILAR** to **“ASTRONOMICAL” PAHs**.
- Important to consider **RELEVANT** parameter for processing: N_C instead of radius.
- Size distribution **MODIFICATIONS** very **SIMILAR**.
- **IR** emission very similar **EXCEPT 3.3-3.4 µm**.
- Suppression **ONLY** for this bands.

Perspectives

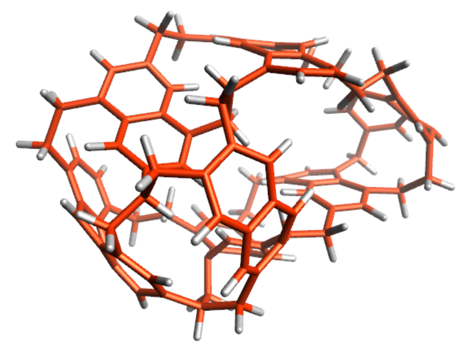
- Which **STRUCTURE** for **a-C NANOPARTICLES**?
- Which **PHYSICAL APPROACH** for such particles?
- How does this **COMPARE** with **OBSERVATIONS**?
- How does this **AFFECT** global **SED MODELLING**?
- Which **ROLE** in dust evolution? E. g. in **EXPOSED** parts of clouds.

Perspectives

- Which **STRUCTURE** for **a-C NANOPARTICLES**?
- Which **PHYSICAL APP**
- How does this **COMP**
- How does this **AFFE**
- Which **ROLE** in dust
  parts of clouds.



Perspectives



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Thank you!