ndradex

June 10, 2020

[3]:

```python
import ndradex
import numpy as np
import matplotlib.pyplot as pl
import os
pl.ion()

#Parametres de la grille
mol = '13co'
Qnul = ['1-0','2-1']
n_H2 = np.logspace(2,6,5)
n_e = 10
N_mol = np.logspace(14.5,17.5,10)
T_kin = np.linspace(10,100,10)
dv = np.linspace(0.5,3.5,4)
fn = "{}_{}.cdf".format(mol,Qnul)
```

[4]:

```python
#Avoid recomputing the grid if already on disk, to force recompute: delete the␣
 ↪"fn" file by hand
if  os.path.exists(fn):
    ds = ndradex.load_dataset(fn)
else:
    #Calcul de la grille
    ds = ndradex.run(mol,Qnul,N_mol=N_mol,n_H2=n_H2,T_kin=T_kin,dv=dv,n_e=n_e)
    ds['I'].attrs['units'] = '$K km/s$'
    ds.coords['T_kin'].attrs['units'] = '$K$'
    ds.coords['N_mol'].attrs['units'] = '$cm^{-2}$'
    ds.coords['n_H2'].attrs['units'] = '$cm^{-3}$'
    ndradex.save_dataset(ds, fn)
```

[5]:

```python
# Quelques commandes utiles:
# Slicing:
a = ds['I'].sel(n_H2=100)

# Interpolating:
b = ds['I'].interp(n_H2=110)
```

