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Exploring Venus interior structure with infrasonic techniques

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Radar images have revealed a surface of Venus that is much younger than expected, as well as a variety of enigmatic features linked to the tectonic activity. If probing the interior structure of Venus is a formidable challenge, it is still of primary importance for understanding Venus itself, its relationship to Earth and more generally the evolution of Earth-like planets. Conventional long period seismology uses very broadband seismic sensors that require to be in contact with the planetary surface, like for the Apollo missions and for the Mars Insight mission; this approach is in the short term impractical for Venus because of its extreme temperature and pressure surface conditions. Russian probes such as Venera 13-14 have only lasted a few tens of minutes, when the required duration of the seismic measurements, based on a rough estimate of the Venus tectonic activity, is at least of a few months. We propose as a possible way forward to use the very conditions at the surface of Venus to record the signal in a more suitable environment: as acoustic and infrasonic waves resulting from seismic activity are coupled much more efficiently than on Earth in the dense carbon dioxide atmosphere, a string of micro-barometers deployed on a tether by a balloon platform at Venus over the cloud layer would record this infrasonic counterpart.

Such an experiment could encompass a wide range of scientific objectives, from the characterization of the infrasonic background of Venus to the ability to record, and possibly discriminate, signatures from volcanic events, storm activity, and meteor impacts. We will discuss our proposed Venus experiment, as well as the experimental validation effort that takes place on Earth to validate the idea and possibly record infrasonic seismic counterparts