National Aeronautics and
Space Administration

Jet Propulsion Laboratory
California Institute of Technology
Pasadena, California

Presentation to MEPAG

Comets at Mars

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Comets Encountering Mars

- **Two comets will have close approaches to Mars in the near future**
  - *Comet 2012 S1 (ISON)* will pass within ~10 million km on Oct. 2, 2013
  - *Comet 2013 A1 (Siding Spring)* will pass within ~130,000 km on Oct. 19, 2014
  - These passages present observing opportunities and, in the case of Siding Spring, a potential hazard to Mars orbiters.
- **There are opportunities for unique observations by Mars assets**
  - Earth-based telescopes currently have a restricted view of ISON which is on the far side of the Sun; Mars does not.
  - The HiRISE spatial resolution when observing the Siding Spring comet from Mars orbit will be exceptional (~100-150 m/pixel)
  - The number of meteors from Siding Spring entering the atmosphere and potentially observable by the orbiters from above and by the rovers from below is large; ability to view is uncertain
  - *Caveat: The Mars spacecraft instruments are optimized for viewing the Mars environment—not for observing extended, low intensity objects like comets*

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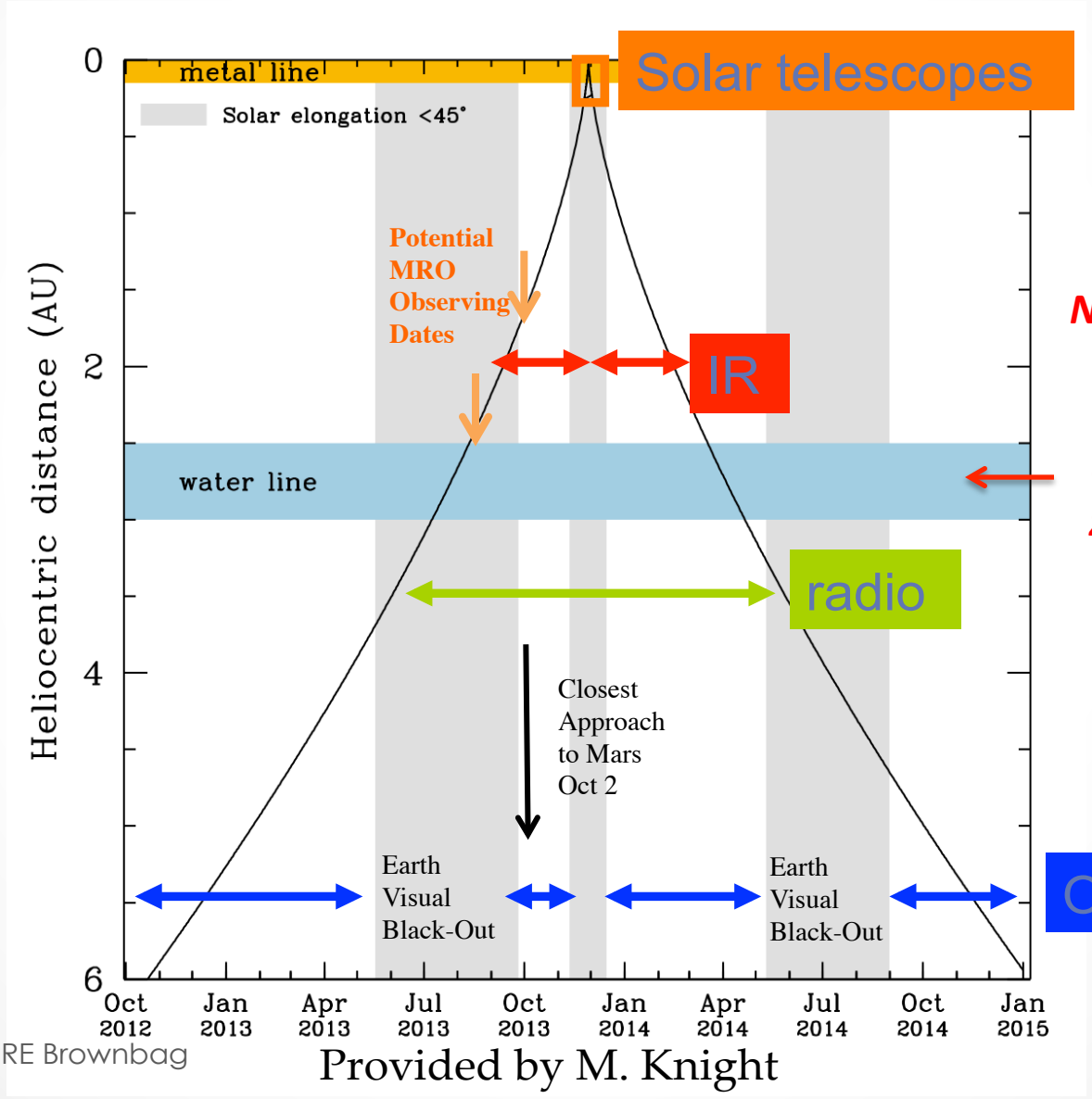
ISON Observations by Mars Missions

