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Possible Ursid outburst on December 22, 2000

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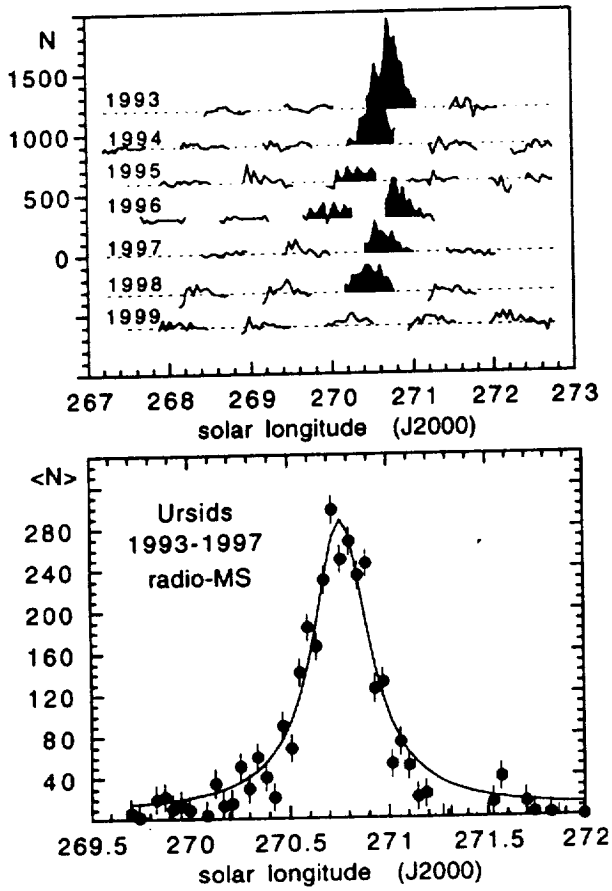
Abstract. The Ursid shower has broad Filament-type outbursts around the perihelion passage of parent 8P/Tuttle, but also isolated narrow outbursts at aphelion. We calculated Tuttle's dust trail encounters in the same way as for the Leonid showers. We discovered that it takes 6 centuries to change the orbit enough to bring the meteoroids to Earth's orbit. During that time, the meteoroids and comet separate in mean anomaly by 6 years, thus explaining the unusual aphelion occurrences. We predict enhanced activity on December 22, 2000, at around 7:29 UT.

1. Introduction

During a cold winter night in December of 1986, Norwegian observers Kai Gaarder and Lars Trygve-Heen saw a spectacular outpour of Ursid meteors over a period of 3 hours [1]. A similar outburst had been reported by visual observers at Skalnaté Pleso Observatory in 1945 [2,3]. These Ursid outbursts are very unusual, because they occur when the parent comet 8P/Tuttle is near aphelion. The comet orbital period is about 13.6 years. At the time of this writing, in early December 2000, it is only a few months before the comet will reach aphelion again.



2. Ursid Filament

Let us first examine other recent Ursid showers to show the unusual aspects of these aphelion outbursts. The annual shower component has ZHR_{max} = 8. On top of that, there are frequent outbursts when the comet is near perihelion (Fig. 1). In 1994, the comet passed 0.061 AU outside of Earth's orbit. In December 1993, Bob Lunsford observed the ascending branch of an outburst from Mt. Laguna, California, to ZHR_{max} = 100 (r = 2.5). Japanese observer H. Shioi observed the peak in 1994 [4], from which we have ZHR_{max} = 50 (r = 2.6). In 1996, rates were still elevated at ZHR_{max} = 25 [5], and of order ZHR_{max} = 16 in 1997.

Figure 1a - Ursid Filament as observed around perihelion passage of comet 8P/Tuttle (1994) by forward meteor scatter. Counts (N) are raw reflections after subtraction of daily background. Data: I. Yrjölä/Global-MS-Net.
Figure 1b - The mean activity profile after correction for observability.