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Identifying Surface Types on an Unresolved Planet

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Even if next-generation space telescopes are capable of spatially resolving planets from their host star, the discs of these planets will not be resolved in the foreseeable future. Fortunately, the various surfaces on such an exoplanet will still be accessible via rotational variability. Identifying these surfaces and their relative positions on the planet would be a boon to studies of climate on these exotic worlds. I will discuss analysis of disc-integrated Earth observations obtained by the Deep Impact spacecraft from both equatorial and polar vantage points, and will compare these observations to detailed models of the present Earth and Snowball Earth. This comparison offers insight into what photometric observations are needed to identify a habitable planet. Lastly, I will address the general problem of identifying surface types on an unresolved body, a form of spectral unmixing.