VLT/NaCo Observations of C/2013 A1 (Siding Spring)

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Motivation

- *Hubble*/WFC3 and IRTF/SpeX data indicate the presence of water ice.
  - Water ice likely driven out by CO_2.
  - If CO_2 driving activity at 1.4 AU, water ice could still be present (cf. Hartley 2 at 1.1 AU; A'Hearn et al. 2011).
- Comets have broad features attributed to organics at 3.4 μm.
  - Some indications for 3.28-μm emission from aromatic molecules in some comets.
  - Some aspects of the 3.4-μm features are better studied at low resolution.

Apparent Detection of Water-Ice at Siding Spring

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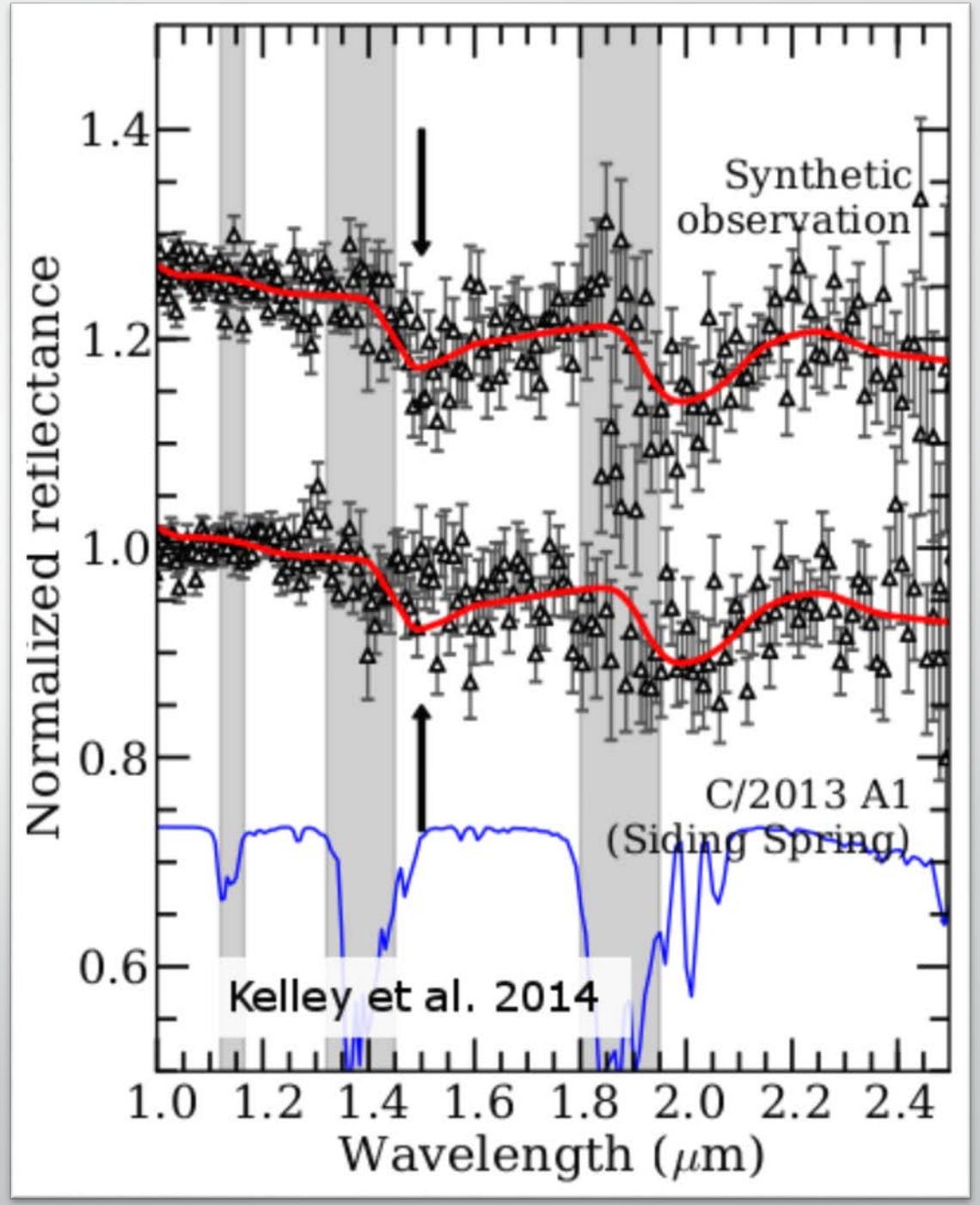
- IRTF/SpeX observations from Jan 2014 (3.7 AU).
- Coma is slightly blue, consistent with HST/WFC3 photometry (Li et al. 2014)
- 2.0-µm absorption feature, but no corresponding 1.5-µm feature. Similar to comet 17P/Holmes (Yang et al. 2010).
- Model (red line) based on Hartley 2 ice model of Protopapa et al. (2014).
- Further work will be reported at the DPS meeting.



