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Io-Jupiter interaction, millisecond bursts and field aligned potentials

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Jovian millisecond (or S-)bursts are intense impulsive decametric radio bursts drifting in frequency in tens of milliseconds. Most of the theories about their origin comprise an interpretation of their frequency drift. Previous analyses suggest that S-bursts are cyclotron-maser emission in the flux tubes connecting Io or Io's wake to Jupiter. Electrons are thought to be accelerated from Io to Jupiter. Near Jupiter, a loss cone appears in the magnetically mirrored electron population, which is able to amplify extraordinary (X) mode radio waves. Here we perform an automated analysis of 230 high resolution dynamic spectra of S-bursts, providing 5×10^6 frequency drift measurements. Our data is consistent with the above scenario. In addition, we confirm over a large number of measurements that the frequency drift $df/dt(f)$ is in average negative and decreases (in absolute value) at high frequencies, as predicted by the adiabatic theory. We find a typical energy of 4 keV for the emitting electrons. In 15% of the cases (out of 230), we find for the first time evidence of localized $\sim$1 keV electric potential jumps at high latitudes along the field lines connecting Io or Io's wake to Jupiter. These potential jumps appear stable over tens of minutes. Finally, a statistical analysis suggests the existence of a distributed parallel acceleration of the emitting electrons along the same field lines.