Heterodyne Discussion Session

Capabilities

What instrumentation and facilities do we currently have access to?

Demands

In the next 5-10 years:
What instruments/facilities are needed for the science goals?

Advancements

In the next 5-10 years:
What instruments/facilities are we building?
What instruments/facilities can we get involved with?

Capabilities

What instrumentation and facilities do we currently have access to?

-1 Gb per second current data rate
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Demands

In the next 5-10 years:
What instruments/facilities are needed for the science goals?

-Currently less proposals at 230 than for 345 GHz - increasing speed to observe dense gas tracers would be useful
-Heterodyne and Continuum should complement each other (overlap in frequency for fair comparisons)
-12CO(3-2) important for polarization science (GK effect). Velocity dispersion information from C18O(3-2) traces same critical density as dust
-LNA cover full bandwidth 12CO(3-2) and 12CO(2-1)
-Take advantage of altitude: 345, Avoid continuum competition: 230. 230 has a strong case (strong lines)
-Flexibility will be key
-We need a plan for the 50M telescope age
-Polarisation may increase in importance - Goretex still concern

Demands

In the next 5-10 years:
What instruments/facilities are needed for the science goals?

-Blind survey (high redshift) with a wide field of view and wide bandwidth is ideal
but initially this is unrealistic
-High redshift - a larger backend to detect multiple lines would be ideal
-Map magnetic field in galactic plane (Planck has a lot of contamination)
-3%/5% CO polarisation - so it is detectable
-Mapping sky, usually interested in a particular set of lines. Divide spectrometer's bandwidth
-ALMA has 4 windows (16GHz) - 200GHz to 400 GHz is feasible
-On chip spectrometers? Spectral resolution is hindered
-Need to resolve velocity dispersion with significant resolution (comparable to sound speed of gas)

Demands

In the next 5-10 years:
What instruments/facilities are needed for the science goals?

-Wide enough bandwidth to observe several molecules simultaneously - multiple transitions
-Common user telescope - need to cater to a variety of projects
-Future spectrometer may have much more flexibility (flexible resolution)
-1 pixel, but many ADCs for wide bandwidth - we would need to invest a lot in downconverters, IF/LO electronics - large cost
-Collaboration with SMA (zero-spacing) - wide bandwidth SMA should be complemented by our instrumentation (and vice versa)
-Extragalactic (even nearby) weak signal - wide bandwidth is key
-High redshift engines worthwhile because of the large amount of information in a single pixel
-100 pixels - large-scale structure
-Don’t need high resolution across full (very wide) bandwidth

Demands

In the next 5-10 years:
What instruments/facilities are needed for the science goals?

-Smaller array heavily optimized?
-If 100 pixels work, it would be very beneficial but the current technology is not scaleable
-Data Rates - how to handle all of the data produced?
-SKA and LSST is developing potential solutions
-Archive system on site
-Matt: Map Andromeda

Advancements

In the next 5-10 years:
What instruments/facilities are we building?
What instruments/facilities can we get involved with?

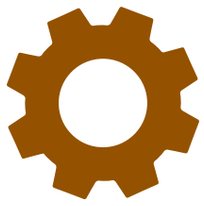
-100 pixel heterodyne instrument at JCMT (2nd generation HARP 345 GHz)
-Factor of 14 improvement over current instrument. Square degree 0.1K in 6.5 hours
-Should we consider 230GHz as opposed to 345GHz to take advantage of time on sky
- Should be used on 50M class telescopes
- This is an ambitious project and will require new solutions for backend - the next generation of telescopes will rely on these solutions
- Backend cost (with current technology) is very high
- Technology is getting better each year and the cost is dropping
- Cannot simply scale up current technology (prohibitive)
-Need to define technological challenges
-Modular (300 pixel system eventually?)

Advancements

In the next 5-10 years:
What instruments/facilities are we building?
What instruments/facilities can we get involved with?

-GPU cards - 1 card for 1 pixel, but this ratio is improving
-Perhaps not a major challenge but there are many details to consider
-Additional sampler required?
-Using less state of the art detectors can limit the cost
-In 1990s superconducting computers already being developed
-Fabrication technology same as SS - need science drivers
-Higher sampling rate = less resolution. Interferometers have cross-correlation (forgiving process). Single dish is more complicated - look to IRAM?
-Local Oscillators (off-the-shelf) exist at these frequencies

Advancements



In the next 5-10 years:
What instruments/facilities are we building?
What instruments/facilities can we get involved with?

-ADC developed for CASPER reasonable price? (ASIAA)
-Cost/Benefit analysis - it is likely that we can't have *everything*
-How many pixels are empty? We need to optimize