Jovian auroral emissions : statistical distribution and localisation of radio sources

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Abstract

The Jovian high latitude radio emissions produced by Jupiter's magnetosphere extend from a few kHz to 40 MHz. There are composed of several components : the broadband kilometric (bKOM) who lies into the frequency range [23–400] kHz, the hectometric (HOM) in the range[400– 3000] kHz and the decametric (DAM) in the range [3000–40000] kHz. The DAM emissions are divided in two : the emissions induced by the satellites Io (Bigg 1964), Europa and Ganymede (Louis et al., 2017) and the emissions not controlled by the satellites. In this study we are interested in the position of the bKOM, HOM and DAM (non-sat) sources. We have pick up all the possible sources, crossed by Juno during perijoves (#1-#11). This allowed us to map the radio sources, as well as associated magnetic field lines, over the entire frequency range covered by Juno/Waves (50Hz-40MHz). The comparison with magnetic field models revealed that all components seem to be on the same magnetic field lines, at different altitudes. The comparison with UV images (Juno/UVS and Hubble/STIS) revealed a correlation between the UV emission of the main oval and the identified radio sources (kilometric, hectometric and decametric).

Goals

Identification of crossed radio sources ?
Localization of crossed radio sources ?
Spatial relationship with UV sources ?

Past studies : direction finding

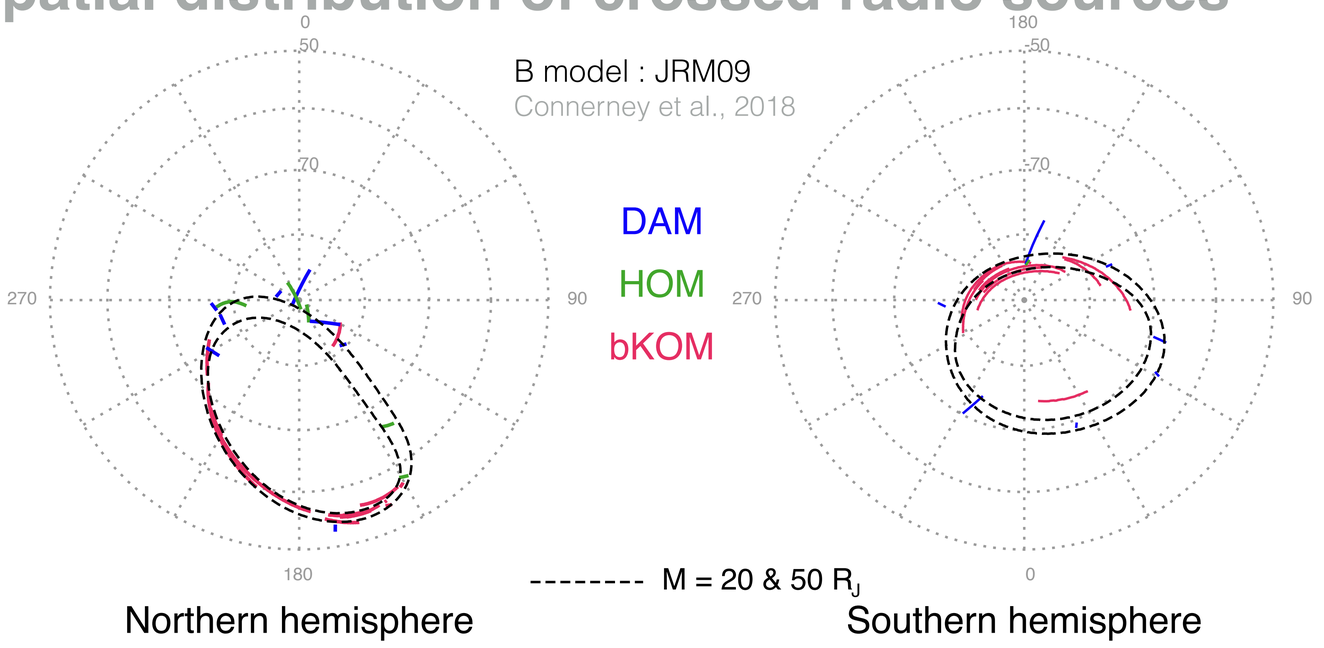
bKOM : L=9-15 R_J (Ladreiter et al.,1994)
L=13-15 R_J (Imai et al., 2017)

