On the role of X-ray background fields for the chemistry of protoplanetary disks.

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Threats from the surroundings - ESO
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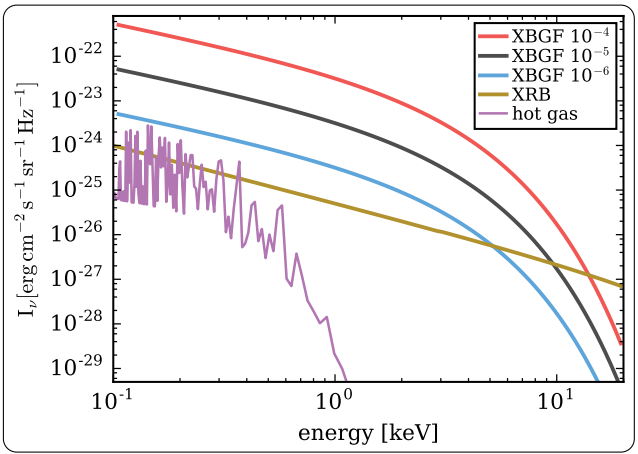
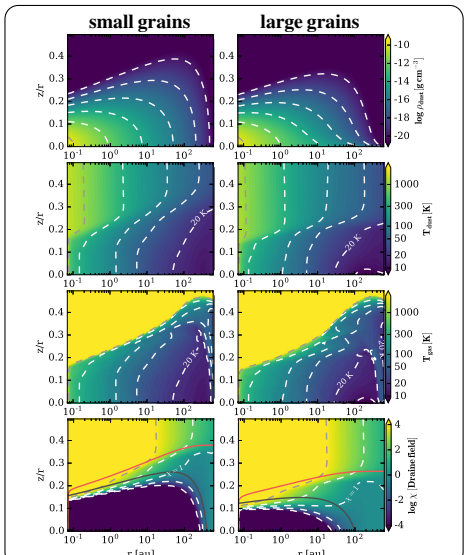
X-ray background fields in young embedded star clusters

- young stars (YSO) are born in clusters and are exposed to the X-ray radiation of all the other cluster members
- the flux of this **X-ray background field (XBGF)** depends on the number of cluster members and the location of a star within the cluster (Adams+ 2012)
- **Aim**: investigate the impact of the XBGF on the chemistry of protoplanetery disks



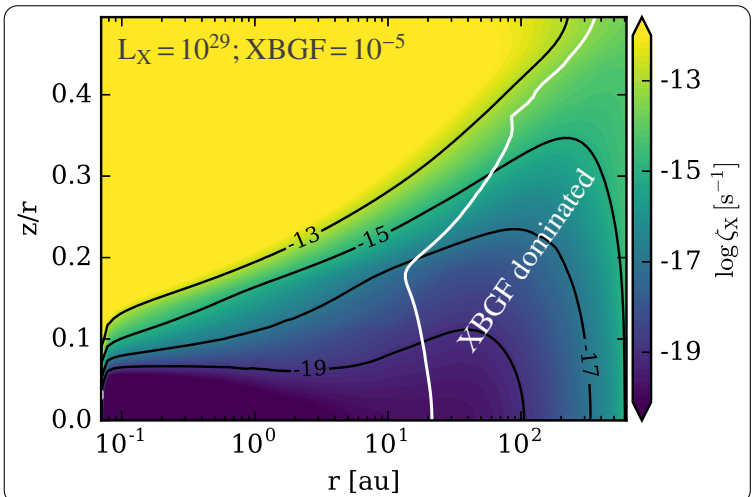
Radiation thermo-chemical modelling with ProDiMo

- radiation thermo-chemical modelling of a static 2D disk structure with ProDiMo (PROtoplanetary DIsk MOdel, https://www.astro.rug.nl/~prodimo/)
- X-ray radiative transfer with scattering and background-fields; solved consistently with the chemistry and thermal balance
- consider different cosmic-ray ionisations rates, XBGF fluxes and different dust properties in the disk

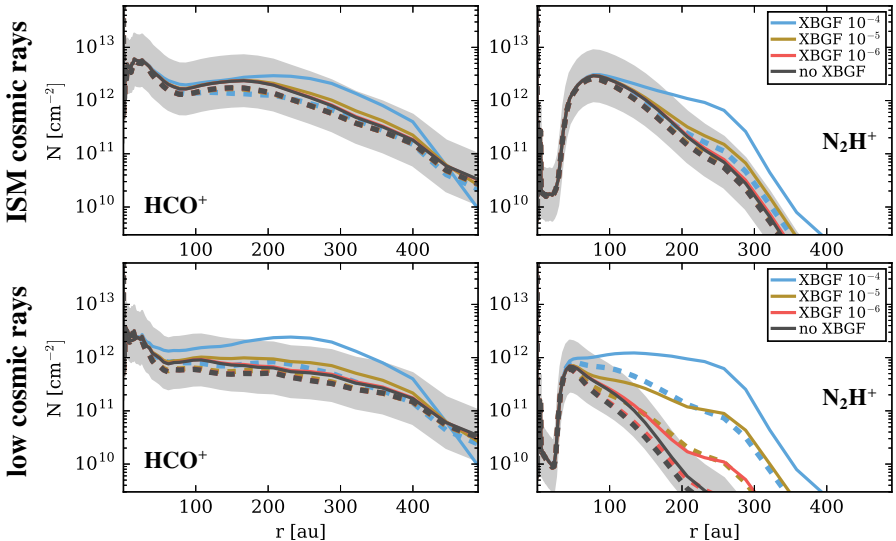


Resulting X-ray ionisation rate

- XBGF can dominate the X-ray ionisation rate ζ_X in the outer region of the disk ($r \gtrsim 20\,\mathrm{au}$)
- but also competes with other H_2 ionisation sources such as cosmic rays



Impact of XBGF on molecular ions



Conclusions

- the XBGF can have a significant impact on the disk chemistry in case of a (very) high XBGF flux and/or low cosmic ray ionisation rates ($\zeta_{\rm CR} < 10^{-18}\,{\rm s}^{-1}$)
- in a star-forming region like Taurus most disks are likely not affected by XBGF because of the low number of X-ray emitting sources

For more details see: https://ui.adsabs.harvard.edu/abs/2018A%26A...609A..91R/abstract

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X-ray radiative transfer in protoplanetary disks

The role of dust and X-ray background fields

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Thank You for Your Attention!

References I

Adams, F. C., Fatuzzo, M., & Holden, L. (2012). Background X-ray Radiation Fields Produced by Young Embedded Star Clusters. *PASP*, 124:913–921.