

Looking into invisible Galactic molecular gas in absorption against bright QSOs

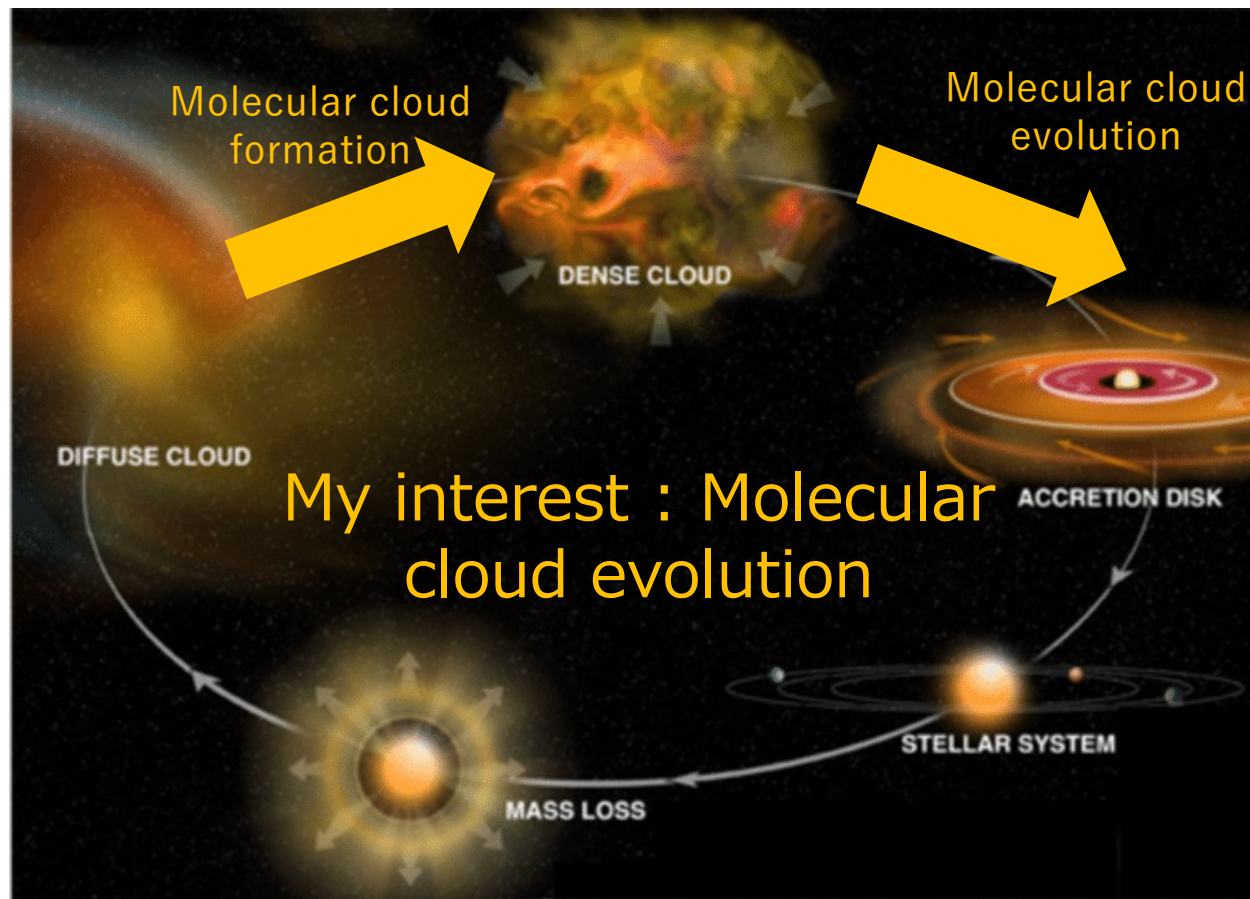
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About Me

- Kanako NARITA
- The University of Tokyo
- Dept of Astronomy M2
- Radio Astronomy