HOM : L=7-11 R_J (Ladreiter et al.,1994)
L=5 or 8-10 R_J (Zarka et al., 2001)
L<6 R_J (Reiner et al., 1993)

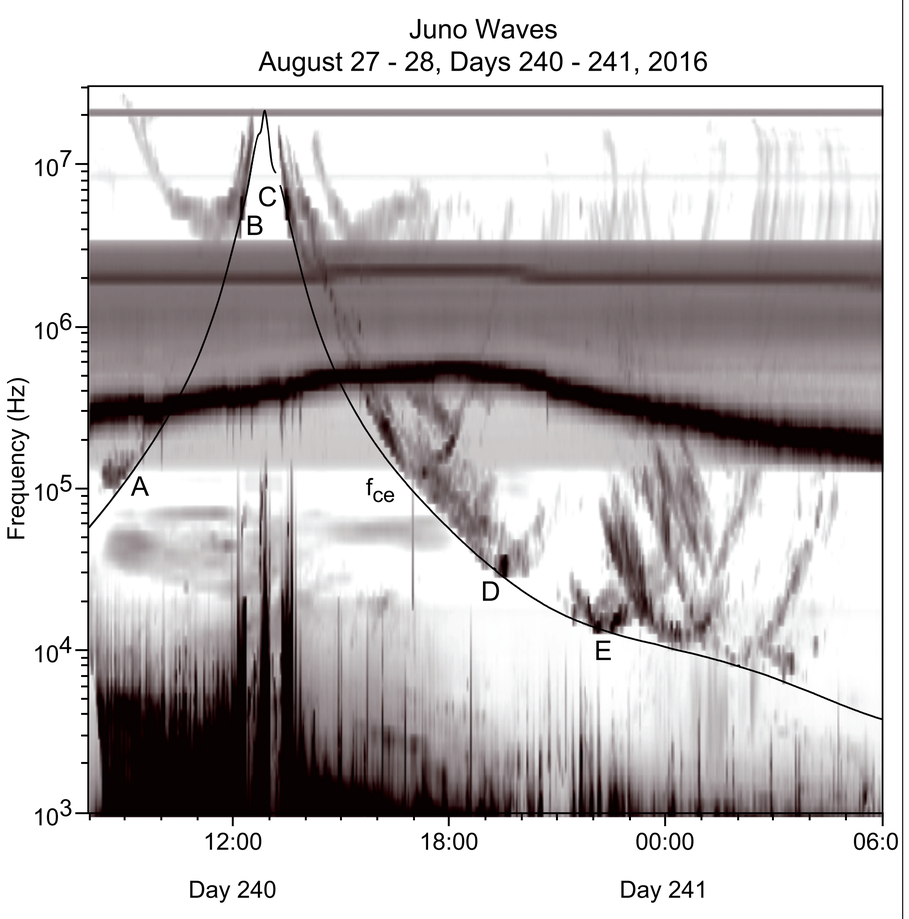
DAM : L>6 R_J (Genova et al., 1987)
Same longitudinal variable of DAM an UV aurora

