C/2013 A1 (Siding Spring): Breathtaker or nightmare?

Q. Ye[1] and M. Hui[2]

[1]Department of Physics and Astronomy, The University of Western Ontario, London, Ontario, N6A 3K7, Canada
[2]Department of Earth, Planetary, and Space Sciences, University of California, Los Angeles, USA

The dynamically new comet, C/2013 A1 (Siding Spring), is to make a close approach to Mars on 2014 October 19 at 18:30 UT at a distance of 40 Martian radii. Such an event is extremely rare (occurs once every 100,000 years) and offers a precious opportunity for the spacecraft on Mars to closely study the comet itself. However, at the same time, the high-speed meteoroids released from the comet also pose a threat to physically damage the spacecraft. Here we report our observations and modeling results of C/Siding Spring for characterizing the comet and assessing the risk posed to the spacecraft on Mars. We find that the optical tail of C/Siding Spring is dominated by larger particles at the time of the observation. By parameterizing the dust activity with a semi-analytic model, we find that the ejection speed of C/Siding Spring is comparable to comets such as the Rosetta target, 67P/Churyumov-Gerasimenko. Under nominal situation, the simulated dust cone will miss the planet by about 20 Martian radii. At the extreme ends of the uncertainties, the simulated dust cone will engulf Mars, but the meteoric influx at Mars is still comparable to the nominal sporadic influx, seemingly indicating that an intense and enduring meteoroid bombardment due to C/Siding Spring is unlikely.

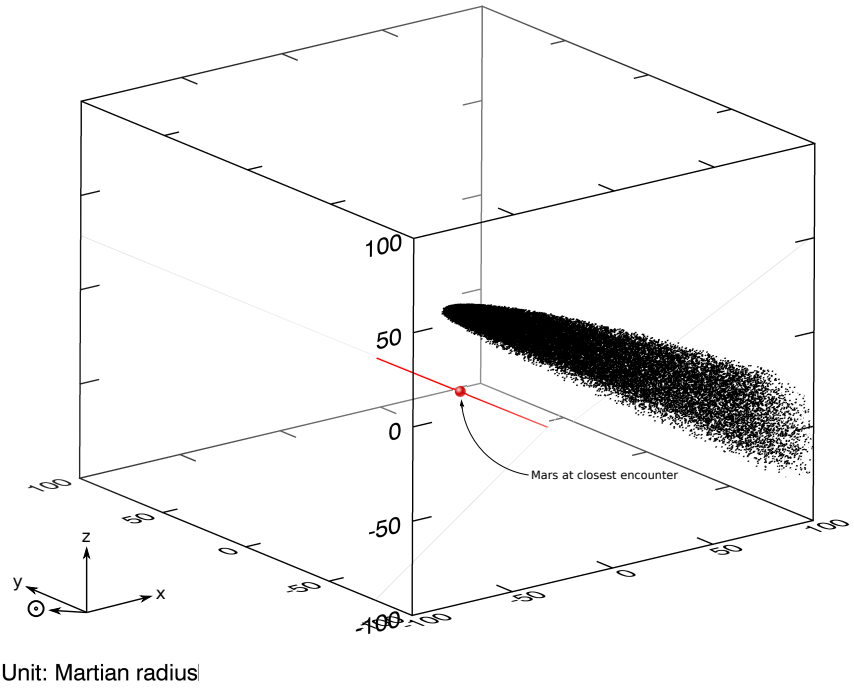

Figure: The simulation result with the trajectory of Mars during C/Siding Spring's Martian encounter shown in a cometocentric ecliptic frame.