Molecular clouds: key role in the baryon cycle of galaxies



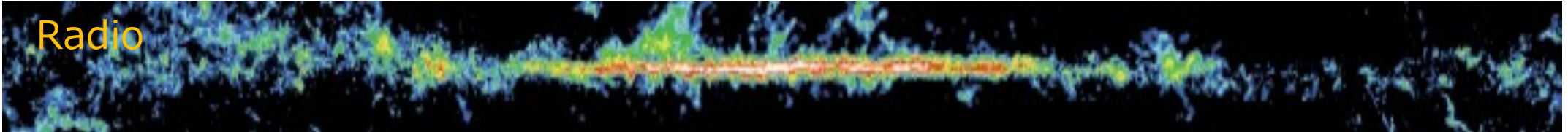
Bill Saxton,
NRAO/AUI/NSF

Visible vs invisible

Optical



Radio

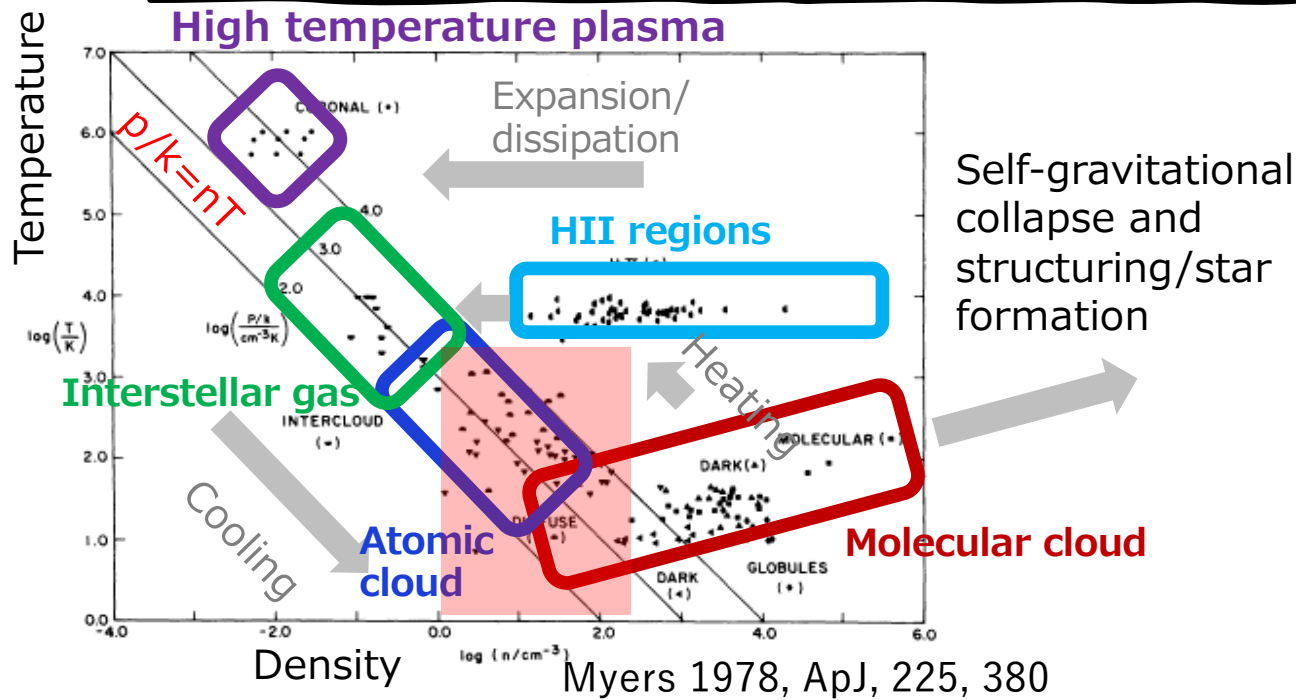


https://asd.gsfc.nasa.gov/archive/mmw/mmw_images.html#about

Molecular clouds are composed of gas and dust, and are invisible in optical wavelength because of their low temperature (~ 10 K).

Dust absorbs the background starlight, and they appear as dark clouds. Such clouds are "visible" in molecular line emission in radio wavelengths.