⟶ bKOM, HOM & DAM not on the same magnetic field lines

Spatial distribution of crossed radio sources



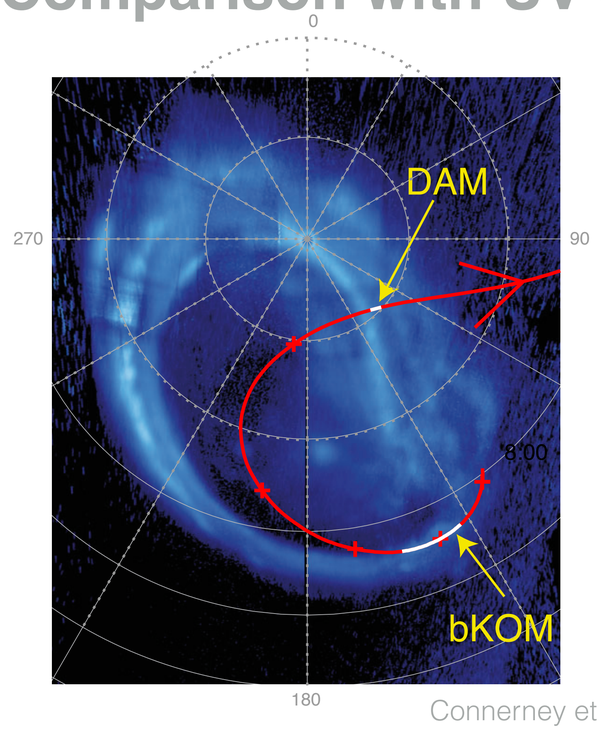
Identification of source crossings



Kurth et al., 2017

How to identify possible candidate ?
f~f_{ce} in Juno/Waves data (survey mode)
⟶ 50 candidate sources

Comparison with UV data



Connerney et al., 2017

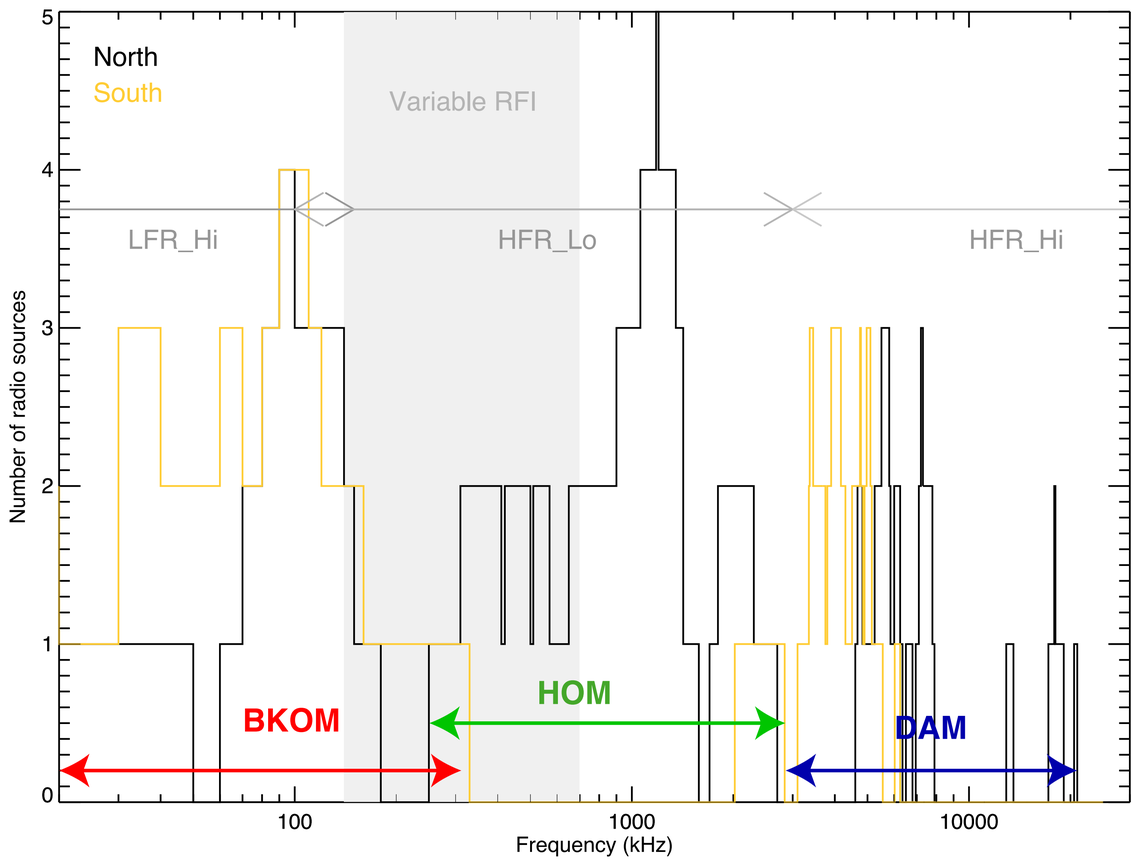
Conclusions

— Localisation of radio sources :
- bKOM : L = [10 - 20] R_J
- HOM : L = [10 - 15] R_J
- DAM : L = [6 - 20] R_J

⟶ **bKOM, HOM & DAM** on the **same magnetic field lines**, at different altitudes

