Radar backscatter from underdense meteors and diffusion rates

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Many meteoroids burn up between about 120 km and 70 km and form ionized trails which can be located by VHF radars [1], [2]. The decay times of radar echoes from underdense meteor trails are mainly determined by ambipolar diffusion. Model studies about the influence of mostly neutral or positively charged background dust on the ambipolar diffusion indicate that trails of weak meteors are mostly influenced. Significant smaller decay times should be observed for weak meteors (low electron line density) than for strong meteors [3].
The variation of meteor decay times as function of meteor echo strength, height, and season was studied with continuous radar observations at Arctic/Antarctic latitudes (69°N, 67°S) and at a low latitude site (22°S) [4]. The decay times of weak echoes (electron line density less than $1.7 \bullet 10^{12}$ m^{-1}) are reduced below about 88 km throughout the year with the largest reduction at 82 km. This behaviour is in agreement with model studies about the absorption of trail electrons by nanometer sized neutral or positively charged background dust which results in an enhanced diffusion rate. At high northern and southern latitudes the anomalous effect of increasing diffusion with decreasing altitude has been observed for weak and strong meteor echoes below about 85 km in summer [5]. This behaviour seems to be related to presence of larger size icy particles in the cold summer mesopause region during the appearance of NLC.
A possible bias of temperatures estimated from meteor decay times is evaluated.

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