



Astrochemistry

(ice-gas synergies)

(UK = lab. + modeling + obs. strengths)

(data needs driven by: ALMA / SOFIA // JWST / E-ELT / PLANK / SKA / SPICA)

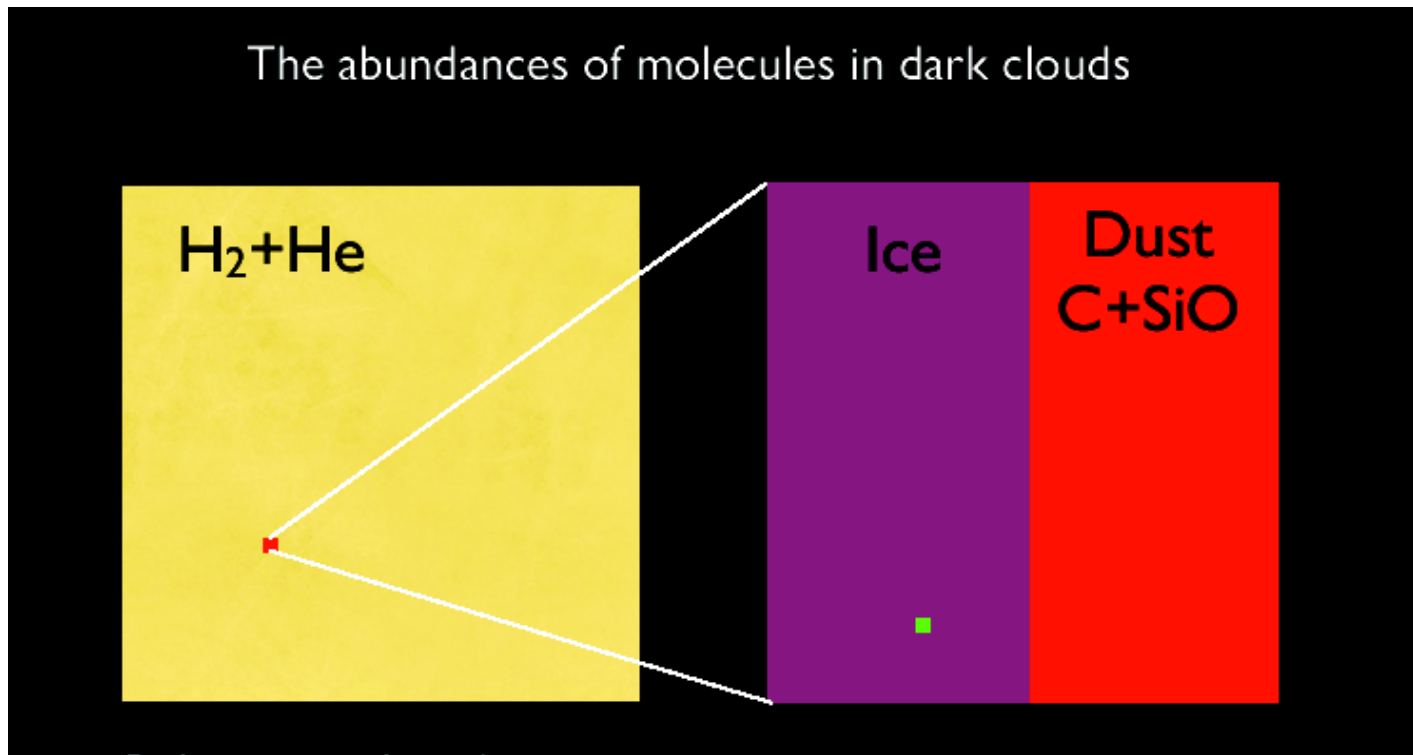
Sorry – omitted = solar system

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What we see in gas ϕ

- Can originate from solid state
- Can be depleted to solid state
- Can be dependent on historical solid state chemistry



