3D tomography of local interstellar gas and dust

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The local interstellar medium

- Local medium: here roughly \( d < 300 \) pc

- Several roles of the ISM in astrophysics
  - Tool for studying the evolution of the ISM
  - Conditions of photons and particules transport in 3D: radiation field, cosmic rays
  - Foreground: needs to be removed for studying specific objects
  - The ambient medium which governs limit conditions for a specific object
  - The context environning a specific object
  - etc…
Means of study

- Absorption lines of the gas in spectra of nearby stars
- Extinction inferred from photometric measurements

Interstellar absorptions database

- Allows to distinguish between foreground absorption and local lines
- Allows to locate objects from their absorption lines

3D mapping of the LISM
Example of absorption due to local ISM

- Spectrum obtained with *Feros* spectograph (La Silla)
  - *Very high resolving power*
Doublet of NaI

HD116226
d = 550 pc
l = 308° b = +14°
column = 76.10^{10} cm^{-2}

HD70715
d = 300 pc
l = 260° b = -3°
column = 44.10^{10} cm^{-2}

HD116663
d = 1020 pc
l = 309° b = +15°
column = 137.10^{10} cm^{-2}

HD71123
d = 610 pc
l = 260° b = -3°
column = 327.10^{10} cm^{-2}
Doublet du CaII

HD97940
- $d = 85$ pc
- $l = 275^\circ$ $b = +35^\circ$
- column $= 8.10^{10}$ cm$^{-2}$

HD133772
- $d = 170$ pc
- $l = 347^\circ$ $b = +38^\circ$
- column $= 80.10^{10}$ cm$^{-2}$

HD97864
- $d = 92$ pc
- $l = 274^\circ$ $b = +38^\circ$
- column $= 89.10^{10}$ cm$^{-2}$

HD137318
- $d = 300$ pc
- $l = 347^\circ$ $b = +31^\circ$
- column $= 260.10^{10}$ cm$^{-2}$
The Local Bubble

3D tomography of local interstellar gas and dust

Raimond Séverine
Comparison NaI / CaII / extinction

CASE OF MERIDIAN PLANE

<table>
<thead>
<tr>
<th>NaI</th>
<th>Call</th>
<th>Extinction</th>
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<tbody>
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<td><img src="image1" alt="NaI Image" /></td>
<td><img src="image2" alt="Call Image" /></td>
<td><img src="image3" alt="Extinction Image" /></td>
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DENSE-NEUTRAL GAS

Welsh et al., 2010

2010/06/24

DENSE NEUTRAL + IONIZED GAS

Vergely et al., 2010

2010/06/24

DUST

SF2A-2010 ASGaia-PNCG
Gould Belt

Nal

extinction
GAS and DUST CLOSER than 200 pc

- Integration in the 3D cube of inverted densities and opacities
Local dust vs Total dust

Finkbeiner et al., 1999
HI data

Map -5:+5 km/s LSR
Determination of the distance of a structure

- Identification of the region: MBM53, MBM54, MBM55
- Research of dense clouds in HI maps and in data cubes

Magnani et al., 1985
Welty et al., 1989
Other high-latitude molecular clouds

Map 0.3 km/s LSR

Map 3.5 km/s LSR

MBM20

MBM40
Perspectives

- Increase of the database

- Generalization of the comparison HI / 3D data
  - better 3D construction

- Preparation of future reddenings and spectroscopic data for GAIA

Thank you for your attention!