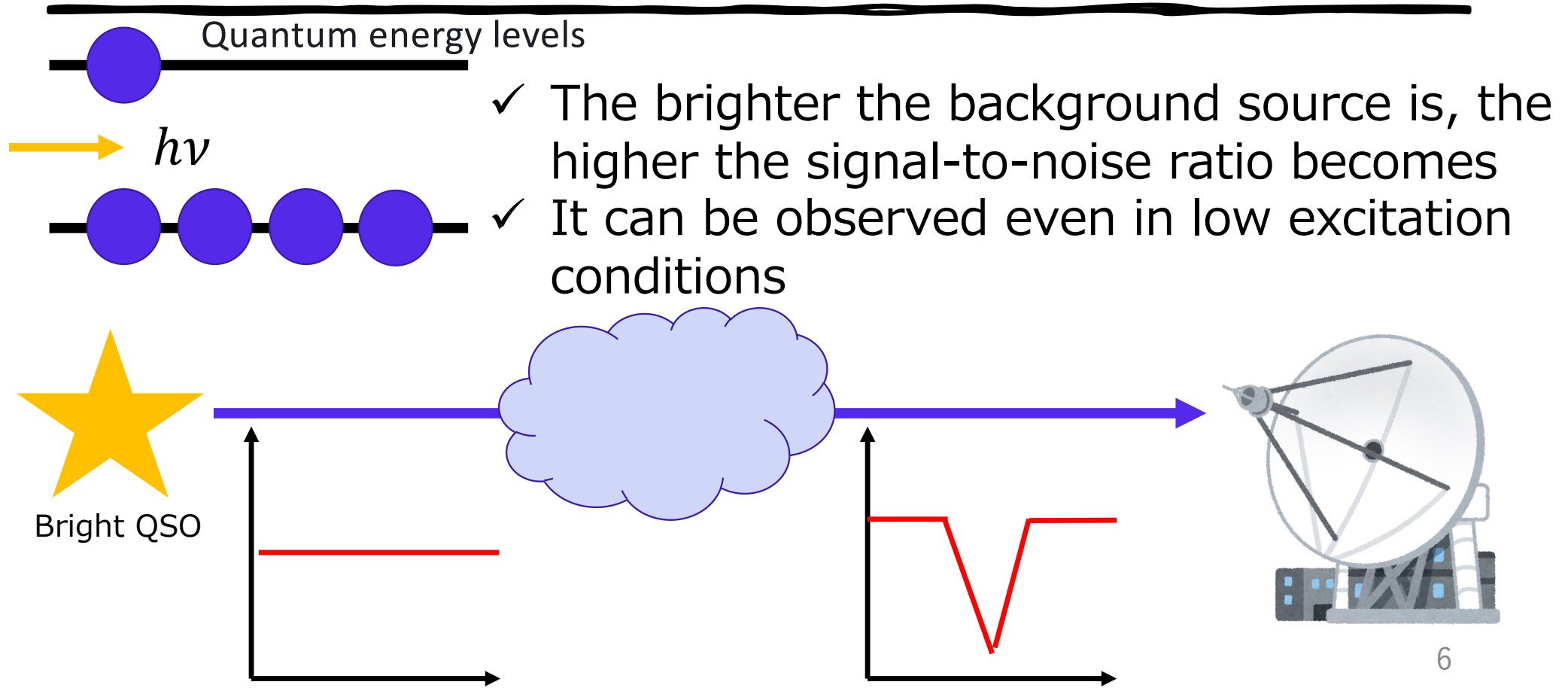
Unexcited or nonexistent?



Diffuse gas is not observed in emission even in radio waves because it is near thermal equilibrium with the cosmic background radiation.

The atomic/molecular transition region contains diffuse gas in which collisional excitation is insufficient. This region provides a key to understanding **initial stage of molecular cloud evolution**, but its observational studies are limited.

Absorption spectroscopy is a powerful tool for diagnosis of invisible molecular gas!