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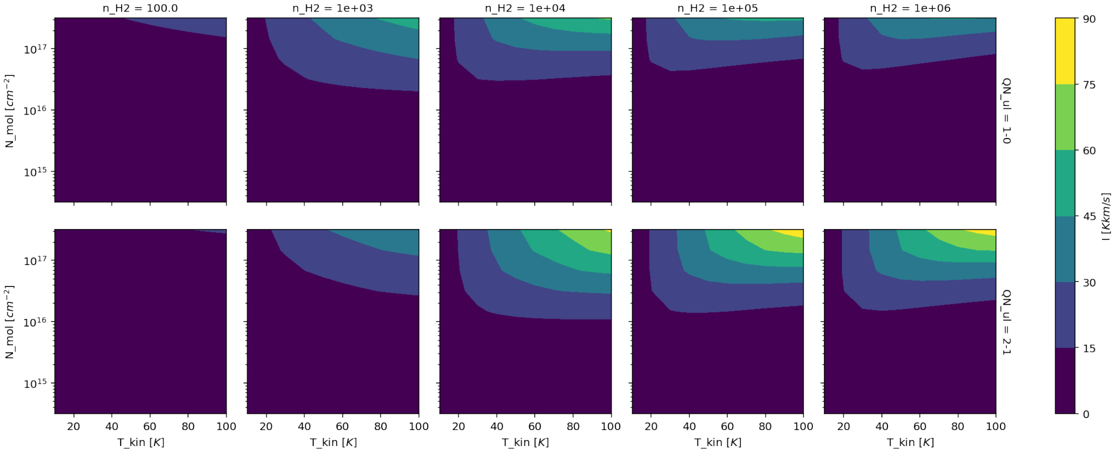
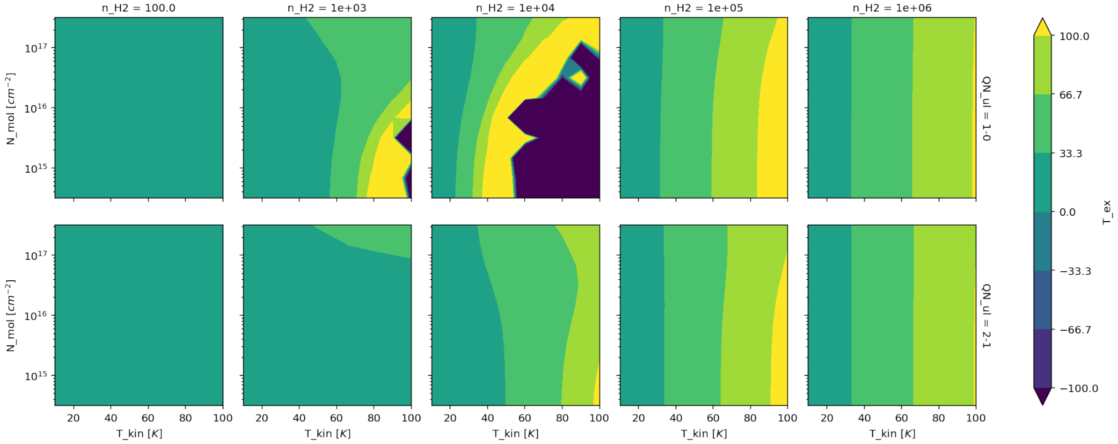
[6]: #Plotting
     g = ds['I'].interp(dv=1).plot.
      ↪contourf(y='N_mol',x='T_kin',col='n_H2',row='QN_ul')
     pl.yscale('log')
```

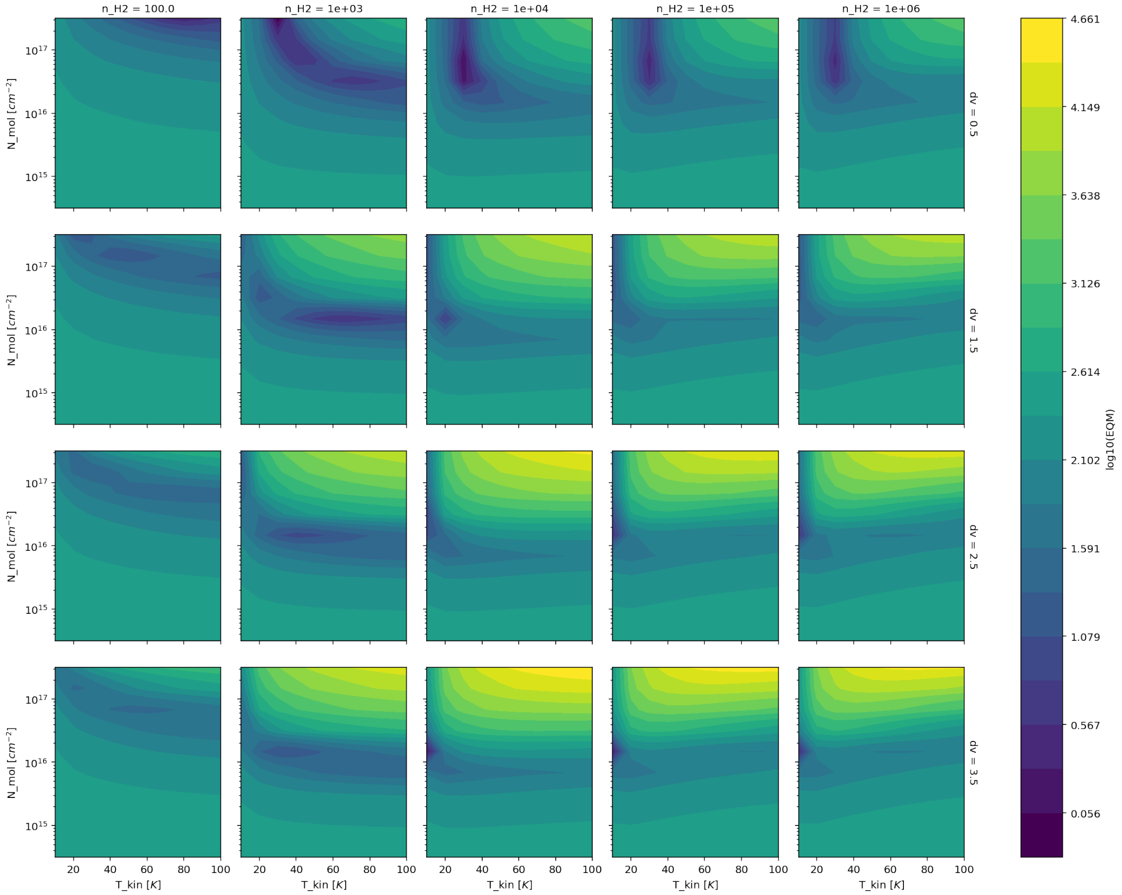


```
[7]: #Plotting
     g = ds['T_ex'].interp(dv=1).plot.
      ↪contourf(y='N_mol',x='T_kin',col='n_H2',row='QN_ul',vmin=-100,vmax=100)
     pl.yscale('log')
```



