Abstract Submitted
for the DFD20 Meeting of
The American Physical Society

Effect of particle inertia on the alignment of small ice crystals in turbulent clouds BERNHARD MEHLIG, K. GUSTAVSSON, U Gothenburg, M. Z. SHEIKH, Univ. Lyon, ENS de Lyon, A. NASO, Univ. Lyon, Ecole Centrale de Lyon, A. PUMIR, Univ. Lyon, ENS de Lyon — Small non-spherical particles settling in a quiescent fluid tend to orient so that their broad side faces down, because this is a stable fixed point of their angular dynamics at small particle Reynolds number. Turbulence randomises the orientations to some extent, and this affects the reflection patterns of polarised light from turbulent clouds containing ice crystals. An overdamped theory predicts that turbulence-induced fluctuations of the orientation are very small when the settling number Sv (a dimensionless measure of the settling speed) is large. At small Sv, by contrast, the overdamped theory predicts that turbulence randomises the orientations. This overdamped theory neglects the effect of particle inertia. Therefore we consider here how particle inertia affects the orientation of small crystals settling in turbulent air. We find that it can significantly increase the orientation variance, even when the Stokes number St (a dimensionless measure of particle inertia) is quite small. We identify different asymptotic parameter regimes where the tilt-angle variance is proportional to different inverse powers of Sv. Our theory predicts how the degree of alignment depends on particle size, shape, and turbulence intensity.

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Date submitted: 09 Aug 2020 Electronic form version 1.4