Geophysical Research Abstracts
Vol. 18, EGU2016-4712, 2016
EGU General Assembly 2016
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Pymiedap: a versatile radiative transfer code with polarization for terrestrial (exo)planets.

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Polarimetry promises to be an important method to detect exoplanets: the light of a star is usually unpolarized[1] while scattering by gas and clouds in an atmosphere can generate high levels of polarization. Furthermore, the polarization of scattered light contains information about the properties of the atmosphere and surface of a planet, allowing a possible characterization [2], a method already validated in the solar system with Venus [3, 4].

We present here Pymiedap (Python Mie Doubling-Adding Program): a set of Python objects interfaced with Fortran radiative transfer codes that allows to define a planetary atmosphere and compute the flux and polarization of the light that is scattered. Several different properties of the planet can be set interactively by the user through the Python interface such as gravity, distance to the star, surface properties, atmospheric layers, gaseous and aerosol composition. The radiative transfer calculations are then computed following the doubling-adding method [5].

We present some results of the code and show its possible use for different planetary atmospheres for both resolved and disk-integrated measurements. We investigate the effect of gas, clouds and aerosols composition and surface properties for horizontally homogeneous and inhomogenous planets, in the case of Earth-like planets. We also study the effect of gaseous absorption on the flux and polarization as a marker for gaseous abundance and cloud top altitude.

References

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