3.4-µm Organics Band in Comets

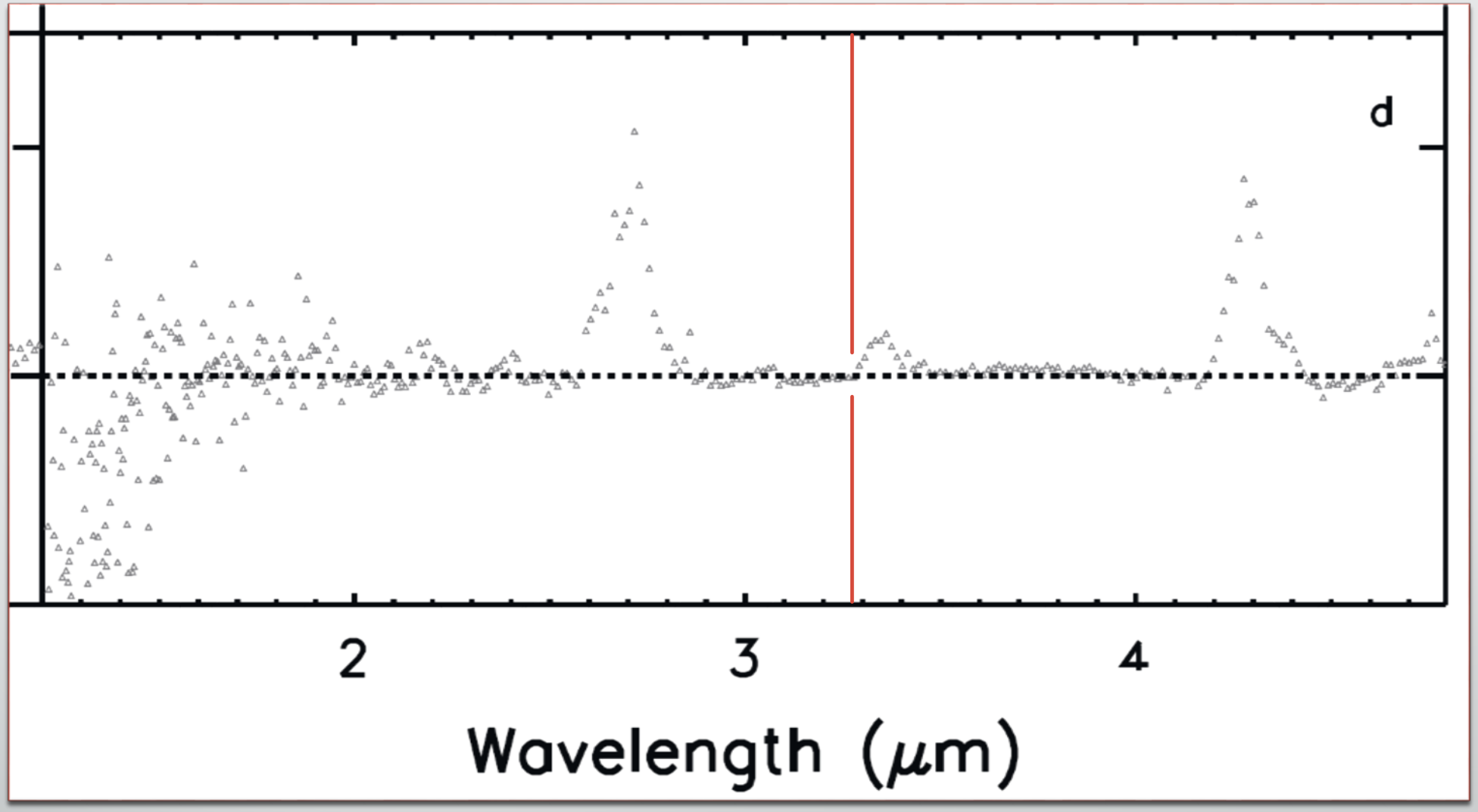
The *L*-band is a feature-rich region in the near-IR.

At low spectral resolution:

- Prominent 3.3-to-3.5-µm band.
- Weaker 3.53-µm band (methanol).
- Occasional 3.28-µm band (aromatics?), e.g., Bockelee-Morvan et al. (1995) report:
  - Missing in comet Austin (1990 V), but
  - Prominent in comet Levy (1990 XX).

3.28-µm aromatic emission requires small carriers, N_C < 100, and should have corresponding bands at longer wavelengths, especially 7.7 µm (Schutte et al. 1993).

See Fig. 1 of
Bockelee-Morvan et al. 1995.



Excerpt from Fig. 5 of Protopapa et al. (2014). The 3.4-μm feature and a small 3.55-μm bump are seen in *Deep Impact* spectra of comet Hartley 2. No 3.28-μm feature is observed here, but it has been detected from the ground in Gemini/GNIRS spectra (Wooden et al. 2011).

Science Goals

- To assess the amount of water ice in the coma.
- To provide spectral context for Mars spacecraft data.
- To assess the shape of the organics band in a dynamically new comet.

Comet	Class	$1/a_o$ (10^{-6} AU^{-1})	3.28-µm
Austin (1990 V)	DN	32	No
C/2013 A1 (Siding Spring)	DN	39	?
Levy (1990 XX)	DY	70	Yes
Hartley 2	JFC	-	Yes

NaCo

- Prism mode allows for 1-to-5-μm in a single order.
  - *L*-band is our priority.
- Observations are scheduled for Oct 5 and 6 (rh=1.4 AU, Delta=1.3 AU).