Home
Online Library ACP
- Recent Final Revised Papers
- Volumes and Issues
- Special Issues
- Library Search
- Title and Author Search

Online Library ACPD
Alerts & RSS Feeds
General Information
Submission
Review
Production
Subscription
Comment on a Paper

Volumes and Issues | Contents of Issue 2 | Special Issue

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Observations of meteor-head echoes using the Jicamarca 50MHz radar in interferometer mode

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Abstract. We present results of recent observations of meteor-head echoes obtained with the high-power large-aperture Jicamarca 50MHz radar (11.95°S, 76.87°W) in an interferometric mode. The large power-aperture of the system allows us to record more than 3000 meteors per hour in the small volume subtended by the 1° antenna beam, albeit when the cluttering equatorial electrojet (EEJ) echoes are not present or are very weak. The interferometry arrangement allows the determination of the radiant (trajectory) and speed of each meteor. It is found that the radiant distribution of all detected meteors is concentrated in relative small angles centered around the Earth's Apex as it transits over the Jicamarca sky, i.e. around the corresponding Earth heading for the particular observational day and time, for all seasons observed so far. The dispersion around the Apex is ~18° in a direction transverse to the Ecliptic plane and only 8.5° in heliocentric longitude in the Ecliptic plane both in the Earth inertial frame of reference. No appreciable interannual variability has been observed. Moreover, no population related to the optical (larger meteors) Leonid showers of 1998-2002 is found, in agreement with other large power-aperture radar observations.

A novel cross-correlation detection technique (adaptive match-filtering) is used in combination with a 13 baud Barker phase-code. The technique allows us to get good range resolution (0.75km) without any sensitivity deterioration for the same average power, compared to the non-coded long pulse scheme used at other radars. The matching Doppler shift provides an estimation of the velocity within a pulse with the same accuracy as if a non-coded pulse of the same length had been used. The velocity distribution of the meteors is relatively narrow and centered around 60kms^{-1}. Therefore most of the meteors have an almost circular retrograde orbit around the Sun. Less than 8% of the velocities correspond to interstellar orbits, i.e. with velocities larger than the solar escape velocity (72kms^{-1}). Other statistical distributions of interest are also presented.

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