- **ISON is an especially difficult target because of its range**
  - Will not detect nucleus (~5 km radius?) with observations from Mars
  - HiRISE resolution at closest approach ~10 km/pixel @ range of 10^7 km
- **MRO will attempt to observe ISON on Aug 20:**
  - Catch ISON when it has crossed "ice line" out-of-Earth-view
    - Range will be ~148 million km (HiRISE ~ 150 km /pixel)
  - Trial run for closest approach observations at the end of September
  - HiRISE may get something; SNR limits or precludes other instruments
- **ISON Closest Approach to Mars:**
  - MRO will also try to observe a few days before (best phase angle ~Sept. 29) and during closest approach (Oct. 2)
  - Curiosity MastCAM and Opportunity PANCAM may attempt twilight observations, but twilight sky is not favorable; no meteor showers are expected
  - ODY is checking whether THEMIS will have any view of the comet during normal operations; no special spacecraft slews will be attempted in order not to stress balky reaction wheels

When will it be Observable

Comet 2012 S1 ISON



Note:
Comet 2013 A1 Siding Spring does not cross this zone until April 7 – May 26 of 2014

Provided by M. Knight

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Comet Siding Spring

- **Observations**
  - Similar campaign to ISON, modified for Siding Spring's geometry
    - MAVEN will have just gone into orbit a month earlier, but will be busy with transition to primary science orbit
    - Best HiRISE resolution ~ 100 m/pixel @ 100,000 km
  - Orbiter observations will be restricted/precluded during several-hour passage through coma/tail (see below)
  - On Mars, meteor shower probably on the dayside or in twilight
- **Hazard Assessment/Mitigation**
  - **The tail or coma of the comet *will* sweep over Mars**
    - Typical comet coma radius is greater than the 130,000 km miss distance;
    - Comet perihelion is just inside the Mars orbit after encounter
  - Main Concern: Impacts by large (>100 μm) particles moving ~56 km/s
    - Main uncertainty on environment is comet activity by encounter time
    - Particles not expected to reach surface; concern is mainly for orbiters
  - Program (with the Projects) will be assessing risks and considering what mitigations (if any) to take

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Key Dates: ISON Observations

- **August 1-2**: Comet ISON Observer's Workshop at JHU/APL
  https://dnnpro.outer.jhuapl.edu/isonworkshop/Home.aspx
- **August 20**: MRO images ISON after it emerges from ice zone
- **September 28-October 4**: ISON closest approach observations by Mars assets
- **October**: Release images to coordinating workshops & to PDS
  - Will inform those imaging ISON later as it moves to its close passage with the Sun in November.

For more information, see the Comet ISON Observing Campaign (CIOC) website: http://www.isoncampaign.org/