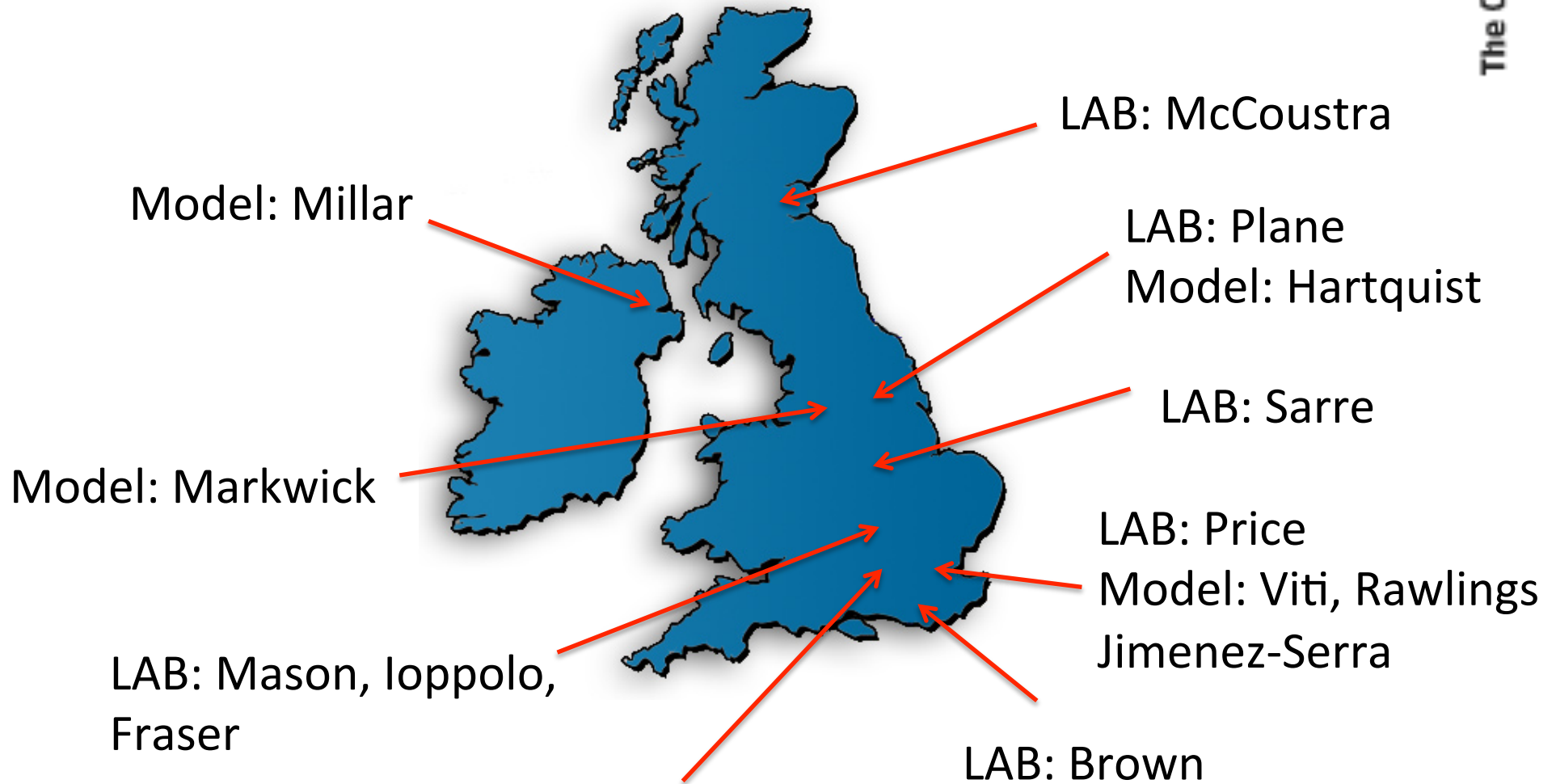


Data Needs from Astrochemical Perspective

- To observe molecules
 - gas and ice spectroscopy 
- To UNDERSTAND origins of molecules
 - Modelling 
 - Laboratory data 
 - Desorption, Diffusion, Chemical reaction rates, Branching ratios, Cross sections
- To extract astrophysics
 - Models as $f(\text{time})$ and / or $f(\text{local conditions})$
 - Laboratory data required with same finesse



e.g. of UK Landscape of Expertise



DIAMOND/ ISIS/ ESA ELIPS

UK Data into Databases?



- Very little UK Lab involvement (except Nigel Mason) in feeding ice data INTO databases
- Often generating our own data – UK Lab <-> model collaboration
- Often generating our own spectra ad hoc (Leiden & GhoSST incomplete) - > see ALEKSI's talk
- WE NEED CONSOLIDATED LINKS BETWEEN DATA BEING GENERATED FOR MODELS AND DATA GENERATED FOR OBSERVATIONAL ANALYSIS.. IN ICE CHEMISTRY = “HOLE”

Limited databases that exist (Leiden Jena Grenoble (private))

Don't necessarily link / co-identify or have validation = huge issue with KIDA (add your data in) = huge issue ref back to lab data (funding)

The Era of Astrochemistry

Is the chemistry underpinning star & planet formation universal?



On Scales Getting “Larger”



- local galaxies

Resolving YSOS in nearby galaxies:

Is ISM / ice / gas the same?

Is chemistry the same as f(conditions)



- higher redshift
- Is chemistry consistent moving towards highest SFR @ $z=2$
- What is the highest z where dust and ice pervade galaxies?
- Chemistry of the first stars / galaxies: do “dust & ice” have a role?

On Scales Getting “smaller”



- pre-stellar clouds

Chemistry as a precursor to SF

Chemical indicators of collapse

Ice distribution: ingredients

Is chemistry and SF the same?

- planet –forming regions

Chemistry as f(disk, r , h)

Inner envelope “edge” vs outer envelope

Snow lines

Asymmetric dust rings



- exoplanets & exomoons
- How is chemistry related to planet type?
- Planetary atmospheres

What next?

- STFC LAD project:-
Feeding observational constraints to models
software for ice observational analysis (suitable for all)
- 3 workshops
 - i. May 22nd Edinburgh “Data needs for solid-state observations” by invite (UK community)
 - ii. July 13th UCL “Databases of Ice Spectroscopy” links to KIDA / SSHADE
 - iii. Sept / Oct – STFC LAD -> community
- KIDA workshop Paris May 5-7th 2015
- IAU GA Aug 3 – 14th 2015 “ Laboratory Astrophysics” Commission