```
[22]: #Comparing to observations
      # Case similar to Figs 4,5 or 6 of https://www.dropbox.com/home/2019-orionb-bcr/
       ↪LVG?preview=ms.pdf
      W10 = 12 #Kkm/s
      W21 = 12 #Kkm/s
```

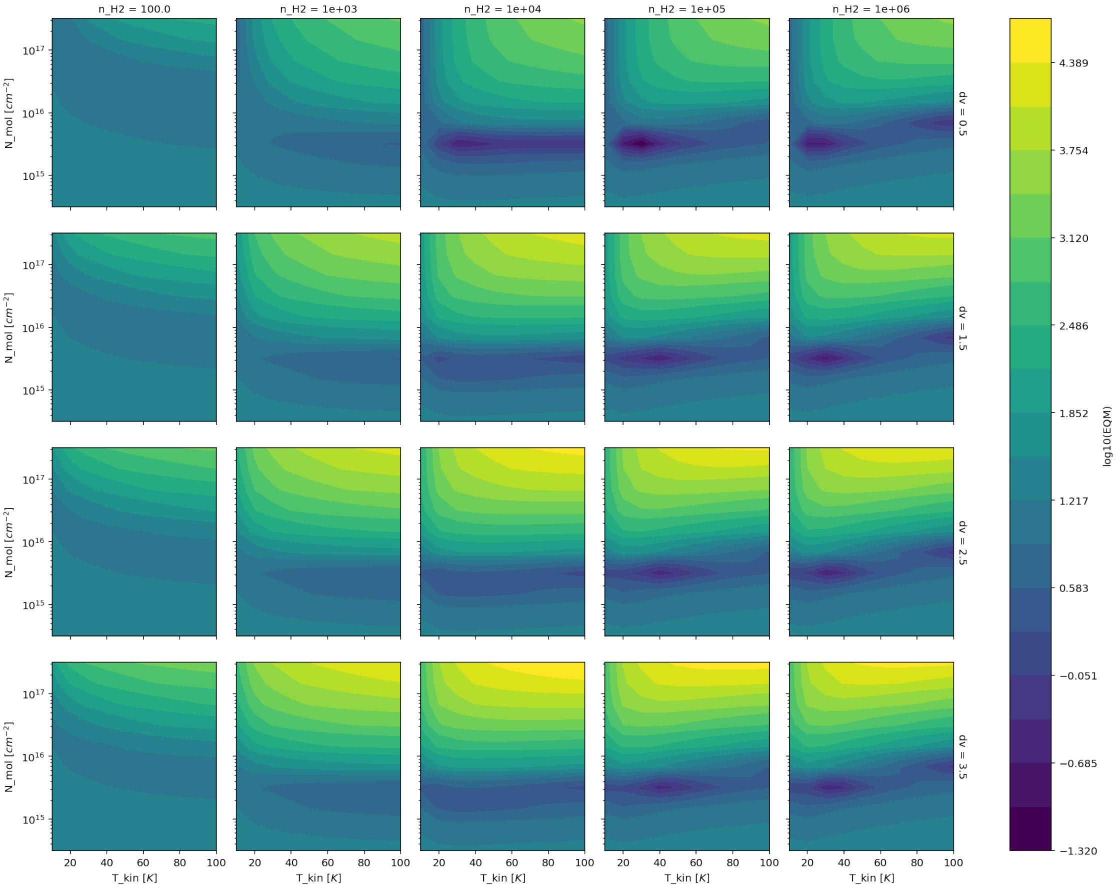
```
EQM10 = (ds['I'].sel(QN_ul='1-0')-W10)**2
EQM21 = (ds['I'].sel(QN_ul='2-1')-W21)**2
EQM = EQM10+EQM21
logEQM = np.log10(EQM)
logEQM.name = 'log10(EQM)'
logEQM.plot.contourf(y='N_mol',x='T_kin',col='n_H2',row='dv',vmin=logEQM.
 ↪min(),vmax=logEQM.max(),levels=20)
pl.yscale('log')
```



[23]:
```
#Comparing to observations
# Case similar to Figs 7, 8 of https://www.dropbox.com/home/2019-orionb-bcr/LVG?
 ↪preview=ms.pdf
W10 = 2 #Kkm/s
W21 = 4.5 #Kkm/s

EQM10 = (ds['I'].sel(QN_ul='1-0')-W10)**2
EQM21 = (ds['I'].sel(QN_ul='2-1')-W21)**2
EQM = EQM10+EQM21
```

```
logEQM = np.log10(EQM)
logEQM.name = 'log10(EQM)'
logEQM.plot.contourf(y='N_mol',x='T_kin',col='n_H2',row='dv',vmin=logEQM.
 ↪min(),vmax=logEQM.max(),levels=20)
pl.yscale('log')
```



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