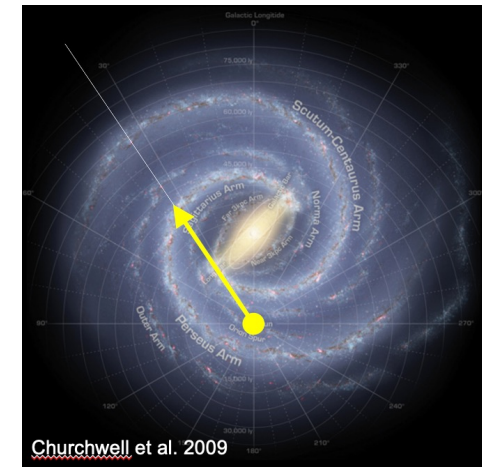
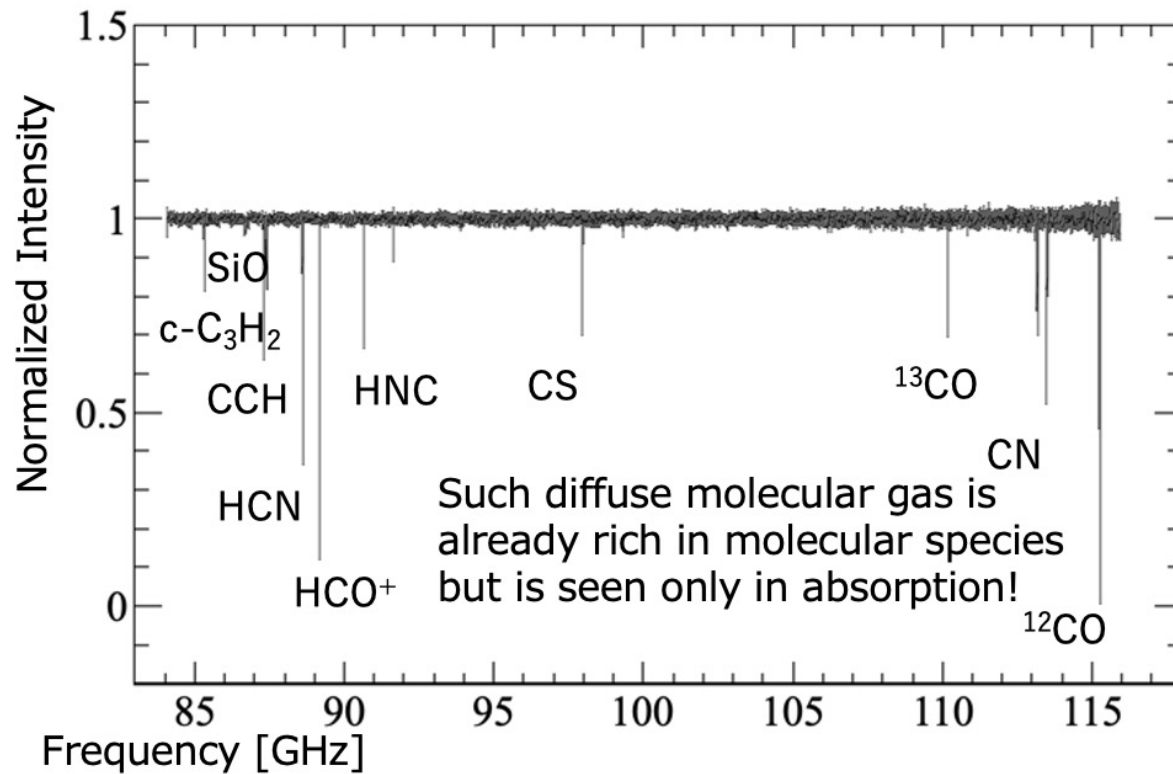


Focus on archival data!

The screenshot displays the ALMA archive interface. At the top, there is a search bar and a navigation menu with options like 'Explore and download'. The main area is split into two panels: a large image of the ALMA antenna array on the left and a spectral plot on the right. The spectral plot shows intensity versus frequency (GHz) with markers for lines 3 through 10. Below the plot, there are tabs for 'Observations (64695)', 'Projects (4285)', and 'Publications (3286)'. At the bottom, a table lists observation details for a specific entry.

Project code	ALMA source name	RA	Dec	Band	Cont. sens.	Frequency support	Release date	Publications	Ang. res.
2011.0.00191.S	Fomalhaut b	22:57:38.685 h:m:s	-29:37:12.616 d:m:s	7	0.1181 mJy/beam	343.077..358.839 GHz	2012-12-06	2	1.047 arcsec

Molecular species seen in absorption



Take home message !

- On ne voit bien qu'avec le cœur.

L'essentiel est invisible pour les yeux.

Le Petit Prince

- Je vous remercie de votre attention !