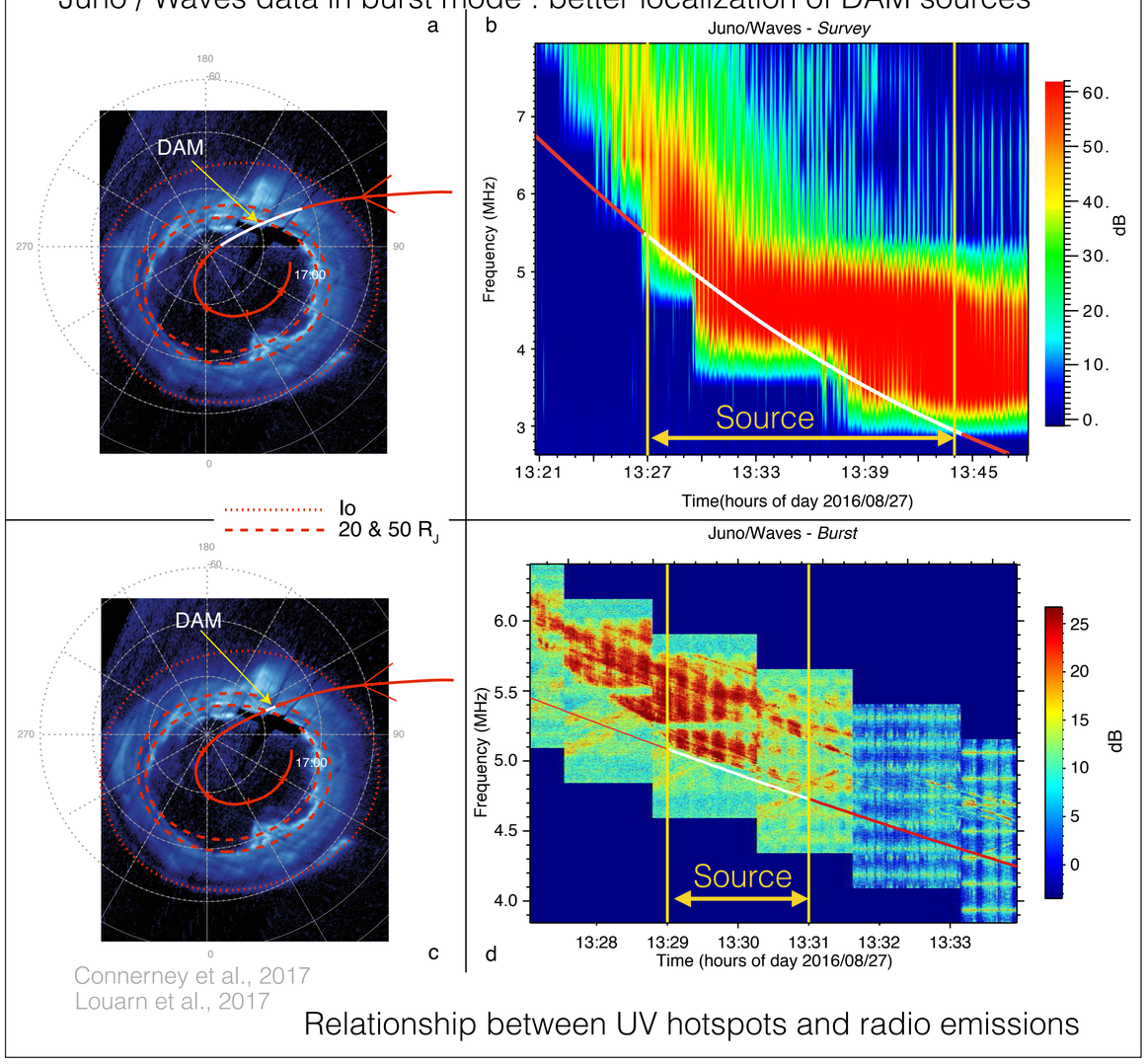
— **Radio and UV sources** localized on the **same magnetic field lines** at different altitudes

Spectral distribution of crossed radio sources



Step in process

Juno / Waves data in burst mode : better localization of DAM sources



Connerney et al., 2017
Louarn et al., 2017

Relationship between UV hotspots and radio emissions