Since 1929, polarization has been used to characterize Venus’ clouds and hazes refractive index, size and distribution. Most of our knowledge is based on measurements and modelisation made by Lyot[4], Hansen and Hovenier[6], Kawabata[2] and Sato[6] with ground and space observation. Our goal here is to make new measurements using the polarimetric data provided by the instrument SPICAV on Venus Express.

### Main cloud layer

<table>
<thead>
<tr>
<th>Abundance</th>
<th>50 to 75 km</th>
<th>70 to 90 km</th>
</tr>
</thead>
<tbody>
<tr>
<td>Composition</td>
<td>H2SO4·H2O</td>
<td>H2SO4·H2O</td>
</tr>
<tr>
<td>Radius</td>
<td>( r \sim 1 \mu m )</td>
<td>( r \sim 0.25 \mu m )</td>
</tr>
</tbody>
</table>

### Scattering processes

Depending on the radius \( r \) and the wavelength of observation, different scattering processes are involved. They can be distinguished with the size parameter \( x = \frac{2\pi r}{\lambda} \).

- **Rayleigh regime** (\( x \ll 1 \)):
  - Isotropically scattered, cross-section \( \propto 1/\lambda^4 \).
  - Linear polarization is \( +100\% \) for \( \theta = 90^\circ \).

- **Mie regime** (\( x > 1 \)):
  - Strong forward scattering. Polarization patterns are much more complicated. Dependence on \( n \) and \( x \). Generates optical features such as glories at low phase angles. Particle size distribution described by \( n_r \), mean radius and \( n_{\text{eff}} \) variance of the distribution.

### Mie model

- Model based on spherical drops with \( n_r \sim 0 \)
- \( x \to 0 \): Rayleigh regime
- \( x \to 20^\circ \): Strong negative polarization feature near 20°.

### SPICAV

SPICAV is a spectrometer onboard the Venus Express spacecraft[3]. Based on an Acousto-Optical Tunable Filter (AOTF) which produces two beams linearly polarized in perpendicular directions.

Measure of the linear polarization degree:

\[
P_L = \frac{P_2 - P_0}{P_1 + P_0} = \frac{d_2 - d_0}{d_1 + d_0} \]

Cross-calibration can be performed by knowing that for any wavelength \( P(x = 0) = 0 \). Acquisition is made with spectral window and sets of 3, 5 or 10 points for continuum measurement. We use the latter points to measure polarization.

### SPICAV observations

- Observations done in nadir mode
- Mostly located on dayside and in northern hemisphere
- Up to 14 wavelengths available

### Analysis

The glory position and shape is dependent on values of \( n_r, n_{\text{eff}} \) and \( n_{\text{ref}} \). We can use this property to constrain the refractive index under a single scattering assumption.

### Conclusion and perspectives

- **SPICAV** polarization data is fully exploitable
- Coherent with previous observations: same features and order of magnitude
- Good coverage in latitude, phase angle and time: possible study of variations
- Glories are a tool to constrain \( n_r, n_{\text{eff}} \) and \( n_{\text{ref}} \)

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### References
